MARINE FISHERIES COMMISSION BUSINESS MEETING
Hilton Riverfront, New Bern, N.C.
May 16-17, 2018

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).

<u>May 16</u>

2 p.m. Call to Order*
Conflict of Interest Reminder
Roll Call
Approval of Agenda**
Approval of Meeting Minutes**

2:15 p.m. Chairman's Report
- Letters
- Ethics Training Reminder
- 2018 Meeting Schedule

2:30 a.m. Committee Reports
- Blue Crab Fishery Management Plan Advisory Committee
- Southern Flounder Fishery Management Plan Advisory Committee
- Habitat and Water Quality Advisory Committee
- Southern Regional Advisory Committee

2:40 p.m. Director's Report - Director Steve Murphey
- Division of Marine Fisheries Quarterly Update
- Coastal Recreational Fishing License Fund Disbursement Procedures – Beth Govoni
- Land or Sell License – Dee Lupton
- Standard Commercial Fishing License Assignments – Dee Lupton
- Standard Commercial Fishing License Transfers – Dee Lupton
- Target Species and Bycatch Reporting – Stephanie McInerny
- Atlantic States Marine Fisheries Commission – Chris Batsavage
- Informational Materials:
  - Rule Suspension Notices/No Action Required
  - Landings Update for Red Drum and Southern Flounder
  - Protected Resources Update
    - Observer Program
    - Incidental Take Permit Annual Reports
  - Mid-Atlantic Fishery Management Council Update

- South Atlantic Fishery Management Council Update
- Highly Migratory Species
- Annual Fish Dealer Report
- Annual Fisheries Landings Bulletin

4 p.m. Stock Assessment 101 – Laura Lee
6 p.m. Public Comment Period

May 17

8:30 a.m. Fishery Management Plan Update – Catherine Blum
8:45 a.m. Blue Crab Stock Assessment – Dr. Yan Li and Jason Rock
9:45 a.m. Shrimp Bycatch Reduction Industry Workgroup Results and Recommendations – Kevin Brown

- **Possible vote on promising configurations for mandatory use****

10:45 a.m. Potential Solutions to Address Shellfish Lease Conflicts – Mike Graven and Anne Deaton
11:15 a.m. Triploid Oysters – Steve Murphey
11:30 a.m. Region 4 Strategic Habitat Area Nominations –Casey Knight

- **Vote on nominations for Region 4 Strategic Habitat Areas for inclusion in the Coastal Habitat Protection Plan****

Noon Rulemaking Update – Catherine Blum

- 2018/2019 rulemaking cycle
- **Vote on 2018/2019 Notice of Text for Rulemaking to Readopt Rules per G.S. 150B-21.3A****

  Review and vote on the following proposed rules and associated fiscal analyses for Notice of Text for Rulemaking to readopt rules per G.S. 150B-21.3A, Periodic Review and Expiration of Existing Rules
  - Conforming Changes to For-Hire Licenses, 15A NCAC 03O .0112
  - Readoption of a Portion of Rules in 15A NCAC 03I, 03J, 03K, 03L, 03M, 03O, and 03R

12:15 p.m. Issues from Commissioners
12:45 p.m. Meeting Assignments and Preview of August Agenda Items – Nancy Fish
1 p.m. Adjourn

2018 Meeting Dates

Feb. 14-15 Wrightsville Beach
May 16-17 New Bern
Aug. 15-16 Raleigh
Nov. 14-15 Kitty Hawk

**** Times indicated are merely for guidance. The commission will proceed through the agenda until completed.***
*****Potential Action Items***

Minutes

Marine Fisheries Commission Business Meeting Minutes
Blockade Runner
Wrightsville Beach, North Carolina
Feb. 14-15, 2018

The commission held a business meeting Feb. 14-15 at the Blockade Runner in Wrightsville Beach, North Carolina.

The briefing book, presentations and audio from this meeting can be found at http://portal.ncdenr.org/web/mf/02-2018-briefing-book .

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

BUSINESS MEETING - MOTIONS AND ACTIONS

Chairman Sammy Corbett convened the Marine Fisheries Commission business meeting at 2 p.m. on Feb. 14 and reminded commissioners of their conflict of interest and ethics requirements.

The following commission members were in attendance: Sammy Corbett-Chairman, Cameron Boltes, Pete Kornegay, Brady Koury, Chuck Laughridge, Rick Smith, and Alison Willis. Janet Rose and Mark Gorges were not present for the first hour of the meeting.

The agenda for the meeting was approved by consensus.

The minutes from the November 2017 meeting were approved by consensus.

Chairman Corbett recognized Governor Roy Cooper's new appointment to the commission, Cameron Boltes and James "Pete" Kornegay. Commissioner Boltes replaces Joe Shute in the recreational industry seat and Commissioner Kornegay replaces Mike Wicker in the scientist seat.

Commission Liaison Nancy Fish reviewed the State Board of Elections and Ethics Enforcement's evaluation of the Statement of Economic Interest for Commissioner Kornegay. The board did not find an actual conflict of interest or the potential for a conflict of interest. Fish reported that the State Board of Elections and Ethics Enforcement advised that a new evaluation was not done for Commissioner Boltes because he already serves on another state board.

Chairman's Report

Chairman Corbett welcomed Steve Murphey, the new director of the Division of Marine Fisheries.

Commission Liaison Nancy Fish reviewed correspondence that had been sent and received by the commission since the last business meeting.

Commissioners were reminded of their ethics training requirements and the annual requirement to submit their Statement of Economic Interest form by April 15 to the State Board of Elections and Ethics Enforcement.

The 2018 meeting schedule was also reviewed:
Feb. 14-15, Wrightsville Beach

May 16-17, New Bern
Aug. 15-16, Raleigh
Nov. 14-15, Kitty Hawk

Chairman Corbett recognized Department of Environmental Quality Chief Deputy Secretary John Nicholson, who welcomed new the commissioners and Director Murphey, and thanked the outgoing commissioners. Nicholson updated the commission on the status of the fiscal analysis for the North Carolina Wildlife Federation's petition for rulemaking and Governor Cooper and Secretary Regan's request for the U.S. Department of Interior to hold hearing on the coast regarding offshore oil drilling.

Director's Report

Division Director Murphey welcomed the new commissioners and shared his past work experience. He let the commission know his goal is to produce plans and management recommendations that the commission can use as the scientific foundation to build its management strategies. He also updated the commission on division activities occurring since the November 2017 business meeting, including:

- A report on the January cold stun and subsequent closure of the spotted seatrout fishery until June 15;
- A new certified state record red grouper that was caught offshore from Carolina Beach;
- Updates on the annual crab pot clean-up, the increasing number of hearings for proposed shellfish leases, and an updated list of division species leads; and
- The work the License and Statistics Section is doing to finalize 2017 landings data, prepare for the 2018 license sales season and their continued efforts to prepare the fiscal analysis for the rules contained in the N.C. Wildlife Federation's petition for rulemaking.

Murphey also discussed the fishery management plan schedule and the division workload. Staff are working at maximum capacity, he explained, and when the fishery management plan schedule is changed, or a plan is expedited, then staff 's efforts are taken away from other required work. Currently, staff are developing expedited amendments to the Estuarine Striped Bass, Blue Crab and Southern Flounder plans. The commission also voted to expedite an amendment to the Shrimp Plan to implement recommendations from the Shrimp Bycatch Reduction Industry Workgroup to reduce bycatch in shrimp trawls. These recommendations are expected later this spring. Murphey advised that the current Shrimp Plan includes provisions for the commission to adopt and implement recommendations from the industry workgroup without undertaking an expedited amendment to the plan. He asked the commission to reconsider moving forward with an amendment to the Shrimp Plan until warranted by action on the petitioned rules or other action.

Chairman Corbett recognized Representative Deb Butler (Brunswick and New Hanover counties) allowing her to address the commission.

The division then provided an overview of recent actions from the Atlantic States Marine Fisheries Commission, the South Atlantic Fishery Management Council and the Mid-Atlantic Fishery Management Council.

ASMFC Cobia Implementation and Recreational Mandatory Reporting

State implementation plans for the Atlantic States Marine Fisheries Commission's Cobia Fishery

Management Plan were due Jan. 1. State implementation measure are required to meet state-specific Recreational Harvest Limits outlined in the plan.

Division biologist and cobia species lead Steve Poland advised the division submitted an implementation plan with two sets of options for management measures for the 2018-2020 fishing years. Both options propose a 36-inch size limit, a one fish per person possession limit and no seasons. Option 1, recommended by the commission, proposed vessel limits of four fish per vessel for for-hire and two fish per vessel for private vessels. Option 2 proposed three fish per vessel for for-hires and one fish per vessel for private vessels. Poland explained Option 1 exceeded the Recreational Harvest Limit, while Option 2 did not.

Poland also reported that the division had formed a workgroup to study a recreational mandatory reporting program for cobia and the group was currently investigating the legal authority needed to enforce mandatory reporting and different survey design options to identify participants and validate reported harvests.

After discussion about options to meeting the Recreational Harvest Limit, the commission approved a recreational cobia season of May 1 to Dec. 31, with a limit for private vessels of one fish per person, up to two fish per vessel from May 1 to May 31 and one fish per vessel June 1 through Dec. 31; the limit for for-hire vessels would be one fish per person up to four fish per vessel May 1 through Dec. 31. All measures include a 36-inch fork length minimum size limit. These management measures must be reviewed by the Atlantic States Marine Fisheries Commission Cobia Technical Committee and approved by the South Atlantic State/Federal Management Board.

Motion by Chuck Laughridge to approve the following recreational cobia management measures:

- **Private - May 1 – May 31: 2 fish/vessel; June 1 – Dec 31: 1 fish/vessel**
- **For Hire - May 1 – Dec 31: 4 fish/vessel**
- **230,513 pounds**

Second by Cameron Boltes.
Motion carries 5-2.

Shellfish Lease Conflicts

As requested at the commission's November 2017 meeting, the division provided the commission with potential solutions to address the growing number of shellfish lease conflicts.

To view the presentation, go to:
http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=31653371&name=DLFE-137507.pdf

The commission asked the division to temporarily stop issuing shellfish leases and accepting shellfish lease applications for waters from Bogue Sound south until the division can fully assess safety concerns and other regulatory needs. The commission asked for a report on this issue at its May 2018 meeting. Division Director Steve Murphey told the commission he would seek legal counsel to see if the division has authority for these actions.

Motion by Alison Willis to temporarily stop issuing shellfish leases and accepting shellfish lease applications from Bogue Sound south until the division can fully assess the safety concerns and other regulatory needs and report back to the commission at its May 2018 meeting. Second by Brad Koury.
Motion carries 8-1.

Documenting Unsold Standard Commercial Fishing License Catch
License and Statistics Section Chief, Stephanie McInerny, updated the commission on the updates to trip tickets to document unsold catch by Standard Commercial Fishing License holders.

To view the presentation, go to:
http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=31653371&name=DLFE-137506.pdf

Motion by Chuck Laughridge to ask the Division of Marine Fisheries to study issues surrounding requiring that both the target species and bycatch species be recorded on trip tickets, including a study of similar motions from 2014 and later.
Motion withdrawn.

Representative Bob Steinburg (Camden, Chowan, Currituck, Pasquotank, Perquimans and Tyrrell counties) asked that correspondence be read into the record that he opposed any changes to the Standard Commercial Fishing License being recommended by the commission. Chairman Corbett accommodated that request and asked Commission Liaison Nancy Fish to read the letter into the record.

Public Comment Period
The following individuals spoke:

Allen Faircloth, a commercial fisherman from Surf City, opposes the committee recommendations on changes to the Standard Commercial Fishing License, saying they are discriminatory. He has purchased the license over the years and feels the commission would be taking his property. He expressed concerns that as he gets older he will not be able to fish as often and that would disqualify him.

Jason Web, a commercial fisherman from Oak Island, opposes the licensing recommendations and feels he is being attacked. He has been a commercial fisherman for three years and has a full-time job too, and fears he will not meet some of the proposed licensing criteria. Web said these measures will hurt business, and continued regulations and license price increases make it seem like the commission is trying to divide the fishermen.

Gabe Guthrie, a commercial fisherman from Beaufort, opposes the license proposals, saying it is a heritage he wants to pass on to his children. He is the first generation in his family unable to fish full-time and said there is no science or data to support the recommended changes. He said fish stocks are not better in states that have more restrictive measures than North Carolina.

Jot Owens, an inshore fishing guide for 25 years from Wrightsville Beach, asked the commission to make Atlantic tarpon a no-kill, catch and release-only species in North Carolina.

He said there is no commercial fishery and if anglers want a fish mount, there are many good fiberglass reproductions available and that a quick photo, measure and release is all that is needed to get a mount made. He said there is no need for them to be killed here.

Jonathan Robinson, Carteret County commissioner and former member of the North Carolina House of Representatives, presented a letter and resolution* from Carteret County opposing the proposed license changes. He said much of fishing in North Carolina is concentrated in rural areas where no other industry is available and that economic stagnation is associated with growing opioid addiction.

***This resolution was received during the Jan. 12 – Feb. 9 written public comment period on commercial licensing proposals and was provided to the commission.**

Myron Smith, from Atlantic, comes from three generations of commercial fishermen and seafood dealers. She opposes the license changes and talked about the economic impact of commercial seafood sales and the employment impact, and how removing the part time fishermen will reduce these numbers. Smith also said decreasing the sales of commercial licenses will reduce the funding available for the state's Observer Program and without observers the waters will close for gill nets.

Wallace Greene, from Frisco, opposes the license proposals, saying it would reduce market participation, thus competition, and raise prices and would make it cost prohibitive for new entrants. He said it was not fair to part time fishermen and will have a trickle down and affect all in North Carolina communities. He said the proposal has nothing to do with conservation of fisheries.

Ken Siegler, a commercial fisherman from Hubert, read a letter from his granddaughter, a high school senior who opposes the license changes. She plans to get commercial license to put herself through college, but would not qualify under the proposed criteria. She asked the commission to consider the impacts of its decisions, not only today, but for years to come. Seigler said he also objects to proposed license changes. He has fished all his life, but is now semi-retired. His fishing income pays for medicine and bills and the proposed income requirements would eliminate his ability to provide for his family. He said Marine Fisheries is not the Department of Revenue, that income is private and the commission has no right to access it. He also said setting 36 trip tickets as a qualifier will skew data because fishermen will break their catch up and take it to different dealers to increase their trip tickets.

C.R. Fredericks, a commercial fisherman from Swansboro, opposes the license proposal, saying the General Assembly has already defined a commercial fisherman. Fishermen already follow stringent rules and if the number of licenses decreased, then the license cost will have to triple to support the Observer Program. He said what is needed is common sense and there is room for everyone on the water.

Phil Mason, from Carteret County, opposes the license recommendations, saying the commission has done nothing but hurt commercial fishermen and is voting to take their licenses.

Tim Gestwicki, Executive Director of the N.C. Wildlife Federation, said his organization opposes offshore oil drilling and they appreciated Gov. Cooper's stance on this issue. He said

they would be ratcheting up their efforts for more support for riparian buffers, sedimentation control, storm water runoff and fully funding the Clean Water Management Trust Fund. They are also challenging a recent EPA ruling under the Clean Water Act that will inhibit the protection of wetlands, Carolina bays, streams that interconnect and feed down into our coastal waters will not be adequately protected.

Walter Davis, from Beaufort, opposes the proposed license changes, saying this issue has been studied several times and always come back with recommendations for no change. Making 36 trips is not easy if you are a shrimper and there is no income requirement for someone to get a license to become a plumber, electrician or lawyer. He said a lot of people use a Standard Commercial Fishing License to be able to use extra gear to feed their family or to be able to pull a trawl with a winch.

Paul Biermann, from Atlantic, opposes any proposal to reduce licenses. He does not want to see anyone lose their license.

Robert Simmons, from Varnamtown, opposes any of the proposed license changes. He said you should ask people to the table and allow the issue to be discussed.

Johnathan Ward, from Sunset Beach, said his family has commercial fished for nearly 100 years and that he works for the state and fishes to supplement his income. Trout fishing is closed this year and that is usually when he makes his money. He will not be able to meet the proposed requirement to have 36 trip tickets because the trout fishery is closed, he said. He doesn't see why there should be an argument against part time and full time fishermen.

Wayne Lewark, a commercial fisherman from Knotts Island, opposes the license proposals because they would probably make him lose license. He makes his living catching jimmy crabs and duck hunting. If duck hunting is good and he does not catch crabs, he will lose his license.

Jerry Schill, Director of Government Relations with the N.C. Fisheries Association, said his association opposes the proposed commercial license changes. He also said the makeup of the current commission was unbalanced and discussed the makeup and balance of power of previous commissions since 1987. Schill reiterated that the current commission was unbalanced and said the members should resign immediately.

Bill Gorham, a lure manufacturer from Southern Shores, expressed concern the commission voted on cobia prior to the public comment period. He preferred options other than the one the commission selected. He closed by saying he could support tarpon becoming a gamefish.

Kelsey Aiken of Jeffrey's Seafood in Hatteras opposes commercial licensing changes being proposed, saying they would dramatically affect his family's business and devastate the coastal economy. He said the proposals were comparable to telling a contractor he cannot keep his plumbing license because he does not make 50 percent of his income from it. He predicted the license changes would eliminate about 28 fishermen that he does business with.

Glenn Skinner, Executive Director of the N.C. Fisheries Association, opposes any attempt to redefine commercial fishermen. His organization represents about 2,000 members, he said, but the commission represents more than that, they represent the state. Most commissioners, he felt,

were using their positions to advance their personal agendas. He said the commission was supposed to listen to the public and the division's scientific recommendations and if they are not going to do that, they should resign.

George Leone, a commercial fisherman and dealer from Newport, opposes the proposals to redefine a commercial fisherman.

Justin Gilgo, from Sea Level, is a full-time fire inspector and commercially fishes on the side to supplement his income. Last year he only had 15 trips due to weather and boat repairs. He opposes the recommended license changes because he would not qualify for a license.

Steve House, a Dare County Commissioner, read a resolution* opposing any change in commercial fishing definition.

***This resolution was received during the Jan. 12 – Feb. 9 written public comment period on commercial licensing proposals and was provided to the commission.**

Ryan Jordan, who charters, and fishes recreationally and commercially, feels there is no problem with the current definition of a commercial fisherman. Many dealers supply customers from catch they buy from part time fishermen. He recently received a Standard Commercial Fishing License through the Eligibility Board, now he is afraid he will lose it if these proposals move forward. He told commissioners the problems they are trying to correct are not regulatory, but enforcement issues.

Adam Tyler, a commercial fisherman from Smyrna, opposes the license recommendations and said there are better ways to take care of the issue rather than just getting rid of a handful of people.

Bill Hooper, from Beaufort, has fished commercially for 35 years, both full-time and part-time. He said he doesn't think he would lose his license under the criteria discussed, however, he does think many other would and he is opposed to these recommended changes. Hooper explained several years ago the commercial industry asked for an increase in fees to fund state's Observer Program. He worries that eliminating commercial license holders may threaten the viability of the Observer Program and thereby shut down the flounder fishery and diminish the amount of money in the N.C. Commercial Fishing Resource Fund.

Larry Springle Jr. said he was against the new proposed definition for a commercial fisherman, which will impact his friends in a very bad way.

Larry Springle Sr., from Beaufort NC, said he is a third-generation commercial fisherman and he doesn't support the proposed changes to license. He has one grandchild and another on the way and these proposals will affect his son and his son's family.

Steve Weeks, attorney from Beaufort, said he held a Standard Commercial Fishing License that may not have any trips associated it. He said his family were commercial fishermen and he worked his way through college by commercial fishing. He pointed out that the North Carolina Constitution guarantees it citizens the right to pursue trades and that is a right that can only interfered with for public protection and welfare. He said no other state issued license requires a

minimum income or percent income to hold that license. The purpose of this proposal, Weeks said, is to reduce the number of license holders.

Lee Weeks, from Beaufort, is a commercial fisherman who works for North Carolina Ferry Division. Due to restrictions and demands of family, he said he had to seek job that provided health insurance, but that he still needed to fish to supplement his state income.

Sandra Gaskill, a commercial fisherman from Harkers Island, is from a commercial fishing family. She said her family is now about the only family from Harkers Island to Cedar Island who are full-time commercial fishermen. Most fishermen work another job to make it and that the Fisheries Reform Act was supposed to protect commercial fishermen. She said commercial fishermen buy their licenses and pay their taxes and that the commission is just trying to cut down the number of commercial fishermen.

Pam Morris, with the Carteret County Fisheries Association, said this is at least the fourth time the commission has looked at this issue. She said there were a lot of young people at the meeting and the state needs to give them a way to enter the commercial fishing business. She went to the most recent committee meeting to define a commercial fisherman and two or the three committee members knew nothing about commercial fishing, but came in with an agenda. She said there were very few full-time commercial fishermen anymore, but they need product going across the dock, whether it is from full-time or part-time fishermen. She is opposed to the proposed license changes.

Dave Beresoff, commercial fisherman and former commission member, said the commission has slowly deviated from intent of the Fisheries Reform Act. He said there were huge gear reduction then, but through regulation, gears were reduced even more. He said he will not be affected by these license proposals, but he has four children that will. His daughter recently went through eligibility process to get her commercial license and she is proud of it. She has used it once or twice, but will not be eligible to keep it under the new proposals. He said if the commission is going to do something like this, it needs to be done through stakeholder meetings.

Birdie Potter, from Pamlico County, is against the proposed changes to the definition of a commercial fisherman and said it would impact many people.

Jane Whitley, from Pamlico County, holds commercial license and keeps it because it is hers. The commercial license supplements hers and her family's income. She said her children may want to be fishermen one day, but they are too young to make that decision now. Commercial fishing is an economic mainstay and the license proposals would take $1.6 million off the top of the coastal economy.

Tim Gillikin has been a part-time commercial fisherman since 1974 and urged the commission not to mess with fishermen's rights and let us make a little money on the side, he said. He opposed the license proposals.

Bart Durham is from Wake Forest and holds a Standard Commercial Fishing License. He said he sees red flags when a board does not want to hear any public comment on an issue. He said the license proposals were another attempt by the CCA-controlled commission to eliminate

commercial fishermen. He said the proposals are unconstitutional and will surely be met with lawsuits.

Jon Flemer, opposes the license proposals, saying they are unconstitutional and that no state has the right to take these privileges. He is unable to depend on fishing to make a living and what he sells rarely offsets the cost of the license. He gives his catch to the widows and others in need and wants his children to be able to do the same.

Willis Baily works on his shad boat in the Gulf part of the year and is licensed and fishes commercially in North Carolina these rest of the year. He was born and raised in North Carolina. He would not be able to meet the license criteria in the proposals being considered and opposes them.

Kenny Rustick, from Gloucester, opposes the license proposals being considered. He has made his living mainly by commercial fishing, but there have been some years where he has had to do other work. He said the definition for a commercial fisherman already exists and the commission should listen to its constituents. The majority of the audience are commercial fishermen who had to shut down a small business to come and speak and fight against this issue once again.

Zack Davis, said he is a teacher in Carteret County, but before that he was a commercial fisherman and commercial fishing helps supplement his income. He said these changes would potentially put him, as well as 90 percent of the fishermen he knows, out of business. This is just one of many examples of honest men and women being stripped of their income. He also feels this will lead to a gill net ban. He is sure the proposals will be passed by the commission, only to be fought in the General Assembly.

Scott Buff, said he owns and operates 10 vessels in North Carolina and only two of those vessels will comply with the license proposals being considered. He said about 50 different people work for him and depend on him to speak - these proposals will hurt them. He said packed 1.5 million pounds of fish last year and huge percent was from part-timer fishermen.

Ernie Foster owns the Albatross Fleet out of Hatteras and he has worked the last 60 seasons charter fishing. He grew up and lives in a fishing community and feels compelled to support his fellow citizens. If this commission is ultimately responsible for these proposals coming a law, there will be much damage done to the communities, and the proposed license changes are not needed. He said the proposed changes will reduce the economic diversity in coastal communities and he questioned if taking a license will keep people from illegally catching fish.

David Wilson, from Hatteras, said he party fishes in the summer and commercial fishes at other times. Commercial fishermen are not a burden on the country and that they sustain themselves. He asked the commission how they would like taking a 25 percent reduction in their income.

Charles Godwin, from Wilmington, said he was all for starting shellfish leases in New Hanover County. He said there was a lot of area to raise oysters and he doesn't want to import seafood. He said we need to be able to farm for seafood in North Carolina.

Brett Padgett, said six years ago he and wife bought a commercial license, a boat and six crab pots and since then his business has grown. He said these proposals will impact more than the

fishermen, it will impact other businesses like net makers, etc. He opposes the proposed license changes.

Dr. Hormoze Goudarzi, from the Masonboro Sound area, talked about the safety of personal watercraft, saying they accounted for many marine accidents and that their use is growing. Shellfish lease gear is hard to see and poses great risk to personal watercraft as it takes 300 feet to stop one of these vessels. He does not think cages and water column leases should be in high-use areas risking fatal accidents and that this gear will be a problem in Masonboro Sound.

Neill Musselwhite, from New Hanover County, loves oysters and has nothing against oyster farming and would like to see increased. He said he agrees with Senator Bill Cook that North Carolina waters are prime for deep water aquaculture as outlined in S410, but questioned if legislators understood that the division would grant leases without respect to adjacent property owners.

Sonny Davis of the Capt Stacy Fishing Center in Morehead City, has been in business for 60 years, and has all the required licenses and renews them every year. Now his children are taking over the business and he goes out and sets a gill net. He thinks the proposals are stupid and that an adequate definition already exists for a commercial fisherman.

Maurice Davis Jr. opposes the license changes and said there was already a definition of commercial fishermen.

Alex Chadwick opposes the license recommendations and said anybody that pays the money for a commercial fishing license should be able to fish.

Clayton Daniels said commercial fishermen are the hardest working group of people in the nation. Anybody who is willing to work and pays for it is a commercial fisherman, he said. The license proposals would put a lot of his family out of business.

Charles Lane, of Southport, is a snapper-grouper captain. He purchased his own boat and then the feds restructured that permit and he lost it. He fished hard last year and only had 32 trips, so he would not make the proposed 36 trip limit. Out of six snapper grouper vessels in Southport, only one would meet the proposed threshold.

John Horton is opposed to the license proposals. He has been a part-time commercial fisherman since 1994 and said many people will be put out of fishing if these proposals go through.

Mike Marhefra is opposed to the license recommendation that set a 36-trip threshold. He said he worked hard last year and only had 26 trips and this would put him out of business.

Dale Britt had a Standard Commercial Fishing License at one time, now he is a charter boat captain. He said he was speaking to represent his friends and his mate, explaining that when the charter business slows in the fall, people like his mate switch to commercial fishing and these license proposals will hurt them. He told the commission this is America here tonight.

Scott Griffin said people were investing their hard-earned money on shellfish leases and they needed to be informed about an N.C. Attorney General opinion on riparian rights that says that docks do not give the property owner the right to the land and water beneath those docks.

Bradley Styron, a commercial fisherman and former commission member, said he opposes further defining a commercial fisherman and the issue has been debated for several years. These license proposals will wipe out part-time fishermen and they are average people trying to feed their families that need this income. Licenses with no trip tickets aren't taking the resource and the state is getting $400 without having to expend anything. He encouraged the commission to do the right thing.

Mark Smith is the sixth generation of commercial fishermen in his family, but now he has to fish part-time. He opposes any changes to the license structure and hopes that the commission can look forward and from now own prevent anything like this from happening again.

Craig Hamilton, from Beaufort, said the license proposals is some kind of divide and conquer agenda by special interests. To take away someone's right to make a living is not the North Carolina way.

Tilman Taylor, from Carteret County, opposes the license recommendations. He said commercial fishing was not his primary income, but still it was income his family depends on.

Phillip Goodwin, Sr. is a full-time commercial fisherman, but he has three brothers and other friends who fish part-time. He said they do it because they need the money. He said he would like the commercial license to be left like it is.

Randy Batts is a commercial fisherman and charter operator. He did not think he could meet the 36-trip threshold and if implemented, these new license requirements would put him out of business.

Elaine Davis, from Stella, said she is an accountant. With increased regulations it is very difficult to support family through fishing only. She said taking people's license away does injustice and is not fair.

Patrick Finn, from Stella, said he was a full-time commercial fisherman and a fish dealer and the proposals would impact those he buys from. He also talked about people who purposely destroy someone else's gear, saying those laws need to go from misdemeanor to felony. He told the commission they should all resign.

Kitty Adair talked about the book *Wetland Riders* and the impact the CCA has had on commercial fishing families. She has master's degree in social work and she said she knows putting commercial fishermen out of work will destroy their families and communities.

Cindy Garb just got a Standard Commercial Fishing License in 2017 that she uses for spearfishing and charter fishing. She is opposed to changes in the license criteria and said it will be nearly impossible to meet the criteria.

Joshua Thompson, from Sneads Ferry, comes from a commercial fishing family. He has always obeyed the law and it has cost him, ultimately the ability to work fulltime as a fisherman. He told the commission they made him a part-time fisherman. He believes the fishing industry is being governed by a commission that is not fair. He refuses to let his heritage and family legacy die and he asked the commission not to make him a criminal.

The commission recessed for the evening at 8:30 p.m.

At 8:30 a.m. the following day, the commission reconvened.

Standard Commercial Fishing License Eligibility Requirements

Commission Liaison Nancy Fish updated the commission on actions regarding Standard Commercial Fishing License eligibility requirements occurring since its November 2017 meeting. At that meeting, the commission voted to have the chair appoint a committee of commission members to develop a definition of a commercial fisherman and bring back an update at the commission's February 2018 meeting.

Chairman Corbett appointed himself, and Commissioners Chuck Laughridge and Mike Wicker to the Standard Commercial Fishing License Eligibility Requirement Committee, which met on Jan. 11, 2018.

The committee voted to recommend to the full commission the following proposed requirements for holding a Standard Commercial Fishing License:

1. Must have 50 percent of earned income from the Trip Ticket Program as in the Fisheries Reform Act of 1997. There is already a statutory precedent for a commercial fisherman in the Fisheries Reform Act.
2. A fisherman must have 36 trip tickets per year.
3. To address crew issues for those who do not have trip tickets, but are bona fide commercial fishermen as crew or any commercial fishing interest in North Carolina or outside the state, proof of income of $10,000 or more per year. The proof of income should come from a commercial fishing operation, business, etc. doing business in North Carolina.

   (The commission can decide if items 1, 2 and 3 are stand alone or a combination thereof.)

4. Inactive Standard Commercial Fishing Licenses that do not have any of the above with a three-year running average, would go back into a special pool and these licenses may be reissued to the original holder subject to commitment to 1, 2 and/or 3 above without going through the Eligibility Pool.
5. Create a Heritage Standard Commercial Fishing License that families may want to maintain that are inactive. The license may be maintained for $100 per year and may be reissued one time to a family member without going through the Eligibility Pool or any of the 1, 2 and 3 requirements listed above. If the reissuance of the license is not wanted, a one-time fee of $100 will retire that license number.

It was noted the proposals would require legislative approval and would serve as a starting point for deliberations at the commission's upcoming February meeting.

The commission held a comment period from Jan. 12 – Feb. 9, soliciting written comment on the recommended license changes. Electronic and hard copies of the comments were provided to the commission. Fish reported approximately 150 comments were received, with 136 in opposition, seven in support and seven that were indeterminate.

The commission had a brief discussion about the makeup of the committee and then, after a series of motions and amendments, voted to send a letter to the legislature recommending the following changes to Standard Commercial Fishing Licenses:

1. Develop a new commercial fishing license based on criteria to qualify current commercial license holders. Current license holders must demonstrate a minimal level of participation in the fishery as reported by landings (1,000 pounds of seafood products) or effort (15 trips) through the Division of Marine Fisheries' Trip Ticket Program during any two out of five continuous calendar years.
2. Only allow license transfers or assignments to members of the immediate family or corporation of a licensed commercial fisherman.
3. Create a Crew License for individuals to apprentice with commercial fishermen for three years, after which time they would be eligible to purchase a standard commercial fishing license. The annual fee for the Crew License would be $100.
4. Cap the pool at 100, and establish a new pool to receive licenses that are not renewed each year. Any non-renewed licenses would be transferred into the new pool and used to fill new commercial fishing license demand for qualified applicants. Inactive licenses may be reactivated for a fee.
5. Inactive Standard Commercial Fishing Licenses that do not have requirements set forth by the legislature would go back into a special pool and these licenses may be reissued to the original holder without going through the Eligibility Pool.
6. Create a Heritage Standard Commercial Fishing License that families may want to maintain that are inactive that may be maintained for $100 per year and may be reissued one time to a family member without going through the Eligibility Pool or any of the requirements listed above. If reissue is not wanted, a one-time fee of $100 will retire that license number.
7. Graduation or completion of community colleges offering a commercial fishing program will be recognized as having served an apprenticeship eligible for an Eligibility Pool license.

Motions

Motion by Pete Kornegay to send a letter to the legislature recommending the below changes to fishing licenses. Second by Chuck Laughridge.

COMMERCIAL

1) Develop a new commercial fishing license based on criteria to qualify current commercial license holders. Current license holders must demonstrate a minimal level of participation in the fishery as reported by landings (1,000 pounds of seafood products) or effort (15 trips) through the DMF trip ticket program during any two out of five continuous calendar years.

~~2) Allow only one license per individual at an annual fee that will remain revenue neutral.~~

~~3) Task the MFC/DMF with developing a plan to expand opportunities including extended seasons, higher trip limits, authorization of hook and line as an allowable gear for all species, and other incentives to allow commercial fishermen greater access to commercial fisheries and provide more harvest opportunities to qualified commercial fishermen.~~

4) Only allow license transfers or assignments to members of the immediate family or corporation of a licensed commercial fisherman.

5) Create a Crew license for individuals to apprentice with commercial fishermen for 3 years after which time they would be eligible to purchase a standard commercial fishing license. The annual fee for the Crew license would be $100.

6) Cap the pool at 100 and establish a new pool to receive licenses that are not renewed each year. Any non-renewed licenses would be transferred into the new pool and used to fill new commercial fishing license demand for qualified applicants. Inactive licenses may be reactivated for a fee.

Motion to amend by Chuck Laughridge to withdraw number 3 from the original motion. Second by Pete Kornegay.
Motion carries unanimously.

Motion by Mark Gorges to amend original motion by striking number 2. Second by Janet Rose.
Motion carries unanimously.

Motion by Chuck Laughridge to amend the original motion to include the below. Second by Rick Smith.
Motion carries 5-3 with one abstention.

1) Inactive Standard Commercial Fishing Licenses that do not have requirements set forth by the legislature would go back into a special pool and these licenses may be reissued to the original holder subject without going through the Eligibility Pool.

2) Create a Heritage Standard Commercial Fishing License that families may want to maintain that are inactive that may be maintained for $100 per year and may be reissued one time to a family member without going through the Eligibility Pool or any of the requirements listed above. If reissue is not wanted, a one-time fee of $100 will retire that license number.

3) Graduation or completion of community colleges offering a commercial fishing program will be recognized as having served an apprenticeship eligible for an Eligibility Pool license.

Motion as amended.
Motion by Pete Kornegay to send a letter to the legislature recommending the below changes to fishing licenses. Second by Chuck Laughridge.

1) **Develop a new commercial fishing license based on criteria to qualify current commercial license holders. Current license holders must demonstrate a minimal level of participation in the fishery as reported by landings (1,000 pounds of seafood products) or effort (15 trips) through the DMF trip ticket program during any two out of five continuous calendar years.**

2) **Only allow license transfers or assignments to members of the immediate family or corporation of a licensed commercial fisherman.**

3) **Create a Crew license for individuals to apprentice with commercial fishermen for 3 years after which time they would be eligible to purchase a standard commercial fishing license. The annual fee for the Crew license would be $100.**

4) **Cap the pool at 100 and establish a new pool to receive licenses that are not renewed each year. Any non-renewed licenses would be transferred into the new pool and used to fill new commercial fishing license demand for qualified applicants. Inactive licenses may be reactivated for a fee.**

5) **Inactive Standard Commercial Fishing Licenses that do not have requirements set forth by the legislature would go back into a special pool and these licenses may be reissued to the original holder without going through the Eligibility Pool.**

6) **Create a Heritage Standard Commercial Fishing License that families may want to maintain that are inactive that may be maintained for $100 per year and may be reissued one time to a family member without going through the Eligibility Pool or any of the requirements listed above. If reissue is not wanted, a one-time fee of $100 will retire that license number.**

7) **Graduation or completion of community colleges offering a commercial fishing program will be recognized as having served an apprenticeship eligible for an Eligibility Pool license.**

<u>Roll Call Vote</u>

Boltes	**yes**
Gorges	**yes**
Kornegay	**yes**
Koury	**no**
Laughridge	**yes**
Rose	**no**
Smith	**yes**
Willis	**no**
Corbett	**no**

Motion carries 5-4.

Striped Mullet Data Analysis and Recommendations

Division biologists Dan Zapf and Tracey Bauer reviewed results of additional analysis of commercial striped mullet landings, specifically from trips that targeted striped mullet. They also reported on standardized fishery independent indices to account for the impact of environmental factors on this fishery. The data time series through 2017 was also reviewed for the commercial landings and fishery independent data to better assess trends in the striped mullet fishery and stock abundance.

To view the presentation, go to:
http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=31653371&name=DLFE-137509.pdf

Southeast Regional Southern Flounder Stock Assessment

Laura Lee, the division's senior stock assessment scientist, and Mike Loffler, the lead southern flounder biologist, presented the commission with the findings from the Southeast Regional Southern Flounder Stock Assessment. Since 2016, the division and state fisheries biologists from South Carolina, Georgia and Florida, along with university scientists, have been working to develop a coast-wide stock assessment. The findings of the peer-reviewed assessment are that the probability that the 2015 stock of southern founder is overfished is 100 percent and the probability that the 2015 stock is experiencing overfishing is 53 percent. However, before the stock assessment is complete, the division must update the approved ASAP pooled-sex model using data through 2017. The division also plans to update MRIP estimates if they are available in July, as suggested by the peer reviewers. The division will move forward to finalize these updates to the stock assessment, while continuing to work with the advisory committee on the development of Amendment 1 to the Southern Flounder Fishery Management Plan.

To view the presentation, go to:
http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=31653371&name=DLFE-137508.pdf .

Dr. Fred Scharf addressed the commission at the request of Chairman Corbett. Scharf is the chairman of the Southern Flounder Fishery Management Plan Advisory Committee and he also served on the 2017 Southern Flounder Stock Assessment Working Group. Scharf said he strongly agrees with the peer reviewers about the need to include 2016-2017 data in the stock assessment and he urged the commission to give the division and the advisory committee time to complete the fishery management plan process and its associated management recommendations.

There was discussion by the commission of implementing interim management measures as a step to ending overfishing.

Director Murphey advised that the division has great concern for the southern flounder stock, but does not have the intent to do interim management measures. He said the fishery management process, as outlined in the Fisheries Reform Act, needed to be allowed to proceed. The division will work to finalize the stock assessment, incorporating the updated 2016-2017 data and the MRIP data this summer. In addition, the staff will be following a rigorous timeline with the advisory committee developing the fishery management plan, which is scheduled to be presented to the commission in early 2019.

Motion by Chuck Laughridge to suggest that the NCDMF director use his proclamation authority to address overfishing of southern flounder. Seconded by Pete Kornegay.
Motion withdrawn.

Rulemaking
For the periodic Review and Expiration of Existing Rules process, the commission took the following action:

Motion by Rick Smith to approve schedule for re-adoption of 15A NCAC 03 rules to be completed by June 30, 2022. Second by Brad Koury.
Motion carries unanimously.

Motion by Alison Willis to approve draft report on 15A NCAC 18A .0100, .0300 - .0900 and .3400 rules to proceed to public notice, per G.S. 150B21.3A. Second by Cameron Boltes.
Motion carries unanimously.

Land and Sell
The commission requested the division research license requirements to determine if vessels with a homeport in North Carolina that take fish outside the territorial waters of the state can land or sell catch in the state through the purchase of a Land or Sell License.

Motion by Chuck Laughridge to have the MFC send a request to the NCGA, Senate president pro-tem, House speaker and N.C. Governor to request allowing fishermen who hold federal permits to be able to use the same land and sell permit as non-NC boats use to land in North Carolina.
Motion withdrawn.

Coastal Recreational Fishing License
The commission requested the division provide an update on the fund disbursements from the Coastal Recreational Fishing License at its next meeting.

Triploid Oysters
The commission requested the division provide a presentation on triploid oysters at its next meeting.

Tarpon
The commission voted to have the division begin the process of drafting rules to make tarpon a no spear, no gaff and no possession fish.

Motion by Cameron Boltes that the division draft rules to make tarpon a no spear, no gaff and no possession fish. Second by Chuck Laughridge.
Motion carries 6-0 with 2 abstentions.

Letter to Governor Cooper
The commission voted to send a letter to Governor Roy Cooper asking him to examine the current membership of the Marine Fisheries Commission and, if need be, make changes to ensure the commission functions as intended.

Motion by Janet Rose that the commission send a request to Governor Cooper asking that he examine the current membership of this commission and, if need be, make changes to ensure this commission functions as intended. Second by Cameron Boltes.

Roll call

Boltes	**yes**
Gorges	**yes**
Kornegay	**no**
Koury	**no**
Laughridge	**no**
Rose	**yes**
Smith	**no**
Willis	**yes**
Corbett	**yes**

Motion carries 5-4

The meeting adjourned.

Chairman's Report

NORTH CAROLINA MARINE FISHERIES COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY

March 8, 2018

The Honorable Roy Cooper, Governor
State of North Carolina
20301 Mail Service Center
Raleigh, NC 27699-0301

Dear Governor Cooper:

During its Feb. 14-15 business meeting, the N.C. Marine Fisheries Commission voted to request that you examine its current membership and make any needed changes to ensure the commission functions as intended. The motion and roll call vote are included below for your review.

> **Motion by Janet Rose that the commission send a request to Governor Cooper asking that he examine the current membership of this commission and, if need be, make changes to ensure this commission functions as intended. Second by Cameron Boltes.**
>
> | | |
> |---|---|
> | **Cameron Boltes** | **Yes** |
> | **Mark Gorges** | **Yes** |
> | **Pete Kornegay** | **No** |
> | **Brad Koury** | **No** |
> | **Chuck Laughridge** | **No** |
> | **Janet Rose** | **Yes** |
> | **Rick Smith** | **No** |
> | **Alison Willis** | **Yes** |
> | **Sammy Corbett** | **Yes** |
>
> **Motion carries 5-4.**

The commission is a nine-member panel appointed by the governor to manage, restore, develop, cultivate, protect and regulate the marine and estuarine resources of the state. Members serve 3-year staggered terms, in seats that have specific occupational, income and residential requirements as set out in G.S. 143B-289.54. For your convenience, attached is a list of the Marine Fisheries Commission, along with the seats held, contact information, and appointment and expiration dates.

Thank you for your consideration of this request; please feel free to contact me if I may be of assistance to you in this or any other matter.

Sincerely,

Sammy Corbett, Chairman
N.C. Marine Fisheries Commission

SJC:ndf

Enclosure

cc: DEQ Secretary Michael Regan
DEQ Chief Deputy Secretary John Nicholson

NORTH CAROLINA MARINE FISHERIES COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY

March 16, 2018

Dear Members of the North Carolina General Assembly:

At its Feb. 14-15 business meeting in Wrightsville Beach, the N.C. Marine Fisheries Commission voted to recommend changes to the licensing structure for commercial fishermen. The motion and roll call vote are included below for your review.

Motion by Pete Kornegay to send a letter to the legislature recommending the below changes to fishing licenses. Second by Chuck Laughridge.

1) **Develop a new commercial fishing license based on criteria to qualify current commercial license holders. Current license holders must demonstrate a minimal level of participation in the fishery as reported by landings (1,000 pounds of seafood products) or effort (15 trips) through the DMF trip ticket program during any two out of five continuous calendar years.**

2) **Only allow license transfers or assignments to members of the immediate family or corporation of a licensed commercial fisherman.**

3) **Create a Crew license for individuals to apprentice with commercial fishermen for 3 years after which time they would be eligible to purchase a standard commercial fishing license. The annual fee for the Crew license would be $100.**

4) **Cap the pool at 100 and establish a new pool to receive licenses that are not renewed each year. Any non-renewed licenses would be transferred into the new pool and used to fill new commercial fishing license demand for qualified applicants. Inactive licenses may be reactivated for a fee.**

5) **Inactive Standard Commercial Fishing Licenses that do not have requirements set forth by the legislature would go back into a special pool and these licenses may be reissued to the original holder without going through the Eligibility Pool.**

6) **Create a Heritage Standard Commercial Fishing License that families may want to maintain that are inactive that may be maintained for $100 per year and may be reissued one time to a family member without going through the Eligibility Pool or any of the requirements listed above. If reissue is not wanted, a one-time fee of $100 will retire that license number.**

7) **Graduation or completion of community colleges offering a commercial fishing program will be recognized as having served an apprenticeship eligible for an Eligibility Pool license.**

Roll Call Vote

Cameron Boltes	**yes**
Mark Gorges	**yes**
Pete Kornegay	**yes**
Brad Koury	**no**
Chuck Laughridge	**yes**
Janet Rose	**no**
Rick Smith	**yes**
Alison Willis	**no**
Sammy Corbett	**no**

Motion carries 5-4.

This action was preceded by a meeting of the commission's Standard Commercial Fishing License Eligibility Requirement Committee on Jan. 11, 2018. The minutes of that meeting are attached for your convenience.

Thank you for your consideration of this request; please feel free to contact me if I may be of assistance to you in this or any other matter.

Sincerely,

Sammy Corbett

Sammy Corbett, Chairman
N.C. Marine Fisheries Commission

SJC:ndf

Enclosure

cc: DEQ Secretary Michael Regan
DEQ Chief Deputy Secretary John Nicholson
DEQ Legislative Affairs Director Anderson Miller
DMF Director Steve Murphey

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

STEPHEN W. MURPHEY
Director

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Nancy Fish
Division of Marine Fisheries

DATE: Jan. 31, 2018

SUBJECT: Standard Commercial Fishing License Eligibility Requirements Committee Meeting

The Standard Commercial Fishing License Eligibility Requirements Committee met at 1 p.m. on Thursday, Jan. 11, 2018 at the Division of Marine Fisheries' Central District Office, 5285 Highway 70 West, Morehead City, NC 28557. The following attended:

Committee Members: Sammy Corbett – Chairman, Chuck Laughridge, and Mike Wicker

Staff: Steve Murphey, Dee Lupton, Nancy Fish, C.J. Alley, Col. Dean Nelson, Major Jason Walker, Kathy Rawls, Stephanie McInerny, Brenda Clark, Kevin Brown, Patricia Smith

Public: David Bush, Skip Conklin, David Sneed, Jan Willis, Bert Billings, Trish Murphey, Bradley Brown, Ken Seigler, Pam Morris, Adam Tyler

Media: Maureen Donald, Mike Shutak, Elizabeth Tew, Dillon Ray

Sammy Corbett, serving as chair, called the meeting to order, reminded commissioners of their duty to avoid any conflicts of interest and asked Nancy Fish to do the roll call.

APPROVAL OF AGENDA

Motion by Mike Wicker to approve the agenda. Second by Chuck Laughridge. Motion passes unanimously.

SCOPE AND PURPOSE

Chairman Corbett explained that at its November 2017, the commission passed a motion by Chuck Laughridge to ask the chairman to appoint a committee of commission members to develop a definition of a commercial fisherman, with staff support from the Division of Marine Fisheries, to bring an update back to the commission at its February 2018 meeting.
He said a similar initiative was undertaken in 2016 at the request of Representatives Bell and Dixon, but he was advised legislators felt those recommendations were too vague. Chairman Corbett explained he had been contacted by legislators again recently, asking for more detailed

recommendations from the commission. Chairman Corbett reminded the committee that changes to the license structure would have to be done by the General Assembly.

Chairman Corbett said he had initially said he would let any commissioner that was interested serve on this committee, but the commission's legal counsel advised the committee should have no more than three members and suggested that the vice-chair and scientist serve of the panel.

He said the meeting is just to discuss the criteria or eligibility requirements to hold a Standard Commercial Fishing License and that the committee was not going to discuss other topics. He also advised the committee was just going to make recommendations to present to the full Marine Fisheries Commission for consideration at its Feb. 14-15 business meeting in Wrightsville Beach.

DISCUSSION OF STANDARD COMMERCIAL FISHING LICENSE CRITERIA, ISSUES AND CONSIDERATIONS

Mike Wicker discussed the need for improved data collection and Chairman Corbett reminded him the meeting was just to discuss eligibility requirements for the Standard Commercial Fishing License and that issues like data collection could be discussed at the upcoming commission meeting.

Wicker said he'd like the Standard Commercial Fishing License to be for people to catch fish to sell and wanted to eliminate the license being used by someone to simply fill their freezer or to give fish to their friends.

Chairman Corbett reminded the committee that the Division of Marine Fisheries has previously stated that the division does not have the statutory authority to require Standard Commercial Fishing License holders to document fish they are not selling.

Chuck Laughridge said better defining a commercial fisherman had been an issue for years and it was needed to have a better handle on the number of participants that are taking a public trust resource.

Chuck Laughridge made a motion for the following requirements for holding a Standard Commercial Fishing License:

1. **Must have 50 percent of earned income from the Trip Ticket Program as in the Fisheries Reform Act of 1997. There is already a statutory precedent for a commercial fisherman in the Fisheries Reform Act;**
2. **A fisherman must have three dozen of 36 trip tickets per year;**
3. **To address crew issues for folks who do not have trip tickets, but are bona fide commercial fishermen as crew or any commercial fishing interest in North Carolina or outside the state, proof of income from a commercial fishing operation, business, etc. doing business in North Carolina (crew) of $10,000 or more per year.**

   (The commission can decide if items 1, 2 and 3 are stand alone or a combination thereof)

4. **Inactive Standard Commercial Fishing Licenses that do not have any of the above with a three-year running average, would go back into a special pool and these licenses may be reissued to the original holder subject to commitment to 1, 2 and/or 3 above without going through the Eligibility Pool.**
5. **Create a Heritage Standard Commercial Fishing License that families may want to maintain that are inactive that may be maintained for $100 per year and may be reissued one time to a family member without going through the Eligibility Pool or any of the 1,2 and 3 requirements listed above. If reissue is not wanted, a one-time fee of $100 will retire that license number.**

Seconded by Mike Wicker.
Motion passed 2-0.

Chairman Corbett said nothing in the motion is etched in stone and these recommendations will serve as a starting point for discussions at the upcoming commission meeting being held Feb. 14-15 in Wrightsville Beach.

Meeting adjourned.

NORTH CAROLINA MARINE FISHERIES COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY

March 28, 2018

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

Dear Mr. Beal:

I am writing on behalf of the N.C. Marine Fisheries Commission regarding the amendment to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan that primarily addresses the commercial summer flounder fishery. The summer flounder fishery has been a very important component of the state's commercial fishing industry for the last several decades. In 2016, North Carolina's commercial fishery landed 2,071,089 pounds of summer flounder with a dockside value of $8,238,703. The summer flounder trawl fishery accounts for nearly all of the commercial summer flounder landings in North Carolina, and a total of 266 flounder trawl trips from 97 vessels landed summer flounder in our state in 2016.

The commercial allocations issue in this amendment is of utmost concern to the commission. North Carolina has the largest allocation of the commercial summer flounder quota based on its historic landings, and shore-based infrastructure and businesses were developed to support the state's commercial summer flounder fishery. We understand that the amendment is still under development, so we ask that proposed management measures concerning allocation include a broad range of options that considers the historic fisheries of the affected states.

Thank you for keeping this request in mind as the amendment to this plan is being developed and please know how much we appreciate the work you do on behalf of our Atlantic Coast fisheries.

Sincerely,

Sammy Corbett

Sammy Corbett, Chairman
N.C. Marine Fisheries Commission

cc: Steve Murphey, Director, N.C. Division of Marine Fisheries
N.C. Marine Fisheries Commission

P.O. Box 769, Morehead City, NC 28557-0769
www.ncfisheries.net

NORTH CAROLINA MARINE FISHERIES COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY

March 28, 2018

Dr. Christopher M. Moore, Executive Director
Mid-Atlantic Fishery Management Council
800 North State St., Suite 201
Dover, DE 19901

Dear Dr. Moore:

I am writing on behalf of the N.C. Marine Fisheries Commission regarding the amendment to the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan that primarily addresses the commercial summer flounder fishery. The summer flounder fishery has been a very important component of the state's commercial fishing industry for the last several decades. In 2016, North Carolina's commercial fishery landed 2,071,089 pounds of summer flounder with a dockside value of $8,238,703. The summer flounder trawl fishery accounts for nearly all of the commercial summer flounder landings in North Carolina, and a total of 266 flounder trawl trips from 97 vessels landed summer flounder in our state in 2016.

The commercial allocations issue in this amendment is of utmost concern to the commission. North Carolina has the largest allocation of the commercial summer flounder quota based on its historic landings, and shore-based infrastructure and businesses were developed to support the state's commercial summer flounder fishery. We understand that the amendment is still under development, so we ask that proposed management measures concerning allocation include a broad range of options that considers the historic fisheries of the affected states.

Thank you for keeping this request in mind as the amendment to this plan is being developed and please know how much we appreciate the work you do on behalf of our Atlantic Coast fisheries.

Sincerely,

Sammy Corbett

Sammy Corbett, Chairman
N.C. Marine Fisheries Commission

cc: Steve Murphey, Director, N.C. Division of Marine Fisheries
N.C. Marine Fisheries Commission

TOWN OF NAGS HEAD RESOLUTION

OPPOSING ACTION TAKEN BY MARINE FISHERIES COMMISSION WITHOUT ADEQUATE PUBLIC NOTICE RE: COMMERCIAL FISHING OPERATION

WHEREAS, commercial fishing is a vital part of North Carolina's history, heritage, and culture and represents a crucial component of the economy for the Town of Nags Head, Dare County, and other coastal communities; and

WHEREAS, the North Carolina General Assembly has declared it to be the public policy of North Carolina that the hearings, deliberations, and actions of public bodies be conducted publicly - N.C.G.S. § 143-318.9; and

WHEREAS, the North Carolina Marine Fisheries Commission (MFC) met on February 15, 2018 to consider proposed changes in the definition of a commercial fisherman prepared by a three member committee; and

WHEREAS, at that meeting, a previously un-seen proposal was presented to the MFC for consideration while the original proposal prepared by the three member committee was never considered or discussed; and

WHEREAS, the commission members and the public did not have a chance to review the un-seen proposal prior to the meeting; and

WHEREAS, although the Final Report from the Fishing License Review Taskforce clearly stated its recommendation that "no changes are needed to the existing definition" and only 10% of the public comments received were in support of changing the definition; and

WHEREAS, the MFC adopted the un-seen proposal changing the definition of a commercial fisherman without the chance for public input and without taking into consideration the 90% in favor of no changes.

NOW THEREFORE BE IT RESOLVED that the Nags Head Board of Commissioners requests that the Marine Fisheries Commission repeal its action from their February 15, 2018 meeting to adopt a resolution modifying the definition of commercial fisherman.

Adopted this the 14th day of March 2018.

Benjamin Cahoon, Mayor
Town of Nags Head

ATTEST:
Carolyn F. Morris, Town Clerk

March 20, 2018

The Honorable Governor Roy Cooper
Office of the Governor
20301 Mail Service Center
Raleigh, NC 27699-0301

Dear Governor Cooper:

The Carteret County Board of Commissioners, while sitting in regular session on Monday, March 19, 2018, adopted the enclosed Resolution asking that you examine the current membership of the North Carolina Marine Fisheries Commission to ensure that the Commission equitably balances commercial and recreational fishing interests in a way that does not benefit private interests or bring harm to others.

We sincerely appreciate your consideration.

Sincerely,

Rachel B. Hammer
Clerk to the Board

/rbh
Enclosure

copy: Senator Norman W. Sanderson
Senator Richard Burr
Senator Phil Berger
Senator Harry Brown
Senator Thom Tillis
Representative Pat McElraft
NC House Speaker Tim Moore
Congressman Walter Jones
Sammy Corbett, Chairman, Marine Fisheries Commission ✓
Braxton Davis, Director, NC Division of Marine Fisheries
Michael S. Regan, Secretary, NCDEQ
Members, Carteret County Marine Fisheries Advisory Board

RESOLUTION
ASKING NORTH CAROLINA GOVERNOR ROY COOPER TO EXAMINE THE CURRENT MEMBERSHIP OF THE NC MARINE FISHERIES COMMISSION

WHEREAS, the State's Marine Resources are a public trust, the owners of which are the 10.2 million residents of the state living from Murphy to Manteo; and

WHEREAS, the North Carolina Fisheries Reform Act of 1997 established the legal framework for the management of fisheries for the benefit of all citizens; and

WHEREAS, the North Carolina Marine Fisheries Commission is comprised of designated seats designed to balance user group interests among recreational, commercial, science, and at-large fisheries stakeholders; and

WHEREAS, the North Carolina Marine Fisheries Commission, whose members are appointed by the Governor, are responsible for adhering to the Fisheries Reform Act in following due process, incorporating stakeholder input, and making science-based decisions; and

WHEREAS, the Commission has exhibited a pattern of willfully disregarding stakeholder input, scientific expertise, and proper legal process and procedures in favor of interest group agendas; and

WHEREAS, improperly-made decisions by the Commission threaten food security for the State and Country, and jeopardize the economic vitality of coastal communities and the occupational viability of commercial fishing families and associated businesses; and

WHEREAS, the Carteret County Board of Commissioners has long advocated that the North Carolina Marine Fisheries Commission serve the public interest by managing the State's fisheries resources for the benefit of all citizens in a way that provides fair and equitable treatment of both commercial and recreational fishing interests in an open and transparent way.

NOW THEREFORE BE IT RESOLVED that the Carteret County Board of Commissioners strongly urges North Carolina Governor Roy Cooper to examine the current membership of the North Carolina Marine Fisheries Commission and if need be, to make changes to ensure that this Commission equitably balances commercial and recreational fishing interests in a way that does not benefit private interests or bring harm to others.

ADOPTED, this the 19th day of March 2018.

Mark Mansfield

Mark Mansfield, Chairman
Carteret County Board of Commissioners

Rachel Hammer

Rachel Hammer, Clerk to the Board

TOWN OF KILL DEVIL HILLS

Post Office Box 1719, 102 Town Hall Drive
Kill Devil Hills, North Carolina 27948
252-449-5300
www.kdhnc.com

March 20, 2018

North Carolina Marine Fisheries Commission
c/o Nancy Fish
N.C. Division of Marine Fisheries
3441 Arendell Street
Morehead City, NC 28557

REF: Enclosed resolutions

Dear Commission Members,

At its March 12, 2018, meeting, the Kill Devil Hills Board of Commissioners adopted the following resolutions:

- Resolution Asking North Carolina Governor Roy Cooper to Examine the Current Membership of the NC Marine Fisheries Commission.

- Resolution Opposing Any Adverse Change in the Definition of a Commercial Fishing Operation

A copy is included for reference. Thank you for your continued service to the citizens of Kill Devil Hills and North Carolina.

Sincerely,

Sheila F. Davies

Sheila F. Davies, Ph.D.,
Mayor

Encl.
c: Governor Roy Cooper
Dare County Board of Commissioners
Dare County Municipalities
file

TOWN OF KILL DEVIL HILLS

Land Where Flight Began

RESOLUTION ASKING NORTH CAROLINA GOVERNOR ROY COOPER TO EXAMINE THE CURRENT MEMBERSHIP OF THE NC MARINE FISHERIES COMMISSION

WHEREAS, the State's Marine Resources are a public trust, the owners of which are the 10.2 million residents of the state living from Murphy to Manteo; and

WHEREAS, the North Carolina Fisheries Reform Act of 1997 established the legal framework for the management of fisheries for the benefit of all citizens; and

WHEREAS, the North Carolina Marine Fisheries Commission is comprised of designated seats designed to balance user group interests among recreational, commercial, science, and at-large fisheries stakeholders; and

WHEREAS, the North Carolina Marine Fisheries Commission, whose members are appointed by the Governor, are responsible for adhering to the Fisheries Reform Act in following due process, incorporating stakeholder input, and making science-based decisions; and

WHEREAS, the Commission has exhibited a pattern of willfully disregarding stakeholder input, scientific expertise, and proper legal process and procedures in favor of interest group agendas; and

WHEREAS, improperly-made decisions by the Commission threaten food security for the state and country, and jeopardize the economic vitality of coastal communities and the occupational viability of commercial fishing families and associated businesses; and

WHEREAS, the Kill Devil Hills Board of Commissioners has long advocated that the North Carolina Marine Fisheries Commission serve the public interest by managing the State's fisheries resources for the benefit of all citizens in a way that provides fair and equitable treatment of both commercial and recreational fishing interests in an open and transparent way.

NOW THEREFORE BE IT RESOLVED that the Kill Devil Hills Board of Commissioners strongly urges North Carolina Governor Roy Cooper to examine the current membership of the North Carolina Marine Fisheries Commission and if need be to make changes to ensure that this Commission equitably balances commercial and recreational fishing interests in a way that does not benefit private interests or bring harm to others.

Adopted this the 12th day of March, 2018.

[SEAL]

By: _____
Sheila F. Davies, Ph.D.
Mayor

ATTEST:

_____
James Michael O'Dell
Deputy Town Clerk

TOWN OF KILL DEVIL HILLS

Land Where Flight Began

RESOLUTION
OPPOSING ANY ADVERSE CHANGE IN THE DEFINITION OF A COMMERCIAL FISHING OPERATION

WHEREAS, the Kill Devil Hills Board of Commissioners unanimously adopted a resolution on January 31, 2018 opposing any change in the definition of a commercial fishing operation; and

WHEREAS, the Marine Fisheries Commission at their Wrightsville Beach meeting voted 5 to 4 to change the criteria that was previously under consideration and approve a redefinition of commercial fishing; and

WHEREAS, the Commission's new criteria identified seven qualification components including a requirement that commercial license holders demonstrate a minimum level of participation by documenting 1000 pounds of landings through the trip ticket program during any of the two out of five continuous calendar years; and

WHEREAS, the new criteria advanced by the Marine Fisheries Commission would have an adverse impact on those who now engage in commercial fishing and already suffer because of government overregulation that imposes severe quotas and unnecessary restrictions on fishing seasons, limits, and gear forcing many to take on additional jobs and engage in part-time businesses in order to support their families; and

WHEREAS, imposing an arbitrary level of participation would unfairly have a harsh and punitive effect on coastal communities hit by hurricanes and other natural disasters where many commercial license holders, whose income generating season may have been entirely wiped out by a storm, are forced to temporarily divert their time and talents to other business enterprises; and

WHEREAS, no other professional license issued by the State dictates a level of participation in order for its holders to qualify; and

WHEREAS, additionally the new criteria would create a requirement that all individuals wanting to engage in commercial fishing must first complete a 3 year apprenticeship or graduate from a community college commercial fishing program before being eligible to purchase a standard commercial fishing license; and

WHEREAS, the imposition of an apprenticeship requirement would unfairly penalize those with an entrepreneurial spirit willing to invest their skills and resources in the commercial fishing industry. This requirement is counterproductive to economic development principles and would only serve to thwart individuals wanting to pursue their dream of creating a small business in our coastal communities; and

WHEREAS, the definition of what constitutes commercial fishing in North Carolina has been determined by the General Assembly and has long been established in section 113-168 of North Carolina's General Statutes; and

WHEREAS, over seven years ago, in October of 2010, the Marine Fisheries Commission empaneled a Fishing License Review Taskforce, which examined in detail the requirements for holding a commercial fishing license and concluded that the definition contained in the General Statutes was adequate and therefore there was no real need to modify the definition of what constitutes a commercial fisherman; and

WHEREAS, furthermore, the Final Report from the Fishing License Review Taskforce clearly stated its recommendation that "no changes are needed to the existing definition;" and

WHEREAS, the effort that is underway by the Marine Fisheries Commission to redefine Commercial Fishing is a misguided attempt to fix something that is not broken and would jeopardize coastal communities whose economy and wellbeing are dependent upon both full-time and part-time commercial fishermen and would have an adverse impact on young entrepreneurs wishing to enter the commercial fishing industry.

NOW THEREFORE BE IT RESOLVED that the Kill Devil Hills Board of Commissioners supports the definition of commercial fishing that has been determined by the duly elected members of the North Carolina General Assembly and reflected in the North Carolina General Statutes.

AND BE IT FURTHER RESOLVED that the Kill Devil Hills Board of Commissioners strongly opposes any adverse change in the definition of commercial fishing and urges the North Carolina General Assembly to take no action that would harm the hard working North Carolinians who put fresh seafood on American tables.

Adopted this the 12th day of March, 2018.

[SEAL]

By: _____
Sheila F. Davies, Ph.D.
Mayor

ATTEST:

_____
James Michael O'Dell
Deputy Town Clerk

NORTH CAROLINA
State Board of Elections & Ethics Enforcement

Mailing Address:
P.O. Box 27255
Raleigh, NC 27611-7255

Phone: (919) 814-0700
Fax: (919) 715-0135

KIM WESTBROOK STRACH
Executive Director

OCTOBER 26, 2017

TIPS FOR THE ONLINE ETHICS EDUCATION PROGRAM COMPATIBILITY ISSUES.

Please share this information with your Agency's covered employees and the members of your Boards and Commissions:

Computers with Windows 10

- Use Microsoft Edge & Microsoft Internet Explorer
- May also work with Foxfire
- Program does **not** work with Google Chrome

Mac Computers

- Use Firefox to open Online Education; if audio does not work, right click "No Audio" button and allow microphone so that audio works.

Computers with Windows 7 & 8

- Use Internet Explorer as your browser

If the above suggestions do not resolve the problem for the person, we recommend they use a computer at a public library, Community College or University as the program seems to run fine on these computers. **NOTE**: individuals are required to complete the ethics education PRIOR to their education due date even if they encounter problems with the online program.

INDIVIDUALS MUST FULLY COMPLETE THE ONLINE PROGRAM.

Many people are not fully completing the online ethics education program. If within a few minutes after you "completed" the online program you do not receive an emailed certificate of completion from us, you probably have **not** fully completed the program. **If one fails to fully complete the online program, we cannot credit them with completing the required ethics education training.**

To complete the program, when one comes to the slide that says "Congratulations," they MUST click on the box that says "complete program." Clicking on this box brings them to a form where they enter identifying information and "certify" that they have taken the complete program. After providing this information, they need to click on the "submit" button; we are then notified of their completion, their record is updated and they will be emailed a certificate of completion from us.

If you or any of your people have any questions, please contact us at (919) 814-3600.

NORTH CAROLINA
State Board of Elections & Ethics Enforcement

Mailing Address:
P.O. Box 27255
Raleigh, NC 27611-7255

Phone: (919) 733-7173
Fax: (919) 715-0135

KIM WESTBROOK STRACH
Executive Director

State Board of Elections and State Ethics Commission Merged into One New State Board

On June 1, 2017, a panel of superior court judges dismissed a lawsuit challenging the constitutionality of Session Law 2017-6, the state law creating the Bipartisan State Board of Elections and Ethics Enforcement (State Board). The new State Board merges the N.C. State Board of Elections and the N.C. State Ethics Commission and assumes duties formerly overseen by these two agencies, along with lobbying compliance carried out by the Secretary of State. Though parties to the lawsuit may seek additional review on appeal, for now, the consolidated State Board is the agency to enforce North Carolina's elections, ethics and lobbying laws.

Currently, the ethics staff and the election staff of the State Board are housed in different buildings. However, the goal is for all staff to be housed in one building by September 1, 2017. **So, the ethics staff will be moving soon, but until then we will remain at our present location at 424 North Blount Street in Raleigh and our direct telephone number remains 919-814-3600.**

Although the State Board is a new entity, the State Government Ethics Act (Ethics Act) remains in effect and applies to the same individuals as it did prior to this merger. **The duties and obligations of the Ethics Act remain, including the *SEI filing requirements and the Ethics Education training requirements.*** In addition, the duties of Agency Heads, including Board Chairs, and those of Ethics Liaisons remain the same.

If you have questions or need additional help, please feel free to contact us at 919.814.3600

Sue Lundberg, Education Attorney - Gretchen Aycock, SEI Attorney

2018 Meeting Planning Calendar

January

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
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February

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March

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April

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- MFC
- ASMFC
- SAFMC
- MAFMC
- State Holiday
- Southern Flounder FMP
- Southern Regional AC
- Northern Regional AC
- Finfish AC
- Habitat and Water Quality AC
- Shellfish/Crustacean AC
- Blue Crab FMP

March 12, 2018

Committee Reports

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

Feb. 1, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Jason Rock, Co-lead Blue Crab Plan Development Team
Corrin Flora, Co-lead Blue Crab Plan Development Team

SUBJECT: Blue Crab Fishery Management Plan Advisory Committee Meeting

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The Blue Crab Fishery Management Plan Advisory Committee met on Jan. 31, 2018 at 6 p.m., at the NCDEQ Washington Regional Office located at 943 Washington Square Mall in Washington, NC. The meeting had been rescheduled from Jan. 17 due to inclement weather. The following attended:

Advisers: Perry Beasley, Steven Bradshaw, Janice Corbett, Elizabeth Cox, Thomas Roller, Joseph Romano, Kenneth Seigler

Staff: Catherine Blum, Corrin Flora, Kathy Rawls, Jason Rock, Katy West, Amy Flowers, Yan Li, Laura Lee, Odell Williams

Public: Mike Blanton, Jamie Rollinson, Vic White, Steven Midgette, Sonya Midgette

MFC: Sammy Corbett

Chairman Romano called the meeting to order at 6 p.m.

APPROVAL OF THE AGENDA AND MINUTES/PUBLIC COMMENT

The meeting agenda and minutes from the September 2017 meeting were approved by consensus. No members of the public provided public comment.

STOCK ASSESSMENT PROCESS PRESENTATION

Division staff gave a presentation that introduced the basic stock assessment concepts and terminology, and the division stock assessment process to the committee. The committee discussed what makes blue crab data unique, how environmental factors are accounted for, bait

supply, how predation is accounted for in stock assessments, whether the modelling approach will be predictive, and regardless of gear shortcomings how the long-term survey trends may be informative.

DATA INPUTS PRESENTATION

Division staff gave a presentation that introduced the various data collection programs and types of data used for the blue crab stock assessment to the committee. The committee discussed gear configuration and use of trawl net studies, minimum of ten years of data for a survey to be useful in assessments, impacts of pollution on stocks, navigation to fixed stations, additional available historic data, and additional sampling methods.

OTHER BUSINESS

Committee briefly reviewed the handout on the number of crab fishery participants, trips, and commercial harvest that was requested at the last meeting. There was interest in finer regional characterizations. Staff noted with the unit stock being the entire state that influenced these initial summaries at a state level.

Staff and committee members discussed the upcoming meeting schedule. The tentative schedule is to hold a blue crab stock assessment peer review workshop in late March, a Blue Crab Fishery Management Plan Advisory Committee stock assessment meeting in April (dependent on the outcome of the stock assessment peer review), and present the stock assessment to the Marine Fisheries Commission in May. Staff will send out information as soon as possible to the committee to set the April meeting date.

The meeting adjourned at 7:40 p.m.

Cc:	Catherine Blum	Dee Lupton	Jason Walker
	Anne Deaton	Nancy Marlette	District Managers
	Nancy Fish	Phillip Reynolds	Committee Staff Members
	Christine Goebel	Jerry Schill	Marine Patrol Captains
	Jess Hawkins	Tricia Smith	Section Chiefs

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

MEMORANDUM

TO: Marine Fisheries Commission
Southern Flounder FMP Advisory Committee

FROM: Michael Loeffler, Co-lead Southern Flounder Plan Development Team
Anne Markwith, Co-lead Southern Flounder Plan Development Team

DATE: March 21, 2018

SUBJECT: Southern Flounder FMP Advisory Committee Meeting

The Southern Flounder FMP Advisory Committee met on Wednesday, March 21, 2018 at 6 p.m. at the NCDEQ Washington Regional Office located at 943 Washington Square Mall in Washington, NC. The following attended:

Advisers: Fred Scharf (chairman), Michael Oppegaard, Tom Roller, Keneth Johnson, Robert Lee Cox, Mary Ellon Ballance, John Tyer, Joe Romano, James Williams.

Absent: Kurt Tressler

Staff: Catherine Blum, Michael Loeffler, Anne Markwith, Katy West, Kathy Rawls, Dana Gillikin, Jennifer Lewis, Charlton Godwin, Carter Witten, Forrest Nelson, Jason Walker

Public: Greg Judy

Fred Scharf, serving as chair, called the meeting to order at 6:02 p.m.

APPROVAL OF AGENDA

Motion by Mike Oppegaard to approve agenda, seconded by Mary Ellon Ballance – motion carries 9-0.

APPROVAL OF MINUTES

Motion by Mike Oppegaard to approve meeting minutes from January 23, 2018, seconded by Joe Romano – motion carries 9-0.

PUBLIC COMMENT

No members of the public provided comment. The chair summarized three emails sent to the committee by the public prior to the meeting, and stated that these had been provided for the committee members to read.

PRESENTATION ON SOUTHERN FLOUNDER DATA SOURCES

Division staff gave a southern flounder data presentation to the committee. Staff presented background information and trends in the data, not the actual data itself. The presentation was broken into two sections, covering the two primary sources of data: fishery dependent and fishery independent. Fishery dependent data comes from fishermen, while fishery independent data are collected by scientists conducting long-term sampling using consistent methods over time. Throughout the presentation committee members asked staff clarifying questions.

The first section of the presentation was about fishery dependent data. The committee asked about the types of gear the observer program covers, which is mostly small and large mesh gill nets. They also asked about the scope of the carcass collection program. The committee discussed the level of confidence in the Marine Recreational Information Program, or MRIP. Proper species identification is an important aspect of this program. Staff presented information on the Coastal Angler Program, which relies on participation by recreational fishermen. For gigs, the numbers fluctuate for harvest, but releases have been consistent. The other three states covered by the stock assessment (Florida, Georgia, and South Carolina) have gig fisheries, but do not have estimates of gigging.

The presentation of fishery dependent sources of data continued and staff clarified information provided about shrimp trawl bycatch was only flounder bycatch, not all species. Regarding commercial landings data, the committee asked if the data for trawls reflects trips targeting flounder. Staff clarified they are shrimp trawls and are a small component of the southern flounder harvest. Also, most summer flounder vessels fish north of North Carolina where southern flounder do not typically occur. Staff explained that although Florida has a dealer trip ticket program and harvest program, the same information is ultimately collected as it is in North Carolina.

The committee asked about the data for various sectors, such as gill nets and pound nets, potentially looking skewed when seen on a coastwide basis. Staff explained North Carolina has much more inside waters than the other states, so data for certain gears needs to be put in context. For example, a large portion of North Carolina harvest comes from pound nets, but North Carolina is the only state with harvest from that gear thus a reduction in the total magnitude is observed when landings are combined from all gears coastwide. Next, staff emphasized that the fish house sampling is not trip ticket data, it is trips sampled by the division. Staff also explained market grade size is determined by the fish house, not the division.

The second section of the presentation was about fishery independent data. The committee primarily asked clarifying questions about the Southeast Area Monitoring and Assessment Program or SEAMAP. Staff explained this survey is conducted in state waters of the southeast states in less than 10 meters of water. Fishing in federal waters did not yield any harvest. There was little variability between the seasons. Male flounder caught were rarely over 14 inches in length, so the harvest is almost 100 percent female, based on the size ratio.

There were a few follow-up questions from the committee about how weather events impact harvest and how that is attributed. Staff explained it is difficult with southern flounder because of unknown factors with the stock, but the stock assessment model takes weather events into account.

OTHER BUSINESS

Staff and committee discussed the upcoming meeting scheduled for May 9 when staff will give a presentation of the stock assessment. Staff gave an overview of topics that will be covered at meetings scheduled for the rest of the year.

The meeting adjourned at 8:27 p.m.

cc:

Catherine Blum	Dee Lupton	Patricia Smith
Anne Deaton	Nancy Marlette	Jason Walker
Nancy Fish	Stephen Murphey	District Managers
Christine Goebel	Hardy Plyler	Committee Staff Members
Jess Hawkins	Phillip Reynolds	Marine Patrol Captains
David Hilton	Jerry Schill	Section Chiefs

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

MEMORANDUM

TO: N.C. Marine Fisheries Commission
Habitat and Water Quality Advisory Committee

FROM: Anne Deaton
Katy West
Division of Marine Fisheries, NCDEQ

DATE: April 11, 2018

SUBJECT: Habitat and Water Quality Advisory Committee Meeting

The Habitat and Water Quality Advisory Committee met at 1 p.m. on Thursday April 12, 2018 at the Washington Regional Office, 943 Washington Square Mall, Washington. The following attended:

Advisors: Mike Street, David Glenn, Brian Boutin, Sam Boyce

Absent: Alison Willis, Mark Gorges, Clay Willis, Joel Fodrie, Dick Bierly, Bob Christian

Staff: Casey Knight, Anne Deaton, Katy West

Other Agency Staff: Jimmy Johnson, Shane Staples, Kevin Hart

Public: None

Anne Deaton called the meeting to order since neither chair was present.

APPROVAL OF THE AGENDA
Since there was not a quorum, the agenda was approved by committee consensus.

APPROVAL OF MINUTES
The meeting minutes from December 15, 2015 were approved by committee consensus.

PUBLIC COMMENT
No public comment was offered.

REGION 4 STRATEGIC HABITAT AREAS (SHA): THE CAPE FEAR RIVER BASIN

Casey Knight gave a presentation on Region 4 Strategic Habitat Areas (SHA): The Cape Fear River Basin. Knight described the goal of SHA is an ecosystem-based approach for fisheries management. She defined a SHA as a subset of all coastal habitats and consist of strategically located complexes of fish habitats. These areas provide the "best of the best" ecological function. The ideal landscape scenario is a mosaic of diverse, connected habitats. Strategic Habitat Areas are defined in Marine Fisheries Commission rule.

Region 4 is the southernmost region for these analyses. Knight described the region and explained the two-phase SHA selection process – part one involves MARXAN site-selection software; part two involves review and modifications based on input from an advisory committee. MARXAN was used to pick best location for SHA based on total alteration scores. Expert modification by advisory committee members and Division staff helped decide what areas to keep or dismiss from the initial model output. This resulted in 43 discrete proposed SHA, 21% of total focus area (74,451 acres). Out of the 43 SHAs, approximately 75% have some level of protection (conservation lands, Primary Nursery Area, Anadromous Fish Spawning Areas). Potential conservation actions based on the SHA designations include local land use planning, increased consideration for restoration projects through agricultural grants or other grant funding opportunities, land acquisition or increased used of Best Management Practices adjacent to SHAs. Once Region 4 SHAs are approved by the commission, groundtruthing of fish and habitat condition within nominated SHAs will be done, and SHAs may be modified, if needed. Staff will then determine if and what management actions are needed to protect or enhance individual SHAs.

Following the presentation, there were questions and discussion by the advisory committee members. Questions included what restrictions to SHAs were planned and how the SHA designations would impact the Wilmington Port and future dredging for larger vessels. Knight answered that no regulatory changes were planned as previously explained. Knight continued that there will be no effect on the port because it is already impacted and not selected by the model for that reason. There were comments that conditionally approved shellfish harvest areas should not automatically be dismissed from consideration as SHAs since they are still of value. Advisory committee members discussed potential negative issues with an area receiving a designation as a SHA, but there was consensus that there were none. Deaton explained that staff were waiting to finish all regions and do groundtruthing before implementing protection and restoration efforts, although some agencies have reached out to staff to use the data for prioritizing grants and land acquisition for conservation. Knight added that she hopes this will ensure that future development will consider best management practices as they move forward.

VOTE ON RECOMMENDATION TO MFC TO APPROVE SHA REGION 4 NOMINATIONS

The committee made a recommendation, by consensus, that the Marine Fisheries Commssion approve the draft Strategic Habitat Area nominations. They did not vote due to a lack of quorum.

MINIMIZING HABITAT IMPACTS THROUGH REVIEW OF DEVELOPMENT PERMITS

Shane Staples, Fisheries Resource Specialist with the Division of Coastal Management, gave a presentation on the current permit review process. He reviews projects in the northern portion of the coast through Carteret County, and Curt Weychert reviews projects in the southern portion of the coast through Brunswick County. These positions are funded through a Coastal Recreational Fishing License (CRFL) grant. Staples said that currently the most pressing permit issues were agricultural drainage projects, development in sensitive habitats, and exceptions to dredging moratorium periods. Many agricultural drainage ditches connect into the upper portion of Primary Nursery Areas, and it is often unclear what is a channelized Primary Nursery Area versus an artificial ditch. This has implications on what is allowed, as well as effects on Primary Nursery Area. In some cases, the ditches are draining freshwater that has sat on flooded fields, and may have high levels of nutrients, herbicides, and pesticides. Staples also described the mitigation currently underway for submerged aquatic vegetation impacts associated with the new Bonner Bridge construction. In FY 2016, the fishery resource specialists reviewed 350 applications. Of those, they requested modifications or conditions on 86 applications and objected to 16. These changes were made to avoid and minimize impacts to designated Primary Nursery Areas and Anadromous Fish Spawning Areas, and submerged aquatic vegetation.

MARINE FISHERIES COMMISSION UPDATE

Katy West provided updates from the February Marine Fisheries Commission meeting in Wrightsville Beach, provided information on the Fisheries Management Plan schedule, shrimp industry workgroup, Atlantic States Marine Fisheries Commission (ASMFC) highlights and upcoming tagging workshops.

PLAN AGENDA ITEMS FOR NEXT MEETING

The next meeting will tentatively be in July, depending on MFC action items. The group discussed potential relevant discussion topics for inclusion at future meetings. Suggestions included GenX status, effect of ocean acidification, agricultural runoff, and drainage ditches on blue crab, other species, and water quality. They also suggested that periodic updates on environmental permit issues would be helpful.

The meeting adjourned at 3:30 p.m.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

MEMORANDUM

TO: N.C. Marine Fisheries Commission
Southern Regional Advisory Committee

FROM: Tina Moore
Chris Stewart
Division of Marine Fisheries, NCDEQ

DATE: April 11, 2018

SUBJECT: Southern Regional Advisory Committee Meeting

The Southern Regional Advisory Committee met at 6 p.m. on Wed. April 11, 2018 at the Wilmington Regional Office, 127 Cardinal Drive Extension, Wilmington. The following attended:

Advisors: Dr. Fred Scharf, Ron McCoy, Charles Griffin, Randy Proctor, Pam Morris, Ruth King

Absent: Christopher Hunt, Chris Medlin, Phillip Smith, Tom Smith, Adam Tyler

Staff: Chris Stewart, Tina Moore, Casey Knight, Anne Deaton, Ashley Bishop, Carter Witten

Public: Keith Walls (left before meeting started)

Dr. Fred Scharf called the meeting to order.

APPROVAL OF THE AGENDA

Randy Proctor moved to approve the agenda; Pam Morris seconded the motion. The motion passed unanimously.

APPROVAL OF MINUTES

Randy Proctor moved to approve the October 25, 2017 minutes from the presentation on management options for cobia; Charles Griffin seconded the motion. The motion passed unanimously.

PUBLIC COMMENT

Scharf asked if any member of the public was in attendance that wanted to provide comments to the committee. One member of the public had signed up to speak but had left the building before the meeting started.

REGION 4 STRATEGIC HABITAT AREAS (SHA): THE CAPE FEAR RIVER BASIN

Casey Knight gave a presentation on Region 4 Strategic Habitat Areas (SHA): The Cape Fear River Basin. Knight reviewed the goals, the Coastal Habitat Protection Plan (CHPP), and the CHPP source document. Ms. Knight described the goal of SHA is an ecosystem-based approach for fisheries management. She defined a SHA as a subset of all coastal habitats and consist of strategically located complexes of fish habitats. They provide the "best of the best" ecological function. The ideal landscape scenario is a mosaic of diverse, connected habitats. SHA is defined in Marine Fisheries Commission rule.

Region 4 is the southernmost region. She described the region and explained the two-phase SHA selection process – part one involves MARXAN selection software, part two involves input from an advisory committee. Ms. Knight explained what makes it strategic vs. non-strategic. Steps involved- identify the priority species, determine the habitats that are a priority to these species, determine how much of each habitat should be included and determine how much alterations occurred.

MARXAN was used to pick best location for SHA based on total alteration scores. Expert modification by advisory committee members and Division staff helped decide what areas to keep or dismiss from the initial model output. This resulted in 43 discrete proposed SHA, 21% of the total focus area (74,451 acres). Out of the 43 SHAs, about 75% have some level of protection (conservation lands, Primary Nursery Areas, anadromous spawning areas). This falls in line with what has been previously nominated in other regions: Region 1 had 20 SHAs – 20% of the focus area, Region 2 had 67 SHAs - 26% of the focus area, Region 3 had 48 SHAs - 19% of the focus area. Potential conservation actions based on the SHA designations include local land use planning, agriculture cost share project, best use management practices, pursue restoration projects etc. Post-approval involves ground truthing fish and habitat condition within nominated SHAs, using the ground truthing results to modify selections, if needed, and to determine if management actions are needed to protect or enhance individual SHAs.

Knight asked for comments or questions from the committee members to work towards a recommendation to provide to the Marine Fisheries Commission. Various advisory committee members asked about restrictions to SHAs, who made the recommendations for regions 2 and 3, the impact on the Wilmington Port, and future dredging for larger vessels. Knight identified there are not restrictions as of now from SHAs, but 75% have some level of protection already, the recommendation for regions 2 and 3 went through the same process. (Anne Deaton added that we often defer to local knowledge. Knight continued that there will be no effect on the port because it is already impacted and not selected by the model for that reason; focusing on least-altered areas. The goal was not to regulate, but to move toward an ecosystem-based management approach. Deaton added that ground truthing the areas will help identify the stressors, and SHA identification is mainly used to focus on land-based impacts.

Advisory committee members asked if there were potential negative effects of an area receiving a designation as a SHA, and whether and whether its recommendation to the Marine Fisheries Commission. is supposed to focus on approval of the specific sites that were nominated as SHAs? Knight explained that is mainly about knowing how they chose the area based on research, sound science and not just selected randomly. Scharf answered yes, that the committee was just voting on the areas selected as SHAs. Scharf also asked if the use of SHAs in other areas have had any impact so far? Deaton answered not yet, we are waiting to finish all regions and do ground truthing. Deaton also noted that other agencies have reached out to staff to use the data for agriculture grants and for land acquirement for conservation. Knight added that she hopes this will ensure that future development will consider best use practices as they move forward.

VOTE ON RECOMMENDATION TO MFC TO APPROVE SHA REGION 4 NOMINATIONS

Randy Proctor moved to approve recommendations of the report; Pam Morris seconded the motion. The motion passed unanimously.

MARINE FISHERIES COMMISSION UPDATE

Tina Moore provided updates from the February Marine Fisheries Commission meeting in Wrightsville Beach, striped mullet, the Fisheries Management Plan schedule, shrimp industry workgroup, Atlantic States Marine Fisheries Commission (ASMFC) highlights and upcoming tagging workshops.

A committee member asked about landings data for weakfish. Moore answered they are looking at commercial landings to the trip level at the request of fishermen to determine if more trips are reaching their trip limit. This information was requested from all states and will be provided to the Atlantic States Marine Fisheries Weakfish Technical Committee for further review and discussion. The committee asked about flounder stock status. Scharf offered that there is a trend in declining harvest rate. A committee member reported seeing a lot of recreational fishermen gigging in Core Sound may be getting more than the limit and concerns the fish are not getting reported.

PLAN AGENDA ITEMS FOR NEXT MEETING

The next meeting will be July 11, 2018 at DEQ Wilmington Regional Office to discuss the stock assessment update for striped mullet. The committee is also scheduled to meet again at the DMF Central District Office in Morehead City on October 3, 2018.

Randy Proctor moved to adjourn; Ron McCoy seconded the motion. The motion passed unanimously.

The meeting adjourned at 7:30 p.m.

Director's Report

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Beth Govoni, Administrative Services Office Section Chief

SUBJECT: Coastal Recreational Fishing License - Fund Disbursement Update

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In a 2013 federal aid audit finding, the U.S. Fish and Wildlife Service determined that North Carolina did not have specific assent legislation related to control of funds generated from the Coastal Recreational Fishing License, as required by the federal Pittman-Robertson Wildlife Restoration and Dingell-Johnson Sport Fish Restoration Acts. These federal laws require state agencies to have control of hunting and fishing license revenues and those revenues are to be used only for the expressed purposes. On March 2, 2017, the U.S. Fish and Wildlife Service restated this concern (see attached letter). To address the U.S. Fish and Wildlife Service's concerns, the Division of Marine Fisheries worked with the Department of Environmental Quality, U.S. Fish and Wildlife Service and the N.C. General Assembly to change the law to address these findings. Session Law 2017-57 was enacted to assent to provisions of certain federal fisheries acts, including the Pittman-Robertson Act and the Dingell-Johnson Sport Fish Restoration Act. More specifically, N.C. General Statutes 113-307.1, 113-175.1, and 113-175.5 were modified.

The U.S. Fish and Wildlife Service stated that these modifications, "…. [it] will satisfy the "assent" language requirement and close the audit finding. We can let headquarters know the findings in tracking can be closed. The license money is protected in a dedicated account, you assent and recognize the Dingell-Johnson Sport Fish Restoration Act, funds can only be disbursed under the written direction by the Division of Marine Fisheries Department of Environmental Quality. I interpret that to be your Director."

Based on this amended legislation, the Marine Fisheries Commission no longer has authority or oversight concerning the distribution of funds from the Marine Resources Fund or the Marine Resources Endowment Fund. However, the statutory purpose of these funds remains to manage, protect, restore, develop, cultivate, conserve, and enhance the marine resources of the State. The division intends to proceed with a request for proposals later this summer. Furthermore, the division will update the commission annually regarding the status of the fund and will consider any requests by the Marine Fisheries Commission with regard to disbursement of funds.

Received by
DMF 3-3-17
BYL

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1875 Century Boulevard
Atlanta, Georgia 30345

IN REPLY REFER TO:
FWS/R4/WSFR

MAR - 2 2017

Dr. Braxton Davis, Director
North Carolina Division of Marine Fisheries
North Carolina Department of Environmental Quality
P.O. Box 769
Morehead City, North Carolina 28557

Dear Dr. Davis:

I want to thank you for the progress that your office is working toward for successful resolution and implementation of a corrective action to an audit finding from Department of Interior Office of Inspector General (OIG) Auditors Report No. R-GR-FWS-0013-2013. The OIG audit determined that the current North Carolina assent legislation does not include language specifically applicable to the Division of Marine Fisheries, and therefore was determined to be an audit finding. It is our understanding that on October 7, 2016, the Division of Marine Fisheries submitted a Justification for Special Provision through the Secretary of Department of Environmental Quality to be submitted in the January –June 2017 legislative session. This Justification for Special Provision proposes to incorporate language into the existing Coastal Fishery License Statute 113-75.1 which is comprised of marine resources license revenues and establishes the North Carolina Marine Resources Fund.

In accordance with 50 CFR 80 entitled "Administrative Requirements, Pittman-Robertson Wildlife Restoration and Dingell-Johnson Sport Fish Restoration Acts, Part 80.10 states:

> Who is eligible to receive the benefits of the Acts?
> States acting through their fish and wildlife agencies are eligible for benefits of the Acts only if they pass and maintain legislation that:
> (a) Assents to the provisions of the Acts;
> (b) Ensures the conservation of fish and wildlife; and
> (c) Requires that revenue from hunting and fishing licenses be:
> (1) Controlled only by the State fish and wildlife agency; and
> (2) Used only for administration of the State fish and wildlife agency, which includes only the functions required to manage the agency and the fish and wildlife related resources for which the agency has authority under State law.

After a careful evaluation of the Coastal Recreational Fishing License Statute G.S. 113-175.1, we believe the statute is not in compliance with 50 CFR Part 80.10 (c) 1. State Game and Fish Agencies are required to control their license revenue, interest earned on license revenue and assets acquired with license revenue. The specific language in the Coastal Recreational Fishing License Statute G.S. 113-175.1 (b) states "*The State Treasurer shall disburse the principal of the Marine Resources Fund and*

marine resources investment income only upon the written direction of the Marine Fisheries Commission." In (c) it further reinforces that the Marine Fisheries Commission controls disbursement of the Marine Resources license revenue with the following statements: "*The Marine Fisheries Commission may authorize the disbursement of the principal of the Marine Resources Fund and marine resources investment income only to manage, protect, restore, develop, cultivate, conserve, and enhance the marine resources of the State. The Marine Fisheries Commission is encouraged to consider supporting the Oyster Sanctuary Program managed by the Division of Marine Fisheries. The Marine Fisheries Commission may not authorize the disbursement of the principal of the Marine Resources Fund and marine resources investment income to establish positions without specific authorization from the General Assembly.*" We believe this language is inconsistent with the requirement of 50 CFR 80.10 (c) (1) that requires the revenue from hunting and fishing licenses to be controlled only by the State Fish and Wildlife agency.

In summary, we believe that under the current North Carolina statutes, the Division of Marine Fisheries lacks the necessary control of the North Carolina Marine Resources Fund which is comprised of Marine Resources license revenues, and thus the State is not in compliance with 50 CFR 80.10 (c) (1) and 50 CFR 80.10 (c) (2). This lack of control of license revenues renders the State of North Carolina in non-compliance with the Acts and could result in North Carolina becoming ineligible to receive the funds and benefits of the Acts until control is restored (per 50 CFR 80.21 and 80.22).

We hope we have provided you with information and references needed to alert you of the potential consequences of the loss of control of license revenue. We look forward to working with you to resolve this issue. If you need additional clarification or information, please feel free to contact me at 404-679-4154.

Sincerely yours,

Michael L. Piccirilli
Chief – Wildlife and Sport Fish Restoration Program

cc: Michael S. Regan
Sheila C. Holman

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Dee Lupton, Deputy Director

SUBJECT: Land or Sell License

The Marine Fisheries Commission requested the Division of Marine Fisheries research license requirements to determine if vessels with a homeport in North Carolina that take fish outside the territorial waters of the state can land or sell catch in the state through the purchase of a Land or Sell License.

North Carolina General Statute 113-169.5 governs the Land or Sell License as a commercial, non-transferable fishing license for vessels fishing beyond territorial waters (more than three miles in the ocean). Except for fee changes, the license has not been modified since before the 1997 Fisheries Reform Act. The *Final Report of the Fisheries Moratorium Steering Committee* noted the need to allow non-resident vessels not licensed in North Carolina the opportunity to come to port and land and sell their catch. The report further clarifies that the provision provides an advantage to North Carolina fish dealers and provides an advantage to non-resident fishermen who may be forced to port in North Carolina due to weather, mechanical problems, landing regulation or other factors.

The fee for a license for vessels not having a primary situs in North Carolina is $400, or an amount equal to the non-resident fee charged by the non-resident's state, whichever is greater. The fee is based on the vessel's homeport as listed on the U.S. Coast Guard documentation or the state in which the vessel is registered.

To determine fees, and because license systems and fees within jurisdictions change frequently, each year, the division surveys other state commercial fishing license programs to determine non-resident Standard Commercial Fishing License and Land or Sell License fees (see attachment for fees for the 2019 license year).

Table 1 shows a summary of data collected from Land or Sell Licenses by year from 2013–2017. License counts are based on the fiscal year which runs from July 1 to June 30. For example, license year 2013 includes July 1, 2012 through June 30, 2013. Most of the landings occur during the winter through the spring (December through May). Fish trawls (i.e., flounder trawl and flynet) were the primary gear used. Other gears used are longlines and handlines (i.e., rod-n-reel, trolling, greenstick), along with a variety of other gears. Summer flounder and highly migratory species (e.g., tunas, sharks (excluding dogfishes), swordfish) were the dominate species landed.

Other landed species include Atlantic croaker, black sea bass (north of Cape Hatteras), coastal migratory pelagics (e.g., king and Spanish mackerels, cobia, wahoo and dolphin), snapper-grouper complex species and a few others. Most vessels with a Land or Sell License were from New Jersey, Virginia, Massachusetts and New York.

Table 1. Land or Sell License information by year, 2013-2017.

Year[1]	Number of Licenses Issued	Pounds Landed	Value of Landings ($)	Number of Trips	Number of Vessels with Landings
2013	88	1,012,937	2,336,883	232	39
2014	83	1,770,076	4,376,153	237	49
2015	114	2,243,202	5,220,557	292	71
2016	102	1,636,676	5,039,305	292	71
2017	109	1,942,698	5,913,394	462	92

[1] Licenses issued is presented by fiscal year (July 1 to June 30). All other data are presented by calendar year.

There have been some comments that the Land or Sell License extends privileges to non-residents that are not available to residents. Allowing North Carolina residents this same privileges will require legislative action to amend North Carolina General Statute 113-169.5 to provide the division the authority to issue the license to North Carolina residents.

A few things to consider before pursuing such action:

The Land or Sell License is a reciprocal agreement commercial fishing license with other states. This establishes relationships with other states to extend landing and selling privileges with the understanding that this exchange benefits both parties. The likelihood of impacting this relationship by allowing North Carolina residents to purchase the license seems small, but there could be unintended consequences.

The Land or Sell License is a commercial fishing license. The commission had extensive debate and recommendations about restructuring the commercial fishing license system. Those recommendations will restrict who can purchase and retain a Standard Commercial Fishing License. If the commission decides there is a need to restrict some commercial fishing licenses, allowing residents to purchase this commercial fishing license, unabated, could place more fishing pressure on the resource. These two initiatives appear to be in conflict with one another. Even though resources harvested under this license are federally managed, as a resource agency, there should be a determination that this unabated fishing pressure will not harm fish stocks.

It will be very difficult to verify these individuals are not fishing in state waters if access to the Land and Sell License is expanded. From an enforcement perspective, there are currently a low number of these licenses to monitor and it is easier to identify traditional commercial fishing vessels. If the license is expanded, monitoring this license group will become more challenging.

A potential alternative is to identify specific species or fisheries to extend Land or Sell License privileges. Then ask for legislative authority to either provide a Land or Sell License Endorsement for residents for the identified species or fishery, or implement a new license type for the specific species, along with a fee.

2019 Non-Resident License Fees

1. Standard Commercial Fishing License (SCFL) - $400 or the amount charged to North Carolina residents in the non-resident state. In no event is it to be less than $400.

2. Retired Standard Commercial Fishing License (RSCFL) age 65 and older- $260

3. Land or Sell License - $400 or an amount equal to the non-resident fee charged by the non-resident's state, whichever is greater.

State	SCFL ($)	Land or Sell Fees ($)
Alabama	603.00	< 30 ft = 400.00 31-45 ft = 422.00 > 45 ft = 482.00
Connecticut	2,405.00	600.00
Delaware	2,260.00	1,500.00
Florida	1,350.00	600.00
Georgia	470.00	400.00
Louisiana	4,460.00	1,820.00
Maine	1,381.00	1,381.00
Maryland	860.00	800.00
Massachusetts	1,210.00	≤ 59 ft = 400.00 60-99 ft = 400.00 > 99 ft = 520.00
Mississippi	1,010.00	400.00
New Hampshire	1,600.00	500.00
New Jersey	700.00	400.00
New York	1,350.00	500.00
Rhode Island	525.00	400.00
South Carolina	925.00	400.00
Texas	4,275.00	1,827.00
Virginia	1,248.00	400.00

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Dee Lupton, Deputy Director

SUBJECT: Standard Commercial Fishing License Assignments

The Standard Commercial Fishing License is an annual license for commercial fishermen who harvest and sell fish, shrimp, crab or any marine species, except for industrial menhaden and shellfish. Industrial menhaden harvest no longer occurs in North Carolina. To harvest shellfish with a Standard Commercial Fishing License, North Carolina resident fishermen must elect the shellfish endorsement. To be eligible for the license, an individual or business must have a valid Standard or Retired Standard Commercial Fishing License for the previous license year. Only Standard Commercial Fishing Licenses can be assigned.

A license assignment is a temporary delegation of license privileges to another eligible person but is not a transfer of ownership of the license. The person assigning the license delegates the privileges permitted under the license to an assignee, but retains the power to revoke the assignment at any time and is still the responsible party for the license. Landings reported by an assigned license are credited to the license holder, not the assignee. There is no cost to assign a license, whether the assignment is to a resident or non-resident. Authorities for the Standard Commercial Fishing License and assignment are:

- North Carolina General Statute 113-168.2 - Standard Commercial Fishing License
- Marine Fisheries Commission Rule 15A NCAC 03I.0101(5) – Definitions,
- Marine Fisheries Commission Rule15A NCAC03O.0101 – Procedures and Requirements to obtain Licenses, Endorsements, and Commercial Fishing Vessel Registrations
- Marine Fisheries Commission Rule15A NCAC 03O.0109 – Assignment of SCFL

The original purposes of the assignments as envisioned by those who drafted the 1997 Fisheries Reform Act were:

1. Ensure licensees, including corporations, partnerships, or individuals owning multiple commercial fishing vessels, have the ability to fish each vessel owned and properly licensed while complying with the requirement that a commercial license must be aboard the vessel at all times.

2. Act as a "disability provision" allowing fishermen to keep vessels working and produce income, when the licensee is either involuntary unable to fish (e.g., sickness or injury) or voluntary chooses not to fish for some reason.

A person with one or multiple Standard Commercial Fishing Licenses can assign their license to any eligible individual resident or non-resident. Marine Fisheries Commission Rule 15A NCAC 03O.0101(a)(5) requires single vessel corporations to designate a vessel master for the specified vessel. This allows others who are not the license holder to fish the vessel and eliminates the need to assign the license. This does not resolve the issue of multiple vessel corporations hiring others to fish their vessel. In these cases, the license is assigned.

Assignees must certify they qualify and are eligible to hold an assignment (e.g., someone who has a revoked license cannot hold an assignment nor can someone with a suspended or revoked license assign it to someone else). Assignments must be documented on a form provided by the division. The person holding the license must give the physical license to the assignee. The assignee must possess the license and assignment form when engaged in commercial fishing activities. Assignments are valid for the dates listed on the assignment form, until the assignor terminates the assignment, or until the end of the license year (i.e., June 30). All landings under the assigned license are credited to the license holder, not the assignee.

Analysis of assignment data using the trip ticket and license databases for calendar years 2011–2016 show that there was an average of 483 total assignments that reported landings each year with an average of 29 assignments to non-residents.

Table 1 shows the top 10 gears used by non-residents assigned a Standard Commercial Fishing License, cumulative pounds reported, number of unique participants and the number of trips taken. The highest average landings and trip counts were in the crab pot fishery, followed by shrimp trawl, flounder trawl and runaround gill net fisheries. Over the last six years, landings from non-resident assignments accounted for 1 percent of the total commercial landings in North Carolina.

Table 1. Average annual characterization of non-resident assignment activities by gear for calendar years 2011–2016. No attempt was made to identify if the assigned license was a resident or non-resident Standard Commercial Fishing License.

Gear	Average Pounds Reported per Year	Average Number of Unique Participants	Average Trips
Crab Pot	293,316	7	295
Shrimp Trawl	241,606	10	43
Flounder Trawl	48,286	1	5
Gill Net (runaround)	24,840	5	34
Cast Net	18,959	2	18
Others	5,311	2	17

If the commission determines that a fishery resource need exists to further restrict or refine license assignments, there are a couple of options to consider.

1. Legislative action - requiring payment for an assignment or eliminating assignments altogether requires legislative action.
2. Marine Fisheries Commission Rule – refine rules governing the assignments. One possible item for consideration for rule development is to restrict assignment of resident Standard Commercial Fishing Licenses to residents only (e.g., eliminate assignment of resident licenses to non-residents). For reference, the history note for Marine Fisheries Commission Rule 03O. 0109 documents an amendment date of Aug. 1, 2000. This amendment removed a statement from the original rule that stated in part (f): "A non-resident is not eligible for assignment of a resident Standard Commercial Fishing License". *Note: The rule development process, including fiscal note could take up to two years, depending on rule cycle.*

The Division of Marine Fisheries recommendation is to identify the resource problems regarding assignments, if any, and pursue commission rule development.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Dee Lupton, Deputy Director

SUBJECT: Standard or Retired Standard Commercial Fishing License Transfers

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The Standard or Retired Standard Commercial Fishing License is an annual license for commercial fishermen who harvest and sell fish, shrimp, crab or any marine species, except for industrial menhaden and shellfish. Industrial menhaden harvest no longer occurs in North Carolina. To harvest shellfish with a Standard Commercial Fishing License, North Carolina resident fishermen must elect the shellfish endorsement. To be eligible for the license, the person must have a valid Standard or Retired Standard Commercial Fishing License for the previous license year.

Standard or Retired Standard Commercial Fishing Licenses are transferable. A license transfer is a permanent transferal to another person the privileges under the license. The person transferring the license does not retain any rights or interest under the license transferred. If the person has multiple licenses, landings history associated with the transferred license can be retained and associated to one of the other licenses held by the licensee. If the person holds a single license, when transferred, the license history transfers with it. Authorities for the Standard or Retired Standard Commercial Fishing License and transfer are:

- North Carolina General Statute 113-168.2 – Standard Commercial Fishing License
- North Carolina General Statute 113-168.3 – Retired Standard Commercial Fishing License
- Marine Fisheries Commission Rule 15A NCAC 03I.0101(5) – Definitions,
- Marine Fisheries Commission Rule15A NCAC03O.0101 – Procedures and Requirements to obtain Licenses, Endorsements, and Commercial Fishing Vessel Registrations
- Marine Fisheries Commission Rule15A NCAC 03O.0108 – License Transfers

Cost for a Standard Commercial Fishing License is $400 for residents and $200 for resident Retired Standard Commercial Fishing Licenses. Non-residents pay $400 for Standard Commercial Fishing Licenses, or the amount charged to a North Carolina resident in the non-resident's state, whichever is greater; in no event may the fee be less than $400. Retired

Standard Commercial Fishing Licenses are $260 for non-residents, regardless of the state of residence.

In fiscal year 2017, there were 6,296 Standard or Retired Standard Commercial Fishing Licenses issued; 90 (1.4 percent) of these were issued to non-residents. For fiscal years 2005-2017, there was an average of 511 transfers per year (see Table 1). There were 202 Standard or Retired Standard Commercial Fishing Licenses from fiscal year 2016 that were not renewed and were returned to the eligibility pool. Over the last 10 years, the number of licenses returning to the eligibility pool after not being renewed has been increasing.

Table 1. Number of Standard and Retired Standard Commercial Fishing License transfers, fiscal years 2005-2017.

Fiscal Year	Standard Commercial Fishing License	Retired Standard Commercial Fishing License	Total
2017	548	101	649
2016	381	80	461
2015	430	94	524
2014	391	96	487
2013	339	78	417
2012	381	80	461
2011	375	75	450
2010	417	86	503
2009	418	87	505
2008	443	76	519
2007	465	73	538
2006	488	69	557
2005	500	76	576

The Moratorium Steering Committee acknowledged that license transferability was one of the most difficult and complex issues discussed and public comment was divided with no clear consensus. They concluded that there is a need for license transferability in limited, specific situations and that license marketability would likely have undesirable consequences including potentially creating inequality, hastening demise of traditional, small family fishing operations in favor of larger fishing operations controlled by nonresident entrants in the industry, and promoting an increase in commercial fishing effort. The committee strongly supported that transferability needed to be slow and deliberate. They recommended authority to establish rules on transferability be given to the Marine Fisheries Commission. The subsequent law required the commission develop license transfer rules for:

1. From the license holder to an immediate family member;
2. Upon death of the license holder through a process whereby it can be transferred to an immediate family member and then can be transferred to a third-party purchaser of the deceased licensee's fishing vessel.

3. The licensee is retiring from commercial fishing and can transfer it to a third-party purchaser of the licensee's fishing vessel.

It has been difficult to determine if those involved in the transfer are adhering to these requirements along with other real world situations for a fisherman to continue to operate thus creating the 'other' category. Below is a brief characterization of these 'other' types of transfers.

1. A fisherman is licensed separately than the vessel. This was a fundamental and important aspect of the Fisheries Reform Act, much like the driver's license and vehicle registration. Both are needed to operate and to track fishing activity, independently, through time. The Standard or Retired Standard Commercial Fishing License holder does not need to be the owner of the vessel to fish commercially from it. This dual system needs to remain for effort and participation determination. The reality is, this linkage is difficult for the division to determine due to the independent nature of the licenses. To further add complexity, the same person may have the vessel set up as a business (e.g., corporation) for liability reasons, although the individual is the owner of the business that is licensed, the two are considered as different entities.
2. Businesses (i.e., corporations, partnerships, limited liability, etc.) have proven complexities within current transfer rules. A business can have a license; but the business is separate from an individual, even if the individual owns the business. Transfers occur from a person's company name to their personal name because the business has been dissolved. Transfers also occur from an individual to a company the individual maintains for business purposes. In addition, transfers occur between companies owned by the same individual.
3. Health conditions no longer allow the person to fish; therefore, will want to transfer their license for a period of time.
4. To be able to transfer a License to Land Flounder from the Atlantic Ocean, purchasers must have a Standard Commercial Fishing License or have one transferred to them, or they must have a non-transferable Land or Sell license for vessels without a home port in North Carolina.

The division acknowledges this complexity and recommends reducing and restricting Standard and Retired Standard Commercial Fishing transfers by refining the rules associated with transfers. Rules can be developed to allow transfers associated with business needs along with identifying better processes through rule development to allow transfers for retirement and death that do not involve vessel sales. In addition, the division recommends reviewing rules associated with the Eligibility Pool to direct people who do not meet transfer rules to apply through the pool. This will allow the Standard Commercial Fishing License Eligibility Pool committee the ability to review an applicant's expertise and experience to determine if they should be granted a license. By revising these rules, the 'marketability' of the Standard or Retired Standard Commercial Fishing License will be eliminated, while at the same time ensuring experienced fishermen can continue to enter the commercial fishing industry.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 17, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Stephanie McInerny, License and Statistics Section

SUBJECT: Target Species and Bycatch Reporting

Over the past few years, the Marine Fisheries Commission passed motions with regard to recording additional landings information on trip tickets to capture target/bycatch species and catch kept for personal use. The first motion was passed in August 2014:

> Motion by Chuck Laughridge from August 2014
> Motion that dealers allowing the bycatch of red drum and striped bass to be landed at their facility without the landings of target species will use the long form trip ticket on paper and not report the bycatch electronically. The target species will be weighed and recorded in the three unused species lines of the long form trip ticket until the N.C. Division of Marine Fisheries software updates take place.
>
> Motion by Chuck Laughridge and seconded by Sammy Corbett.
> Motion carries 6-1, with 2 abstentions.

Species identified in the motion (i.e., red drum, striped bass) require landed catch of other finfish or target species (i.e., flounder, bluefish, black drum, striped mullet) to be more than the catch of the bycatch to legally harvest those bycatch species.

In addition to the August 2014 motion, another motion was made in February 2016:

> Motion by Mike Wicker from February 2016
> Motion by Mike Wicker to ask the DMF to move forward with including a new disposition category to the development of the new FIN database software that accounts for the actions of August 2014 to document fish landed but not sold. Second by Rick Smith.
>
> Motion passes 5-1 with one abstention.

After the February 2016 motion was made and seconded, discussion from Marine Fisheries Commission members stated that this motion addressed the previous (August 2014) motion concerning targeted/bycatch reporting along with capturing personal consumption information (reference audio of discussion http://portal.ncdenr.org/web/mf/02-2016-mfc-audio under the second Issues for Commissioners section).

In response, and as provided in the February 2018 memo to the Marine Fisheries Commission, the Trip Ticket Program redesigned the Trip Ticket system to capture disposition of the catch. For your convenience that memo is also attached.

North Carolina General Statute 113-169.3(i) states a licensed seafood dealer is required to record the landings of any seafood that is bought or accepted at the time of transaction. Currently, there is no statutory authority to require licensed commercial fishermen to take fish not sold or provided to a licensed fish dealer and require that dealer to record catch not being bought or accepted (e.g., unsold, sold to another dealer, etc.) from commercial fishing license holders. Legislative action will be needed to further facilitate mandatory reporting of catch kept for personal use or to require catch of target species and bycatch be sold to the same dealer.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

January 31, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Stephanie McInerny, License and Statistics Section

SUBJECT: Documenting Unsold Standard Commercial Fishing License Catch

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The N.C. Trip Ticket Program has the authority through G.S. 113-168.2,113-169.3, and 113-170.3 to require reporting of all seafood sold to a licensed dealer in North Carolina. Seafood caught by the holder of a commercial license with selling privileges (i.e., Standard Commercial Fishing License, Retired Standard Commercial Fishing License, Shellfish License, Recreational Tournament License to Sell Fish) is not required to be sold nor are they required to be reported. To document unsold catch from commercial fishing licenses, the Trip Ticket Program redesigned paper trip tickets to include a place to record the disposition of the catch (Figure 1). This disposition is typically "food" or "bait" but options such as "personal use" and "kept, disposition unknown" are now available to the dealer to record all catch retained by the fishermen; however, unsold catch cannot be reported if it is not seen by the dealer. The list of disposition types is in Table 1. Tickets with this new disposition field have been purchased and are being distributed to dealers when they exhaust their supply of old forms.

A few of these new tickets have been received back from the dealers, but dispositions were not recorded. Disposition of catch was previously available to federally permitted dealers who use the electronic trip ticket software and as of late 2016, state dealers had to update their software so they could use this field as well (Figure 2). Preliminary 2017 data show a small number of landings were reported under "personal use" and "kept, disposition unknown" as well as a few additional dispositions other than the default "food" and "bait" categories. Total landings in 2017 reported as "personal use" were 891 pounds, and most of the landings were bluefish and menhaden. Total landings in 2017 under "kept, disposition unknown" were 6,472 pounds, and the majority of those landings were unclassified bait fish and menhaden. These data are preliminary and may change after routine edits are performed.

Currently, South Carolina and Georgia do not collect disposition on trip tickets. Florida Fish and Wildlife does provide a space on their trip tickets to record disposition and North Carolina's approach was modeled after Florida. Virginia also records catch kept for personal use, but their system is based on mandatory harvester reporting.

Data provided by the Virginia Marine Resources Commission showed that species kept for personal use include striped bass, blue crab, Atlantic croaker, American eel, summer flounder, Atlantic menhaden, spotted seatrout, spot, and oysters (Tables 2-4). Most of the personal use catch of these species was less than three percent of the total harvest in Virginia waters from 2009-2013 (Table 4). American eel kept for personal use were between 1.9 and 8.1 percent of the catch because this species is typically kept for bait. Virginia's commercial landings are reported by the harvester making it easier to determine what the fisherman kept from his trip for personal use and what was sold to the dealer. North Carolina's commercial landings are reported by the dealer so fish kept for personal use by the fisherman are likely not ever seen by the dealer, and therefore, not easily captured using the existing dealer reporting system.

In 2015, the License and Statistics Section sent out a five-question pilot survey to a subsample of individuals holding either a Standard Commercial Fishing License, Retired Standard Commercial Fishing License, or Shellfish License to gather information on catch kept by these license holders for personal use (i.e., unsold). This was a very simplistic pilot survey to gauge if more effort was needed to investigate the extent of unsold catch and was not meant to be used to quantify the amount of seafood kept for personal use. The results of that study should not be used for management purposes, nor carry any weight when evaluating current license use characteristics. A more detailed survey could be designed and administered if more accurate information on the use of commercial fishing licenses for reasons other than selling their catch is desired.

According to G.S. 113-169.3(i), the dealer is required to record the landings of any seafood that he buys or accepts at the time of transaction. Without additional authority to require the dealer to record catch that they are not buying or accepting from (i.e., unsold) commercial fishing license holders, the division has exhausted its resources. A legal evaluation of the current authority is needed to determine what authority changes may be needed to facilitate mandatory reporting of catch kept for personal use.

Implementation of Disposition Code

<u>Progress to date</u>

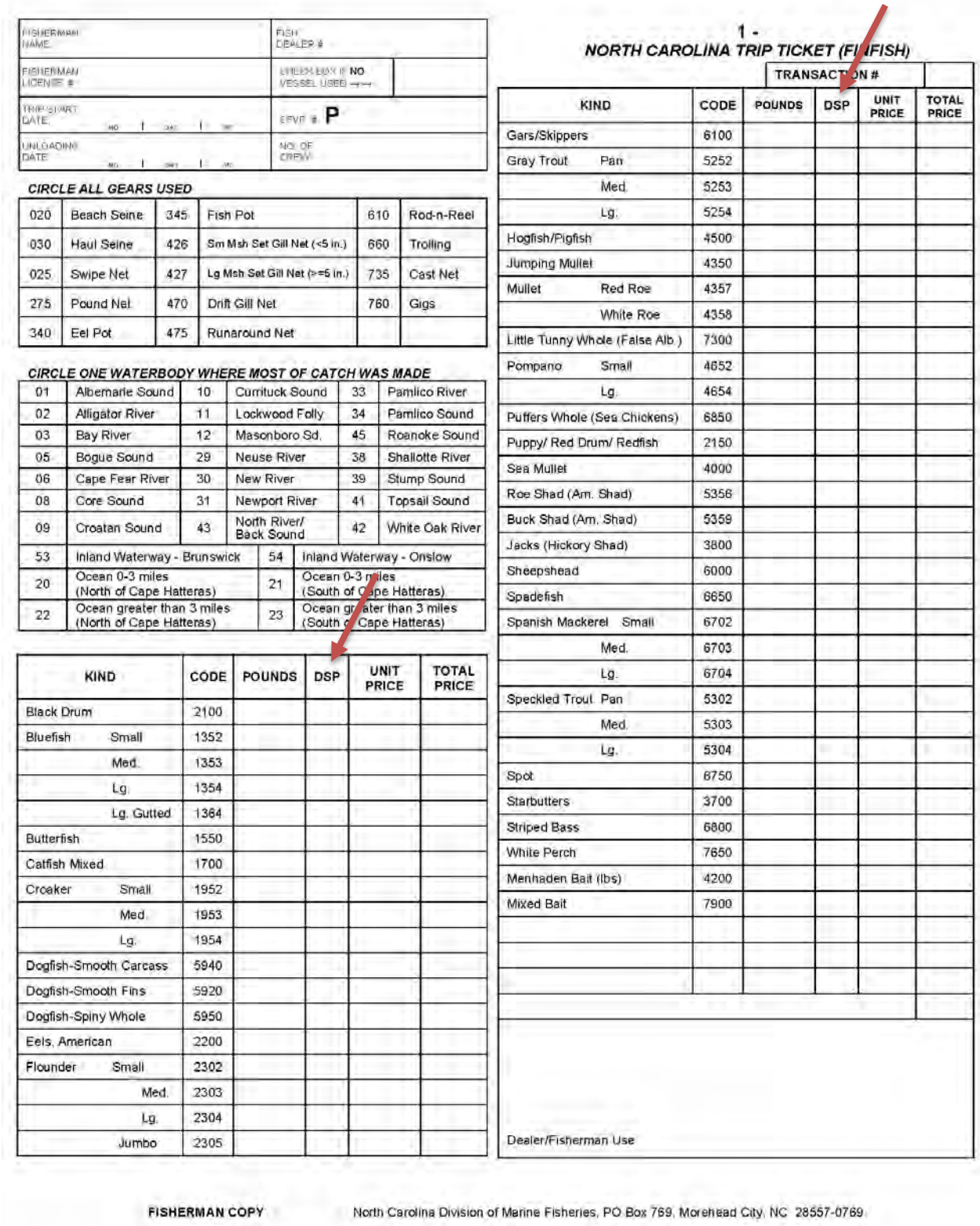
- A field to capture disposition has been added to the electronic trip ticket software and is visible to all dealers using the most current version of the software (Version 7.0.0).
- Data on disposition is being included in the electronic data files submitted by the dealers.
- Dispositions sent by the electronic dealers are being imported into the Fisheries Information Network database.
- New ticket templates, including a place to record disposition, were developed for all paper ticket types and purchased by the division.
- A reference sheet for disposition codes was developed and is included with all paper trip ticket books sent to the dealers (Table 1).
- Trip Ticket Program staff are documenting any dispositions other than the default ("food" and "bait") in a spreadsheet until these data can be entered into the Fisheries Information Network.
- Notice of these new disposition codes was provided in the semi-annual dealer reports in October of 2016 and 2017.

Next steps

- The Fisheries Information Network user interface will need to be modified to include disposition code so Trip Ticket Program staff can enter data collected on paper trip tickets into the database instead of the spreadsheet.
- Trip Ticket Program staff will do more outreach to the dealers to inform them of the new disposition codes.

Table 1. North Carolina Trip Ticket Program disposition codes.

Disposition Code	Description
0	No Disposition
1	Food
2	Personal Use
5	Aquaculture
6	Canned Pet Food
7	Animal Food
8	Bait
9	Reduction/Meal
10	Aquarium
11	Kept, Disposition Unknown
12	Biomedical Use
13	Packing, Only
14	Fertilizer
15	Research
100	Reason not specified
101	No Market
602	Seized by Law Enforcement



1 -

NORTH CAROLINA TRIP TICKET (FINFISH)

FISHERMAN NAME

FISH DEALER #

FISHERMAN LICENSE #

UNLOADING BOX # NO. VESSEL USED

TRIP START DATE MO DAY YR

EFVT # P

UNLOADING DATE MO DAY YR

NO. OF CREW

TRANSACTION #

CIRCLE ALL GEARS USED

020	Beach Seine	345	Fish Pot	610	Rod-n-Reel
030	Haul Seine	426	Sm Msh Set Gill Net (<5 in.)	660	Trolling
025	Swipe Net	427	Lg Msh Set Gill Net (>=5 in.)	735	Cast Net
275	Pound Net	470	Drift Gill Net	760	Gigs
340	Eel Pot	475	Runaround Net		

CIRCLE ONE WATERBODY WHERE MOST OF CATCH WAS MADE

01	Albemarle Sound	10	Currituck Sound	33	Pamlico River
02	Alligator River	11	Lockwood Folly	34	Pamlico Sound
03	Bay River	12	Masonboro Sd.	45	Roanoke Sound
05	Bogue Sound	29	Neuse River	38	Shallotte River
06	Cape Fear River	30	New River	39	Stump Sound
08	Core Sound	31	Newport River	41	Topsail Sound
09	Croatan Sound	43	North River/ Back Sound	42	White Oak River
53	Inland Waterway - Brunswick		54	Inland Waterway - Onslow	
20	Ocean 0-3 miles (North of Cape Hatteras)		21	Ocean 0-3 miles (South of Cape Hatteras)	
22	Ocean greater than 3 miles (North of Cape Hatteras)		23	Ocean greater than 3 miles (South of Cape Hatteras)	

KIND	CODE	POUNDS	DSP	UNIT PRICE	TOTAL PRICE
Black Drum	2100				
Bluefish Small	1352				
Med.	1353				
Lg.	1354				
Lg. Gutted	1364				
Butterfish	1550				
Catfish Mixed	1700				
Croaker Small	1952				
Med.	1953				
Lg.	1954				
Dogfish-Smooth Carcass	5940				
Dogfish-Smooth Fins	5920				
Dogfish-Spiny Whole	5950				
Eels, American	2200				
Flounder Small	2302				
Med.	2303				
Lg.	2304				
Jumbo	2305				

KIND	CODE	POUNDS	DSP	UNIT PRICE	TOTAL PRICE
Gars/Skippers	6100				
Gray Trout Pan	5252				
Med.	5253				
Lg.	5254				
Hogfish/Pigfish	4500				
Jumping Mullet	4350				
Mullet Red Roe	4357				
White Roe	4358				
Little Tunny Whole (False Alb.)	7300				
Pompano Small	4652				
Lg.	4654				
Puffers Whole (Sea Chickens)	6850				
Puppy/ Red Drum/ Redfish	2150				
Sea Mullet	4000				
Roe Shad (Am. Shad)	5356				
Buck Shad (Am. Shad)	5359				
Jacks (Hickory Shad)	3800				
Sheepshead	6000				
Spadefish	6650				
Spanish Mackerel Small	6702				
Med.	6703				
Lg.	6704				
Speckled Trout Pan	5302				
Med.	5303				
Lg.	5304				
Spot	6750				
Starbutters	3700				
Striped Bass	6800				
White Perch	7650				
Menhaden Bait (lbs)	4200				
Mixed Bait	7900				

Dealer/Fisherman Use

FISHERMAN COPY North Carolina Division of Marine Fisheries, PO Box 769, Morehead City, NC 28557-0769

Figure 1. Type 1 (Finfish) trip ticket with new disposition field.

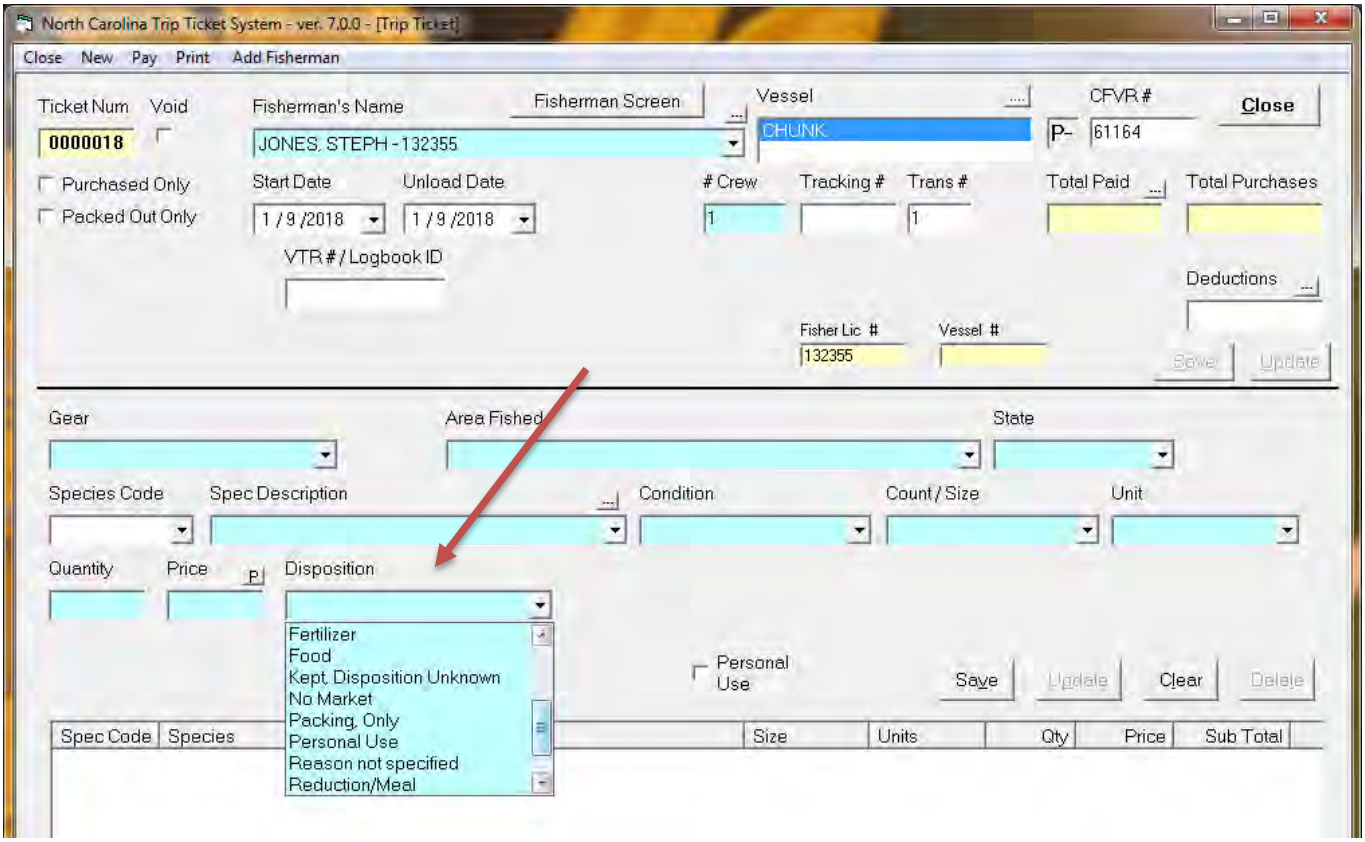


Figure 2. New disposition field within electronic trip ticket software. Dispositions of "Kept, Disposition Unknown" or "Personal Use" could be used to document unsold seafood.

Table 2. Total harvest (in pounds) of select species from Virginia waters, 2009-2013.

	Year				
Species	2009	2010	2011	2012	2013
Bass, Striped	1,553,753	1,440,849	1,436,723	1,510,407	1,188,154
Crab, Blue	26,073,609	29,969,987	30,288,070	24,871,904	17,948,632
Croaker, Atlantic	6,712,265	6,480,239	4,278,289	5,520,905	4,730,876
Eel, American	119,187	78,076	103,856	122,123	101,510
Flounder, Summer	218,408	271,402	170,863	130,643	50,037
Menhaden	4,129,080	4,552,360	3,648,617	4,866,005	5,096,027
Seatrout, Spotted	22,887	16,242	14,214	79,125	27,138
Spot	3,601,947	997,882	3,364,373	548,459	1,809,577
Oyster, Public	380,122	506,212	763,854	814,180	1,437,430

Table 3. Harvest reported as kept for personal use (in pounds) from Virginia waters by species, 2009-2013.

	Year				
Species	2009	2010	2011	2012	2013
Bass, Striped	5,537	8,073	6,631	7,212	1,416
Crab, Blue	622,476	699,276	350,044	525,793	312,641
Croaker, Atlantic	12,738	39,036	10,388	19,940	9,898
Eel, American	2,216	5,051	2,014	9,919	6,113
Flounder, Summer	1,911	3,677	2,607	2,786	1,367
Menhaden	41,518	47,785	36,039	61,822	91,644
Seatrout, Spotted	300	799	728	336	578
Spot	27,247	18,978	18,999	9,174	9,511
Oyster, Public	3,481	2,017	2,818	4,374	4,347

Table 4. Percent of total harvest from Virginia waters that was reported as kept for personal use by species, 2009-2013.

	Year				
Species	2009	2010	2011	2012	2013
Bass, Striped	0.4%	0.6%	0.5%	0.5%	0.1%
Crab, Blue	2.4%	2.3%	1.2%	2.1%	1.7%
Croaker, Atlantic	0.2%	0.6%	0.2%	0.4%	0.2%
Eel, American	1.9%	6.5%	1.9%	8.1%	6.0%
Flounder, Summer	0.9%	1.4%	1.5%	2.1%	2.7%
Menhaden	1.0%	1.0%	1.0%	1.3%	1.8%
Seatrout, Spotted	1.3%	4.9%	5.1%	0.4%	2.1%
Spot	0.8%	1.9%	0.6%	1.7%	0.5%
Oyster, Public	0.9%	0.4%	0.4%	0.5%	0.3%

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ASMFC

FISHERIES focus

Vision: Sustainably Managing Atlantic Coastal Fisheries

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ASMFC Spring Meeting

April 30 - May 3, 2018

The Westin
1800 S. Eads Street
Arlington, VA

Preliminary Agenda

The agenda is subject to change. Bulleted items represent the anticipated major issues to be discussed or acted upon at the meeting. The final agenda will include additional items and may revise the bulleted items provided below. The agenda reflects the current estimate of time required for scheduled Board meetings. The Commission may adjust this agenda in accordance with the actual duration of Board meetings. Interested parties should anticipate Boards starting earlier or later than indicated herein.

Please note: Commission leadership is reviewing an appeal submitted regarding the Black Sea Bass Addendum XXX decision. Depending on the outcome of this review, a Summer Flounder, Scup, and Black Sea Bass Management Board meeting may be added to the agenda on Thursday, May 3.

MONDAY, APRIL 30

10 a.m. – Noon & 1:00 – 3:00 p.m. **Summer Flounder, Scup and Black Sea Bass Management Board Jointly with the Mid-Atlantic Fishery Management Council**

- Consider Approval of Summer Flounder Draft Amendment for Public Comment
- Review Alternatives for Black Sea Bass Framework/Addendum on Recreational Issues
- Review Black Sea Bass February Recreational Fishery Harvest

3:15 – 4:45 p.m. **Bluefish Management Board Jointly with the Mid-Atlantic Fishery Management Council**

- Review and Consider Approval of Public Information Document/Scoping Document for Allocation Amendment

TUESDAY, MAY 1

9 – 11 a.m. **Coastal Sharks Management Board**

- Review Results of North Atlantic Shortfin Mako Stock Assessment
  - Discuss Potential Management Response
- Review Results of Sandbar Shark Stock Assessment
- Update on Endangered Species Act Listing Status for Oceanic Whitetip Shark
- Review and Consider 2016 Fishery Management Plan Review and State Compliance Reports

continued, see SPRING MEETING PRELIMINARY AGENDA on page 6

Upcoming Meetings

The Atlantic States Marine Fisheries Commission was formed by the 15 Atlantic coastal states in 1942 for the promotion and protection of coastal fishery resources. The Commission serves as the deliberative body of the Atlantic coastal states, coordinating the conservation and management of nearshore fishery resources, including marine, shell and diadromous species. The fifteen member states of the Commission are: Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida.

Atlantic States Marine Fisheries Commission

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Patrick A. Campfield
Science Director

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April 2 (2 - 4:30 PM)
Atlantic Menhaden Technical Committee and Ecological Reference Point Workgroup Webinar; go to http://www.asmfc.org/calendar/ for more details

April 10 - 12
Mid-Atlantic Fishery Management Council, Montauk Yacht Club, 32 Star Island Road, Montauk, NY

April 10 - 12
Northern Shrimp Assessment Workshop, Westin Portland Harborview, 157 High Street, Portland, ME

April 17 (3 - 4:30 PM)
Atlantic Striped Bass Advisory Panel Conference Call; go to http://www.asmfc.org/calendar/ for more details

April 17 - 19
New England Fishery Management Council, Hilton, Mystic, CT

April 20 (10 AM - Noon)
American Lobster Electronic Reporting Subcommittee Webinar; go to http://www.asmfc.org/calendar/ for more details

April 23 (begins at 9 AM) - 25 (ends at 5 PM)
Atlantic Menhaden Data Workshop, Hyatt Centric Arlington, 1325 Wilson Boulevard, Arlington, VA

April 25 (begins at 9 AM) - 27 (ends at 5 PM)
Ecological Reference Point Workgroup Data Workshop, ASMFC Offices, 1050 N. Highland Street, Suite 200A-N, Arlington, VA

April 25 (10 AM - Noon)
Atlantic Herring Days Out Meeting, location to be determined

April 30 - May 3
ASMFC Spring Meeting, Westin Crystal City, 1800 South Eads Street, Arlington, VA

May 8 (begins at 1 PM) - 10 (ends at 1 PM)
Horseshoe Crab Assessment Workshop, ASMFC Offices, 1050 N. Highland Street, Suite 200A-N, Arlington, VA

May 14 (begins at 1 PM) - 17
American Lobster Data Workshop, University of Rhode Island Graduate School of Oceanography, 218 South Ferry Road, Narragansett, RI

May 15 (begins at 9 AM) - 17 (ends at 5 PM)
Atlantic Striped Bass Modeling Workshop, Renaissance Providence-Downtown, Providence, RI

May 17 - 18
Atlantic Coastal Fisheries Habitat Partnership Steering Committee, Savannah, GA

June 5 - 7
Mid-Atlantic Fishery Management Council, Doubletree by Hilton, 237 South Broad Street, Philadelphia, PA

June 11 - 15
South Atlantic Fishery Management Council, Bahia Mar Doubletree by Hilton, 801 Seabreeze Boulevard, Fort Lauderdale FL

Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change

One only needs to look at the poor condition of northern shrimp in the Gulf of Maine or Southern New England American lobster to know that climate change is not on the horizon – it's here and it's already impacting Atlantic fisheries. As average temperatures rise, mobile marine species are migrating offshore or poleward into cooler, more habitable waters. Distribution and productivity changes are now resulting in ecological and economic disruptions – such as separating predator from prey, or fishing communities from the species their livelihood relies on. In the face of climatic shifts, change is likely to be the only constant. To address this change, fishery managers will need to adapt management from preserving historical abundances to sustaining ecological functions. As conditions change, current conservation goals and management objectives may no longer serve the resource or its users. Successful adaptation depends not only upon modifying management strategies, but also reevaluating and revising, as necessary, the underlying conservation goals and objectives of fishery management plans.

> Successful adaptation depends not only on adjusting management strategies, but also reevaluating and revising, as nescessary, the underlying conservation goals and objectives of fishery management plans.

Over a year ago, the Commission's Interstate Fisheries Management Program Policy Board (Policy Board) recognized the need for a suite of tools management boards may use to address the effects of warming water temperatures on Commission-managed resources, and established a Climate Change Work Group to undertake this task. Composed of members of the Policy Board (a mix of administrators, state legislators, Governor Appointees and federal representatives), the Management and Science Committee, and the Assessment Science Committee, the Work Group was tasked with developing science, policy, and management strategies to assist the Commission with adapting its management to climate-induced changes in species abundance and distribution. In February, the Work Group presented its recommendations to the Policy Board for approval. Outlined in the document, "Adapting Fisheries Management to Changes in Species Abundance and Distribution Resulting from Climate Change," are five main recommendations: (1) a stepwise approach for working through climate-related fishery management issues; (2) management options for stocks at persistently low biomass; (3) management options for stocks with changing spatial distributions; (4) the possible inclusion of a climate change terms of reference for stock assessments; and (5) the creation of a list of climate change data available for inclusion in analyses. For recommendations 2 and 3, the Work Group listed options that could be considered when evidence suggests a changing environment could be impacting species' biomass levels or distributions. However, none of the options have been analyzed based on their pros and cons, and there are options included that may not be consistent with current federal law or the fisheries management goals identified in the Interstate Fisheries Management Program Charter. Thus, the guidance provided in the document is intended to provide a starting point for managers as they discuss management options. Further, the document is meant to be dynamic, evolving as new information or data become available.

For the past several decades, marine fisheries management strategies have remained nearly static, focused on single species management. Although surveys and assessment models are advancing rapidly, adopting new management strategies that address productivity and distribution changes presents a formidable challenge. Mindsets and behaviors will need to shift at all levels of the management process — managers, scientists and stakeholders. Our experiences in exploring multispecies management and ecological reference points have taught us that fundamental changes in fisheries management strategies not only take a significant investment of resources, time, and energy, but the willingness among managers and stakeholders to make that shift. Moving away from traditional management to more contemporary approaches will be challenging, and will need to be done deliberately and incrementally to preserve what trust exists between state and federal managers and stakeholders. The Work Group's recommendations are an important step towards proactively addressing changes in marine species distributions and abundances due to environmental drivers.

As we consider sacrifices we may make together for a brighter tomorrow, may the words of wise and eminent Mainer Stephen King remind us all of what is at stake: "Resistance to change is proportional to how much the future might be altered by any given act."

For more details on the options provided in the document, go to http://www.asmfc.org/files/pub/ClimateChangeWorkGroupGuidanceDocument_Feb2018.pdf.

Cooperative Efforts Seek to Improve Management of Stock

Introduction

Avidly pursued by recreational anglers as ready biters and fierce fighters, cobia support recreational fisheries throughout the South Atlantic and into the Mid-Atlantic region. A fast growing, moderately lived species, they occur most abundantly from Chesapeake Bay through the Gulf of Mexico, preferring to stay close to structure to feed and find shelter from predation. While the 2013 stock assessment indicated overfishing was not occurring and the stock was not overfished, spawning stock biomass has experienced a general decline since 2002. A benchmark stock assessment is scheduled for 2019 through the SouthEast Data, Assessment and Review (SEDAR) process.

Landings are driven by the recreational fishery, with the commercial fishery primarily being a bycatch fishery. The Commission approved the Interstate Fishery Management Plan (FMP) for Atlantic Migratory Group (AMG) Cobia in October 2017. The FMP was initiated due to recent overages of the federal annual catch limit (ACL) for AMG cobia, which disrupted fishing opportunities and jeopardized the health of the stock. The Commission FMP introduces state-specific allocations of a coastwide recreational harvest and maintains the commercial regulations set under the South Atlantic Fishery Management Council's (SAFMC) FMP.

Life History

Cobia (*Rachycentron canadum*) are distributed worldwide in tropical and warm temperature waters. They occur along the Atlantic coast from Nova Scotia to Argentina, and are most abundant in U.S. waters from Chesapeake Bay south through the Gulf of Mexico.

Male cobia typically reach sexual maturity by 2 years (generally 2 feet long), while females are sexually mature by 2-3 years (generally 3 feet long). Females grow to be larger than males, and may reach 6 feet and weigh up to 100 pounds. An extended spawning season occurs from late June to mid-August along the Southeastern U.S., and from late summer to early fall in the Gulf of Mexico. Cobia are broadcast spawners; a single female may spawn many times each season. Cobia make seasonal migrations, wintering in the south and moving north for the summer months. They are drawn to structure to feed and find shelter from predation. Juveniles and adults are often found around live bottom, wrecks, and buoys, as well as flotsam and seaweed mats. Their diet consists primarily of fish and crustaceans.

Commercial & Recreational Fisheries

Enthusiastically pursued by recreational anglers, cobia support an important recreational fishery throughout the South Atlantic and into the Mid-Atlantic region. Primary methods include bottom fishing with natural bait as well as sight-casting, which has gained popularity in recent years. The annual recreational harvest of AMG cobia, found along the US Atlantic coast from New York to Georgia, has varied erratically with little trend since 2005, ranging from 328,000 to 1.7 million pounds. Landings have increased within the past two years. In 2015 and 2016, recreational anglers landed approximately 1.7 million and 1.3 million pounds of cobia, respectively. These are the two highest values in the time series, which extends back to 1981. These harvests resulted in significant overages of the federal ACL and federal fishery closures in 2016 and 2017.

The commercial fishery is on a much smaller scale, but has increased from 2011 to 2016. Primarily a bycatch fishery, it is has been associated with the snapper/grouper hook and line fishery and troll fisheries for many South Atlantic species, although more directed fisheries have recently developed in some areas. Commercial restrictions are consistent throughout the range, with a 2 fish per person possession limit, 6 fish vessel limit, and a 33" fork length minimum size limit. The two greatest commercial harvests in the time series, which extends back to 1950, occurred in 2015 (83,000 pounds) and 2016 (84,000 pounds).

Stock Status

Two cobia stocks are recognized off the U.S. Atlantic coast; AMG cobia and Gulf of Mexico Migratory Group (Gulf cobia), occurring throughout the Gulf of Mexico and extending to Florida's east coast. The SAFMC manages the Atlantic stock, and is allotted a small portion

Species Snapshot

Cobia
Rachycentron canadum

Common Names: black kingfish, black salmon, ling, lemonfish, crabeater, prodigal son, black bonito, sergeantfish, yew, cubby

Management Unit: New York to Georgia

Family: Rachycentridae
The name originates from the Greek words 'rhachis' (spine) and 'kentron' (sting), and was inspired by the dorsal spines that make up the first dorsal fin.

Interesting Facts
- Cobia is the only species in the family Rachycentridae.
- They are a close relative of remoras, suckerfish known for attaching to large marine mammals, sharks, and ships using a suction disk on top of their heads.
- They migrate seasonally, wintering in the Gulf of Mexico and moving up the coast as far as Massachusetts in the summer.
- Cobia feed primarily on crabs, squid, and fish, but will also follow large animals (sharks, turtles, manta rays) to scavenge what they leave behind.
- They are one of the best candidates for warm, open-water marine fish aquaculture due to their fast growth rate and the high quality of their flesh.

Maximum Size: 6.5 feet, 172 pounds

Life Span: 14 years old

Stock Status: Not overfished nor experiencing overfishing

Photo (c) Aaron Game

of the Gulf stock's ACL to manage the Gulf cobia which extend along the Atlantic coast of Florida. Genetic studies continue to explore appropriate stock boundaries, and an upcoming 2018 Stock Identification Workshop may result in modifications to these boundaries.

The 2013 SEDAR stock assessment indicated overfishing was not occurring and neither stock was overfished. ACLs were established as a precautionary measure to prevent the stocks from reaching an overfished status. Despite the stock status, the last assessment showed a general decline in spawning stock biomass since 2002. Since the assessment, recreational harvests have continued to be highly variable and exceeded the ACL (620,000 pounds) in 2015 and 2016. Future overages could lead to the stock becoming overfished. The stock status is expected to be updated by the upcoming SEDAR stock assessment in 2019.

Atlantic Coastal Management

In 2017, the Commission approved the Interstate FMP for AMG Cobia. Complementing many aspects of the SAFMC's cobia regulations for federal waters extending from Georgia through New York, the FMP was initiated in response to recent overages of the federal ACL for AMG cobia. Managing the recreational ACL on a coastwide basis has resulted in federal closures and significant overages in 2015 and 2016, disrupting fishing opportunities and jeopardizing the health of the stock.

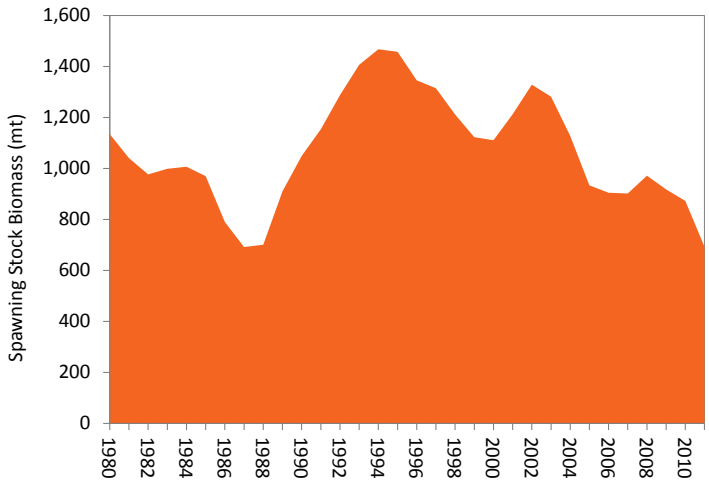
Under the Interstate FMP, the recreational fishery is managed with a one fish bag limit and a minimum size limit of 36" fork length (FL) or total length equivalent. Vessel limits will be determined once individual states set their seasonal restrictions, but may not exceed six fish per vessel. State-specific allocations of a coastwide recreational harvest limit that is equivalent to the federal AMG cobia recreational ACL of 620,000 pounds result in the following state-specific soft targets:

- Georgia - 58,311 pounds
- South Carolina - 74,885 pounds
- North Carolina - 236,316 pounds
- Virginia - 244,292 pounds

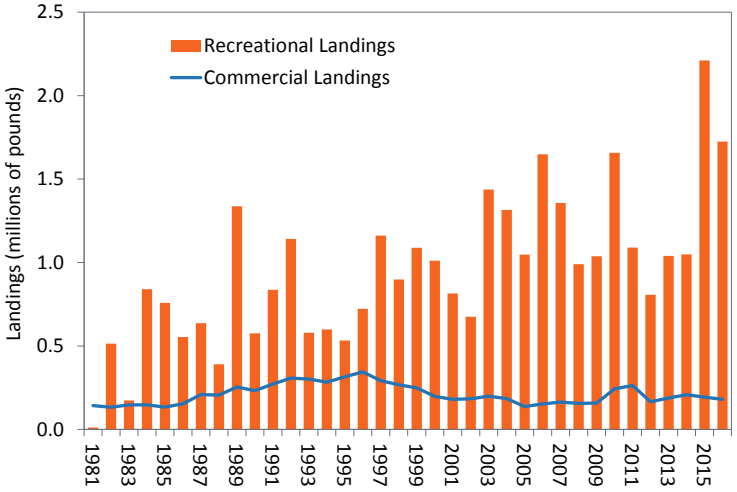
Recreational harvest of state-specific allocations will be evaluated over a three-year time period. If states exceed their soft harvest targets, states will be required to adjust management measures to achieve the soft harvest target in the subsequent three-year period.

The commercial fishery will maintain the current management measures as implemented through the SAFMC FMP and continue to be managed with a 33" FL minimum size limit and two fish limit per person, with a six fish maximum vessel limit. The federal ACL of 50,000 pounds is allocated to the entire commercial fishery from Georgia through New York. The commercial AMG cobia fishery will close once the ACL is projected to be reached. The FMP provides the opportunity for states to declare *de minimis* status for their recreational fishery if landings constitute less than 1% of the recreational AMG cobia harvest. For more information, please contact Mike Schmidtke, Fishery Management Plan Coordinator, at *mschmidtke@asmfc.org*.

Cobia Spawning Stock Biomass
Source: SouthEast Data Assessment and Review , 2013



Cobia Commercial & Recreational Landings
Source: ACCSP Data Warehouse, 2017



SPRING MEETING PRELIMINARY AGENDA continued from page 1

9 a.m. – 5 p.m. Law Enforcement Committee

(A portion of this meeting may be a closed session for Committee members only)

- Review and Comment on Ropeless Fishing Technologies
- Review of 2018 Action Plan Items
- ASMFC Species Management Issues
- State and Federal Agency Reports

11:15 a.m. – Noon Shad & River Herring Management Board

- Consider Approval of Shad and River Herring Sustainable Fishery Management Plans
  - Technical Committee Report
    - Massachusetts (Merrimack River)
- Report on the Funded Research Proposal on Blueback Herring
- Review and Consider 2018 Fishery Management Plan Review and State Compliance Reports

Noon – 1:15 p.m. Legislators and Governors' Appointees Luncheon

- Introductions
- General Comments/Discussion
- Discuss Non-compliance

1:15 – 2:45 p.m. Atlantic Striped Bass Management Board

- Provide Guidance to Stock Assessment Subcommittee Regarding Biological Reference Point Development for the 2018 Benchmark Stock Assessment

3 – 3:45 p.m. Atlantic Herring Section

- Discuss Potential Impact of River Herring/Shad Caps and Mackerel Fishery Possession Limits on Atlantic Herring Fishery
- Review Technical Committee Report on Scaling Up of Spawning Fish Samples Involving Less than One Hundred Fish

4 – 5 p.m. Atlantic Coastal Cooperative Statistics Program (ACCSP) Coordinating Council

- ACCSP Status Report
  - Program Status and Committee Updates
- Review and Consider Approval of FY19 Request for Proposals Package
- Accountability Standards

6 – 8 p.m. Annual Awards of Excellence Reception

WEDNESDAY, MAY 2

8:30 – 10:30 a.m. Executive Committee

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

- Report of the Administrative Oversight Committee
  - Presentation of FY19 Budget
- Discuss Appeals Process
- Discuss Conservation Equivalency Process
- Discuss Commissioner Conflict of Interest
- Future Annual Meetings Updates
- CLOSED SESSION: Executive Director Performance Review

10:45 a.m. – Noon Atlantic Menhaden Management Board

- Review and Consider Approval of Terms of Reference for the 2019 Atlantic Menhaden-Specific and Ecosystem-Based Benchmark Stock Assessments and Peer Reviews

Public Comment Guidelines

In order to ensure a fair opportunity for public input, the ISFMP Policy Board has established the following guidelines for use at management board meetings:

For issues that are not on the agenda, management boards will continue to provide opportunity to the public to bring matters of concern to the board's attention at the start of each board meeting. Board chairs will use a speaker sign-up list in deciding how to allocate the available time on the agenda (typically 10 minutes) to the number of people who want to speak.

For topics that are on the agenda, but have not gone out for public comment, board chairs will provide limited opportunity for comment, taking into account the time allotted on the agenda for the topic. Chairs will have flexibility in deciding how to allocate comment opportunities; this could include hearing one comment in favor and one in opposition until the chair is satisfied further comment will not provide additional insight to the board.

For agenda action items that have already gone out for public comment, it is the Policy Board's intent to end the occasional practice of allowing extensive and lengthy public comments. Currently, board chairs have the discretion to decide what public comment to allow in these circumstances.

In addition, the following timeline has been established for the submission of written comment for issues for which the Commission has NOT established a specific public comment period (i.e., in response to proposed management action).

1. Comments received 3 weeks prior to the start of a meeting week will be included in the briefing materials.

2. Comments received by **5 PM on Tuesday, April 24, 2018** will be distributed electronically to Commissioners/Board members prior to the meeting and a limited number of copies will be provided at the meeting.

3. Following the April 24th deadline, the commenter will be responsible for distributing the information to the management board prior to the board meeting or providing enough copies for management board consideration at the meeting (a minimum of 50 copies).

The submitted comments must clearly indicate the commenter's expectation from the ASMFC staff regarding distribution. As with other public comment, it will be accepted via mail, fax, and email.

- Review and Consider Approval of Stock Assessment Subcommittee Membership
- Review and Consider 2018 Fishery Management Plan Review and State Compliance Reports
    - Review Final 2018 Commercial Quotas

12:45 – 1:30 p.m. Atlantic Sturgeon Management Board
- Review and Consider 2018 Fishery Management Plan Review and State Compliance Reports

1:45 – 3:45 p.m. American Lobster Management Board
- Review Lobster Conservation Management Teams' Proposals to Reduce Latent Effort
- Law Enforcement Committee Report on Enforceability of Ropeless Fishing
- Plan Development Team Update on Development and Timeline of American Lobster Draft Addendum XXVII

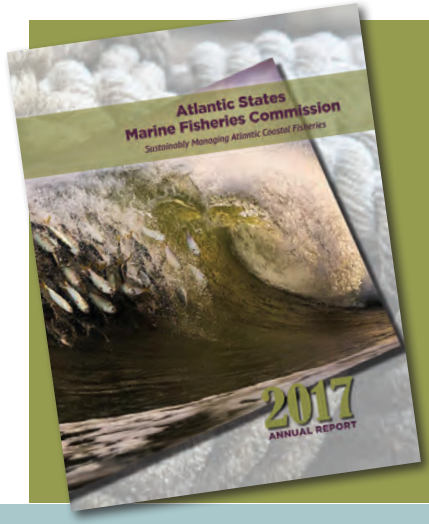
4 – 4:45 p.m. Winter Flounder Management Board
- Review and Consider Rhode Island's Conservation Equivalency Proposal
    - Technical Committee Report

THURSDAY, MAY 3

8 – 10 a.m. Interstate Fisheries Management Program Policy Board
- Law Enforcement and Artificial Reef Committee Reports
- Horseshoe Crab
    - Update on 2018 Benchmark Stock Assessment and Timeline
    - Consider Approval of Non-traditional Stakeholder Nominations

10 – 10:15 a.m. Business Session
- Consider Noncompliance Recommendations (If Necessary)

10:30 a.m. – 12:30 p.m. South Atlantic State/Federal Fisheries Management Board
- Review Public Comment on Draft Addendum I to the Black Drum Fishery Management Plan
    - Consider Draft Addendum I to the Fishery Management Plan for Final Approval
- Consider Management Action Based on Technical Committee/Plan Review Team Recommended Updates to the Annual Traffic Light Analyses for Atlantic Croaker and Spot
- Updates on SEDAR 58 Cobia Stock Identification Workshop and Board Tasking of Cobia Technical Committee from February 2018 Meeting
- Discuss Request to the Secretary of Commerce to Implement Cobia Regulations in Federal Waters in the Absence of a Federal Fishery Management Plan
- Elect Vice-Chair



2017 ANNUAL REPORT NOW AVAILABLE

The Commission has released its 2017 Annual Report, which provides an overview of significant management actions and associated science activities the Commission and its member states took in 2017 to maintain and restore the abundance of Commission-managed species. The report is available on our website at, www.asmfc.org, under Quick Links, or directly at *http://www.asmfc.org/files/pub/2017AnnualReport.pdf*. Limited printed copies are available; to request a copy, contact *info@asmfc.org*.

Comings and Goings

COMMISSIONERS

STEVEN BOWMAN
With his appointment as Commissioner of the Virginia Marine Resources Commission (VMRC), Steven Bowman returns to the ASMFC as Virginia's Administrative Commissioner. Mr. Bowman served as both VMRC and ASMFC Commissioner from 2006 to 2012. Prior to that, he worked as a VMRC conservation law enforcement officer and was an important contributor to the Commission's Law Enforcement Committee. After a six-year stint as Chief of Police for the Smithfield Police Department, he has returned to the realm of Atlantic coast fisheries management. Welcome back, Mr. Bowman!

STEPHEN MURPHEY
In January, in his new position as Director of North Carolina's Division of Marine Fisheries (DMF), Stephen Murphey became the state's Administrative Commissioner to the ASMFC. Mr. Murphey has over 30 years of experience in fishery and shellfish habitat enhancement programs, shellfish growing area surveys, shellfish processing inspection, and program administration. He began his career with the DMF in 1987 as a biologist. In 2010 he was promoted to Section Chief for Habitat and Enhancement. As Section Chief, Mr. Murphey was responsible for managing and coordinating large-scale marine and estuarine habitat restoration, management, and enhancement programs including shellfish aquaculture and oyster enhancement, and management of the Coastal Habitat Protection Plan. Welcome aboard, Mr. Murphey!

continued, see COMINGS & GOINGS on page 8

American Lobster Board Approves Addenda XXVI/III to the American Lobster/Jonah Crab FMPs

The Commission's American Lobster Management Board (Board) approved American Lobster Addendum XXVI/Jonah Crab Addendum III (Addenda) to the American Lobster and Jonah Crab Fishery Management Plans (FMPs). The Addenda improve the spatial resolution of harvester data collection, expand the required harvester reporting data elements, establish a timeline for increased harvester reporting in the American lobster and Jonah crab fisheries, and prioritize the development of electronic harvester reporting. In addition, the Addenda include recommendations for improved reporting and biological sampling in federal waters.

The Addenda respond to two concerns: (1) the current requirements for harvester reporting are insufficient to respond to external management actions; and (2) while the American lobster and Jonah crab fisheries continue to expand offshore, most of the biological sampling occurs inshore or nearshore. In particular, the Board expressed concern the spatial resolution of harvester data is too coarse to respond to finer-scale management issues. As a result, the Addenda improve the spatial resolution of data by requiring fishermen to report via 10 minute squares, which further divide the existing statistical areas. In addition, the addenda establish a one year pilot program to explore electronic tracking devices in the fishery which would address the special resolution and enforcement concerns. The addenda require additional data elements in harvester reports, including number of traps per trawl and number of buoy lines in order to collect information on gear configurations. Finally, the Addenda establish a deadline that, within five years, states are required to implement 100% harvester reporting, with the prioritization of electronic harvester reporting development during that time. In the interim, jurisdictions not at 100% harvester reporting should redistribute the current effort associated with harvester reporting to focus on active, as opposed to latent, permit holders.

The Addenda also improve the biological sampling requirements by establishing a baseline of ten sampling trips per year in the American lobster/Jonah crab fishery and encourage states with more than 10% of coastwide landings in either the American lobster or Jonah crab fisheries to conduct additional sampling trips.

Finally, the Addenda provide three recommendations for actions in federal waters. Specifically, a harvester reporting requirement be established for federal lobster permits in order to collect information from the growing offshore fishery; a fixed-gear VTR form be created to improve data collection in the American lobster and Jonah crab fisheries; and a biological sampling program be established in federal waters in order to address current data gaps in the assessment. These recommendations will be forwarded to NOAA Fisheries.

The Addenda can be obtained at *http://www.asmfc.org/uploads/file/5a9438ccAmLobsterAddXXVI_JonahCrabAddIII_Feb2018.pdf*. For more information, please contact Megan Ware, Fishery Management Plan Coordinator, at *mware@asmfc.org* or 703.842.0740.

COMINGS & GOINGS continued from page 7

JASON MCNAMEE

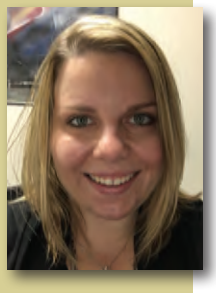
No stranger to the Commission, Jason McNamee has served on, chaired, and played a critical role on a number of ASMFC species technical committees throughout his career. Now Chief of Rhode Island's Marine Resources Section, Mr. McNamee oversees the administration of the Department of Environmental Management's marine fisheries science and management programs and staff, including its technical projects, scientific research, and outreach activities. In this role, he also serves as the state's Administrative Commissioner to the ASMFC. With a Bachelor's of Science in Zoology, a Master's of Science in Biological Oceanography and a soon to be Ph.D. in Oceanography, Mr. McNamee has a wealth of experience and outstanding qualifications to bring to the table as he works closely with his fellow Commissioners, federal partners, industry representatives, organizations and other stakeholders to develop interstate regional plans for the conservation and management of marine fisheries resources. Welcome aboard, Mr. McNamee!

STAFF

RACHEL COLLINS

In February, with her acceptance of a new position with Specialists on Call, the Commission bid farewell to Rachel Collins. Since September 2015, Ms. Collins served as Human Resources Manager, assisting in the implementation of ASMFC's HR policies and procedures. In her two and a half years with ASMFC, Ms. Collins assisted with the hiring and orientation of APAIS seasonal staff, updated ASMFC's employee handbook with current laws and regulations, and streamlined and improved accounting of employee timesheets and benefits through ADP software. We wish her the best of luck in her future endeavors!

ELIZABETH WYATT



In February, ACCSP said farewell to its Program Coordinator, Elizabeth Wyatt, as she accepted a program coordinator position in her home state of Michigan. Ms. Wyatt first joined the ACCSP staff as a Program Assistant back in May of 2014. Her role expanded to that of Program Coordinator in March 2016. During her time at ACCSP, Elizabeth was instrumental in coordinating ACCSP's annual funding process, organizing its Integrated Reporting Workshop, and ensuring program operations ran smoothly. She was a great boost to office morale, organizing socials and hosting a weekly trivia game. Elizabeth's affable nature, sense of humor, and levelheadedness will be greatly missed. We wish her the best of luck in her future endeavors!

Cooperative Research Seeks to Fill In Data Gaps to Support Fisheries Science and Management Efforts

Fisheries management is a data hungry endeavor. Whether it be recreational catch, commercial landings, fishing effort, or data on fish biology and life history, data feeds stock assessment processes and fisheries management decisions. Unfortunately, data collection is costly, labor intensive, and is becoming increasingly more challenging as state and federal fisheries science and management budgets and personnel have decreased in recent years.

The Commercial Fisheries Research Foundation (CFRF), a non-profit, private foundation established by commercial fishermen to conduct collaborative fisheries research and educational projects, seeks to provide more complete and consistent data to support fisheries science and management in a cost-efficient and scientifically reliable way. CFRF's work allows for the incorporation of fisherman-collected data into science and management measures. The cooperative research approach is especially useful for fisheries with significant temporal and spatial data gaps that would otherwise go unsampled (e.g., offshore areas).

CFRF is currently leading several projects, three of which are highlighted below.

Brian Thibeault collecting Jonah crab data aboard the FV Ashley Ann. Photo (c) CFRF.

Black Sea Bass Research Fleet

Black sea bass is a popular fishery throughout the Mid-Atlantic and Southern New England. Over the past few years, the distribution of black sea bass has begun to expand its range into more northern waters, largely in response to warming waters, leading to increased abundance throughout Southern New England. The species is also a protogynous hermaphrodite, meaning individuals change from female to male. These two factors – the species changing distribution and unique life history – make gathering comprehensive information about the population for use in future stock assessments and management plans particularly challenging and important.

The Black Sea Bass Research Fleet is a partnership between CFRF and the Rhode Island Department of Environmental Management (RI DEM) to collect and communicate black sea bass biological data in a cost-effective way using modern electronic technology and fishermen's time on the water. The goal is to develop a model approach for fishery-dependent data collection that involves the commercial and recreational fishing industries. The fleet consists of nine Rhode Island commercial and recreational fishermen, using several different gear types, to collect biological and fishery data on black sea bass during routine fishing practices throughout the year. Data collected include gear type and effort, sampling depth, percentage of catch retained and discarded, as well as fish length and sex. Data are transmitted to CFRF through a mobile tablet application, and then to RI DEM and the Atlantic Coastal Cooperative Statistics Program, allowing for timely transfer of the data for scientific and management use. The fishermen participating in the Black Sea Bass Research Fleet have sampled over 8,000 black sea bass since December 2016 and will continue through April 2019.

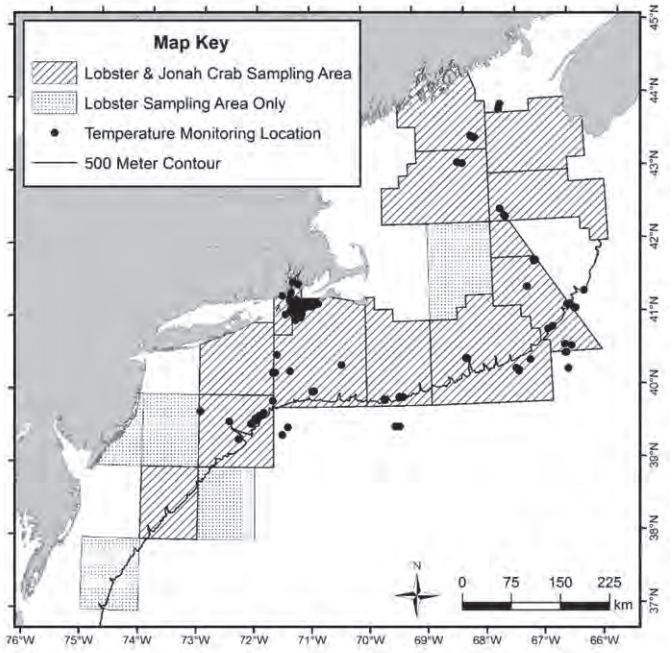
For more information on the Black Sea Bass Research Fleet, please contact Tom Heimann at *theimann@cfrfoundation.org*.

Supporting Management of Jonah Crab and American Lobster Fisheries in the Northeast

The Jonah Crab and Lobster Research Fleet works to implement a cost-effective method to collect critically needed biological data for two commercially important species. The American lobster fishery is one of the most valuable fisheries in New England, but significant data gaps exist in the southern part of its range and offshore waters. While the adult lobster population in the Gulf of Maine and Georges Bank is at historic highs, the Southern New England population is depleted, a status most likely driven by overfishing and changing environmental conditions, such as increased water temperatures in the area. Jonah crab is a rapidly expanding fishery whose popularity is partially driven by the decrease in availability of Southern New England lobster. An Interstate Fishery Management Plan for Jonah crab was approved in 2015. Information is needed to support the species' first stock assessment and evaluate the status of the stock.

continued, see SCIENCE HIGHLIGHT on page 10

SCIENCE HIGHLIGHT continued from page 9



Map of the areas sampled by the CFRF Lobster and Jonah Crab Research Fleet from June 1, 2013 to July 1, 2017, including bottom water temperature monitoring locations (black circles). Image (c) CFRF

The Jonah Crab and American Lobster Research Fleet collects data on the two species, which are caught in similar gear types, in order to better inform their stock assessments and management decisions.

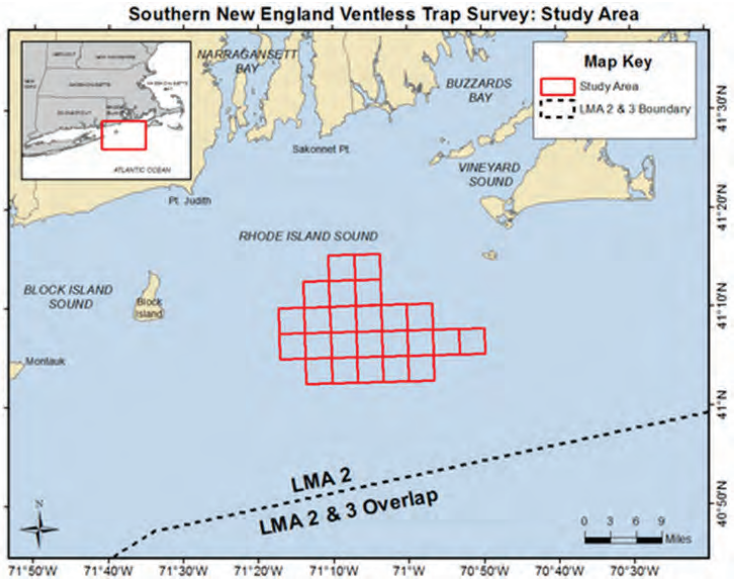
For the project, running since January 2013, 18 American lobster and Jonah crab fishing vessels use digital calipers and the 'On Deck Data' application (app) to collect biological and environmental data from their commercial and ventless traps. At the same time, fishermen also collect bottom water temperatures where they fish. The On Deck Data app was created by CFRF as a way for data to be easily deposited into Android tablets and transferred to a database for use. The project is especially useful in providing more complete temporal and spatial data for the species, as more traditional surveys that only sample within state waters and primarily during the summer months. The app records biological information, such as length, sex, shell disease, eggs, v-notch, shell hardness, and disposition. Each vessel samples at least 300 lobsters or 60 commercial traps each month, or 150 Jonah crabs or 60 commercial traps a month. For the past two years, over 2,300 male and female Jonah crabs have been collected from five geographical regions for Massachusetts Division of Marine Fisheries to analyze and better understand sexual maturity for both stocks. In 2018, the project started using Bluetooth caliper technology, hoping to pioneer its use in other fishery data collection projects. To date, the program has sampled 107,667 American lobsters and 47,400 Jonah crabs.

For more information on the Jonah Crab and American Lobster Research Fleet, please contact Aubrey Ellertson at aellertson@cfrfoundation.org.

Southern New England Cooperative Ventless Trap Survey

This survey is a continuation of the 2014/2015 Southern New England Ventless Trap Survey and will run from March 2018 to February 2019. The survey focuses on American lobster and Jonah crab, assessing the seasonal distribution, movement, and habitat use by these species in the Cox's Ledge Wind Energy Area. The goal is to establish a pre-construction baseline for the populations to enable assessment and mitigation of the impacts of offshore wind energy development. Commercial lobstermen are collaborating with CFRF on the project, providing the vessel capacity and expert knowledge to guide the research. Twenty-four lease blocks were selected in the Rhode Island-Massachusetts Wind Energy Area and biological sampling is conducted within each lease block twice a month from May to November. The project is being implemented in conjunction with a lobster tagging program to determine seasonal movement patterns and habitat use by lobsters in the area. The combined results of the projects will be used to better inform decisions about which locations should be selected for wind turbines in order to limit development impacts on American lobster and Jonah crab.

For more information on the Ventless Trap Survey, please contact Michael Long at mlong@cfrfoundation.org. Additional information on CFRF and its projects can be found at http://www.cfrfoundation.org/.



Map of the areas to be sampled by the Southern New England Cooperative Ventless Trap Survey from May 2018 - November 2018. Image (c) CFRF

-- This article was contributed by Jessica Kuesel, Fisheries Administrative Assistant

American Eel Draft Addendum V Approved for Public Comment

In February, the American Eel Management Board approved Draft Addendum V to the Interstate Fishery Management Plan for public comment. The Draft Addendum proposes alternative coastwide landings caps, management triggers, state-by-state allocations, and transfer provisions for the yellow eel commercial fishery; as well as alternatives to the current Maine glass eel commercial quota and the aquaculture provisions of the plan. The Board initiated Draft Addendum V in October 2017 in response to concerns over the management program as specified in Addendum IV.

Currently, the yellow eel fishery is managed to an annual coastwide landings cap of 907,671 pounds. The coastwide cap is evaluated against two management triggers: (1) the coastwide cap is exceeded by more than 10% in a given year; or (2) the coastwide cap is exceeded for two consecutive years, regardless of the percent overage. If either of these triggers are tripped, state-by-state quotas will be implemented. 2016 landings exceeded the coastwide cap by less than ten percent. If landings in 2017 exceeded the coastwide cap by any amount, state-by-state quotas would be implemented. The Board expressed concern that the current management triggers do not account for annual fluctuations in landings and the immediate implementation of state-by-state quotas would pose significant administrative challenges. Draft Addendum V proposes alternatives to the coastwide cap, management triggers, state-by-state allocations and transfer provisions to address the Board's concerns.

Draft Addendum V proposes alternative quota levels for the Maine glass eel fishery, increasing the quota above the 2015-2018 level of 9,688 pounds. The Draft Addendum also proposes changes to the aquaculture provisions of the plan. It includes an option that would allow contiguously bordered states to pool their 200 pound glass eel aquaculture allowance up to a maximum of 600 pounds.

It is anticipated the majority of states from Maine through Florida will be conducting public hearings on the Draft Addendum. A notice of the document's availability for public comment, as well as the public hearing schedule will be released late April/early May. The Board will meet in August at the Commission's Summer Meeting to review submitted comment and consider final action on the Addendum. For more information, please contact Kirby Rootes-Murdy, Senior FMP Coordinator, at krootes-murdy@asmfc.org.

ACCSP
Good Data, Good Decisions

ACCSP Announces FY2018 Funding Awards

The Atlantic Coastal Cooperative Statistics Program (ACCSP) has allocated nearly $1.4 million to its state and federal partners for 11 new and ongoing projects to improve data collection and processing for Atlantic coastal fisheries in 2018. The table details the projects that will be awarded funding.

ACCSP is a cooperative state-federal program focused on the design, implementation, and conduct of marine fisheries statistics data collection programs and the integration of those data into a single data management system that will meet the needs of fishery managers, scientists, and fishermen. It is composed of representatives from natural resource management agencies coastwide, including the Atlantic States Marine Fisheries Commission, the three Atlantic fishery management councils, the 15 Atlantic states, the Potomac River Fisheries Commission, the D.C. Fisheries and Wildlife Division, NOAA Fisheries, and the U.S. Fish & Wildlife Service. For further information please visit www.accsp.org.

PROGRAM PARTNER	PROJECT	AWARD (Rounded to nearest hundred)
Maine Department of Marine Resources	Managing Mandatory Dealer Reporting in Maine	$193,500
	Portside Commercial Catch Sampling and Bycatch Sampling for Atlantic Herring (*Clupea harengus*), Atlantic Mackerel (*Scomber scombrus*), and Atlantic Menhaden (*Brevoortia tyrannus*) Fisheries	$26,000
Rhode Island Division of Fish and Wildlife	Maintenance and Coordination of Fishery-Dependent Data Feeds to ACCSP from the State of Rhode Island	$77,000
	Voice Recognition and HeadBoat Survey Mobile Application	$48,300
	Advancing Fishery-Dependent Data Collection for Black Sea Bass (*Centropristis striata*) in the Southern New England and Mid-Atlantic Region Utilizing Modern Technology and a Fishing Vessel Research Fleet Approach	$135,600
New Jersey Division of Fish and Wildlife	Electronic Reporting and Biological Characterization of New Jersey Commercial Fisheries	$164,400
South Carolina Department of Natural Resources	ACCSP Data Reporting from South Carolina's Commercial Fisheries	$163,200
	VESL/SAFIS Integration Development	$86,400
Georgia Department of Natural Resources	Continuing Data Entry and Management of Commercial Fisheries Paper Trip Tickets in Georgia	$116,900
NOAA Fisheries' Southeast Fisheries Science Center	Continued Processing and Ageing of Biological Samples Collected from U.S. South Atlantic Commercial and Recreational Fisheries	$251,600
ACCSP Recreational Technical Committee and Florida Fish and Wildlife Conservation Commission	Increase At-sea Sampling Levels for the Recreational Headboat Fishery on the Atlantic Coast	$134,400

National Oceanic and Atmospheric Administration (in $ thousands)							
	2016 Enacted	2017 Enacted	2018 Trump	2018 House	2018 Senate	2018 Enacted	2019 Trump
National Marine Fisheries Service							
Marine Mammals, Turtles & Other Species	110,246	111,342	106,993	108,500	113,342	113,342	108,460
Species Recovery Grants	6,000	6,200	5,989	5,989	7,000	7,000	5,993
Atlantic Salmon	6,163	6,224	6,151	6,224	6,224	6,224	6,218
Pacific Salmon	60,000	62,000	59,887	63,000	62,000	63,000	60,944
Ecosystem Science Programs & Services	139,489	139,489	141,323	141,323	141,327	144,196	141,185
Data Collections, Surveys & Assessments	163,271	164,000	154,961	163,000	164,749	164,749	156,558
Observers and Training	43,655	43,655	43,572	43,655	43,655	53,955	43,768
Fisheries Management Programs & Services	115,995	117,051	111,153	117,000	117,051	118,659	112,598
Aquaculture	6,300	9,300	6,288	8,000	15,000	15,000	9,327
Salmon Management Activities	31,500	33,500	31,440	34,000	35,469	35,500	31,524
Regional Councils & Fisheries Commissions	33,470	34,254	33,407	34,000	35,871	35,871	34,495
Interjurisdictional Fisheries Grants	3,000	3,004	0	3,000	3,004	3,004	0
Enforcement	69,000	69,000	68,943	69,000	69,000	69,073	51,495
Habitat Conservation and Restoration	61,408	52,524	51,334	51,334	53,342	53,384	47,919
Selected Additional NOAA Accounts							
National Sea Grant College Program	64,000	63,000	0	63,000	65,000	65,000	0
Marine Aquaculture Program	9,000	9,500	0	7,000	11,500	11,500	0
Coastal Zone Management and Services	40,000	42,500	39,924	39,600	42,500	42,500	40,489
Coastal Zone Management Grants	26,000	85,000	0	45,000	85,000	75,000	0
Title IX Fund	-	-	-	-	-	30,000	-
Coral Reef Program	26,000	26,100	25,955	26,100	26,600	26,604	26,033
Sanctuaries and Marine Protected Areas	49,000	51,000	48,907	52,000	51,000	54,500	49,739
National Estuarine Research Reserve System	23,000	23,500	0	23,500	25,000	25,000	0

Magnuson-Stevens Act Reauthorization

On February 28, 2018, the U.S. Senate Committee on Commerce, Science and Transportation approved S. 1520, the Modernizing Recreational Fisheries Management Act. S. 1520 contains a number of provisions championed by the recreational fishing community, including use of alternative fishery management measures, requiring allocation reviews for some South Atlantic and Gulf fisheries, and changes to how fisheries data is collected.

On December 13, 2017, the U.S. House Committee on Natural Resources approved its Magnuson-Stevens Fishery Conservation and Management Act (MSA) reauthorization bill, H.R. 200 – the Strengthening Fishing Communities and Increasing Flexibility in Fisheries Management Act. During the mark-up, H.R. 200 was amended to include provisions of H.R. 2023/S. 1520 – the Modernizing Recreational Fisheries Management Act.

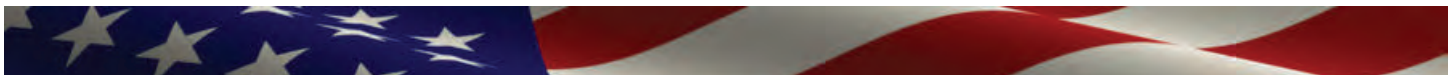
Federal Appropriations

On March 23, 2018, the President approved an omnibus appropriations bill for Fiscal Year 2018. In addition to funding the federal government, the legislation contains instructions to the various federal agencies, including NOAA Fisheries. Two provisions have the potential to impact Atlantic coast striped bass management:

- The Atlantic States Marine Fisheries Commission is completing a new stock assessment of Atlantic striped bass in 2018. After this assessment is complete, the Secretary of Commerce is directed to use this assessment to review the federal moratorium on Atlantic striped bass.
- NOAA Fisheries, in consultation with the Atlantic States Marine Fisheries Commission, is directed to consider lifting the ban on striped bass fishing in the Federal Block Island Transit Zone.

President Trump submitted his Fiscal Year 2019 Budget Request to Congress on February 12, 2018. The Budget again proposes to eliminate Interjurisdictional Fisheries Act Grants, National Estuarine Research Reserves, and Sea Grant. For the second year, the President also proposes to use all available Saltonstall-Kennedy funding to offset NOAA Fisheries' appropriation for Data Collections, Surveys, and Assessments. Therefore, no Saltonstall-Kennedy grants would be available for Fiscal Year 2019. The federal government is currently operating under a stop-gap funding measure at Fiscal Year 2017 levels through March 23, 2018.

Funding levels for NOAA Fisheries and other selected accounts within NOAA can be viewed in the above chart. For more information, please contact Deke Tompkins at dtompkins@asmfc.org.



ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Kathy Rawls, Fisheries Management Section Chief

SUBJECT: Rule Suspensions

Attached is the temporary rule suspension information for the May 2018 meeting. In accordance with the North Carolina Division of Marine Fisheries Resource Management Policy Number 2014-2, the North Carolina Marine Fisheries Commission will vote on any new rule suspensions that have occurred since the last meeting of the commission. No new rule suspensions have occurred since the February 2018 meeting; therefore, no action is necessary. The current rule suspensions are as follows:

- Continued suspension of North Carolina Marine Fisheries Commission Rule 15A NCAC 03M .0516 Cobia, for an indefinite period of time. This continued suspension allows the division to manage the commercial and recreational cobia fisheries in accordance with management actions taken by the commission and in accordance with Framework Amendment 4 to the federal Coastal Migratory Pelagics Fishery Management Plan. This suspension was continued in Proclamation FF-10-2018.

- Continued suspension of portions of North Carolina Marine Fisheries Commission Rule 15A NCAC 03J .0301 Pots, for an indefinite period of time. This continued suspension allows the division to implement the crab pot escape ring requirements adopted by the commission in the May 2016 Revision to Amendment 2 of the North Carolina Blue Crab Fishery Management Plan. This suspension was effective January 15, 2017, implemented in Proclamation M-11-2016.

- Continued suspension of portions of North Carolina Marine Fisheries Commission Rule 15A NCAC 03L .0201 Crab Harvest Restrictions, and portions of 03L .203 Crab Dredging, for an indefinite period of time. This continued suspension allows the division to implement the blue crab harvest restrictions adopted by the commission in the May 2016 Revision to Amendment 2 of the North Carolina Blue Crab Fishery Management Plan. These suspensions were implemented in Proclamation M-11-2016.

- Continued suspension of portions of North Carolina Marine Fisheries Commission Rule 15A NCAC 03J .0501 Definitions and Standards for Pound Nets and Pound Net Sets, for an indefinite period of time. Continued suspension of portions of this rule allows the division to increase the minimum mesh size of escape panels for flounder pound nets in accordance with Supplement A to Amendment 1 of the North Carolina Southern Flounder Fishery Management Plan. This suspension was implemented in Proclamation M-34-2015.

- Continued suspension of portions of North Carolina Marine Fisheries Commission Rule 15A NCAC 03M .0519 Shad and 03Q .0107 Special Regulations: Joint Waters, for an indefinite period of time. Continued suspension of portions of these rules 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-15-2018.

Red Drum Landings 2016-2017

Landings are complete through January 31, 2018
2016 and 2017 landings are final. 2018 landings are preliminary.

Year	Month	Species	Pounds	2009-2011 Average	2013-2015 Average	
2016	9	Red Drum	18,748	28,991	35,003	
2016	10	Red Drum	13,907	43,644	63,662	
2016	11	Red Drum	8,308	14,318	27,643	
2016	12	Red Drum	1,990	3,428	2,197	
2017	1	Red Drum	1,313	5,885	1,699	
2017	2	Red Drum	2,808	3,448	3,996	
2017	3	Red Drum	5,392	5,699	3,971	
2017	4	Red Drum	4,402	7,848	6,528	
2017	5	Red Drum	7,775	13,730	9,664	
2017	6	Red Drum	12,517	12,681	6,985	
2017	7	Red Drum	14,108	13,777	15,618	
2017	8	Red Drum	18,579	21,252	15,846	
Fishing Year (Sept 1, 2016 - Aug 31, 2017) Landings			**109,848**			

Year	Month	Species	Pounds	2009-2011 Average	2013-2015 Average	
2017	9	Red Drum	28,280	28,991	35,003	
2017	10	Red Drum	58,824	43,644	63,662	
2017	11	Red Drum	27,750	14,318	27,643	
2017	12	Red Drum	4,714	3,428	2,197	
2018	1	Red Drum	2,056	5,885	1,699	
2018	2	Red Drum	1,842	3,448	3,996	*
2018	3	Red Drum	3,002	5,699	3,971	*
2018	4	Red Drum	***	7,848	6,528	*
Fishing Year (Sept 1, 2017 - Aug 31, 2018) Landings			**126,468**			

*partial trip ticket landings only
***landings are confidential

Year	Month	Species	Pounds	Dealers	Trips	Average (2007-2009)	
2015	1	SOUTHERN FLOUNDER	1,984	30	237	7,713	
2015	2	SOUTHERN FLOUNDER	495	21	93	4,617	
2015	3	SOUTHERN FLOUNDER	10,750	62	768	23,512	
2015	4	SOUTHERN FLOUNDER	20,824	88	1,074	68,389	
2015	5	SOUTHERN FLOUNDER	42,454	117	1,282	122,514	
2015	6	SOUTHERN FLOUNDER	53,838	116	1,482	154,090	
2015	7	SOUTHERN FLOUNDER	42,806	106	1,144	170,387	
2015	8	SOUTHERN FLOUNDER	43,900	111	1,152	201,862	
2015	9	SOUTHERN FLOUNDER	255,067	122	2,335	396,301	
2015	10	SOUTHERN FLOUNDER	429,234	127	2,554	781,717	
2015	11	SOUTHERN FLOUNDER	301,489	90	1,755	392,150	
2015	12	SOUTHERN FLOUNDER	89	7	10	37,303	
2016	1	SOUTHERN FLOUNDER	2,625	33	264	7,713	
2016	2	SOUTHERN FLOUNDER	1,643	31	291	4,617	
2016	3	SOUTHERN FLOUNDER	9,183	58	914	23,512	
2016	4	SOUTHERN FLOUNDER	10,558	72	628	68,389	
2016	5	SOUTHERN FLOUNDER	24,522	90	821	122,514	
2016	6	SOUTHERN FLOUNDER	44,952	100	1,242	154,090	
2016	7	SOUTHERN FLOUNDER	43,574	102	1,132	170,387	
2016	8	SOUTHERN FLOUNDER	53,057	106	1,409	201,862	
2016	9	SOUTHERN FLOUNDER	245,870	131	3,004	396,301	
2016	10	SOUTHERN FLOUNDER	279,618	117	2,161	781,717	
2016	11	SOUTHERN FLOUNDER	182,148	102	1,465	392,150	
2016	12	SOUTHERN FLOUNDER	14	5	5	37,303	
2017	1	SOUTHERN FLOUNDER	1,677	38	122	7,713	
2017	2	SOUTHERN FLOUNDER	2,758	55	215	4,617	
2017	3	SOUTHERN FLOUNDER	8,254	67	874	23,512	
2017	4	SOUTHERN FLOUNDER	9,591	83	787	68,389	
2017	5	SOUTHERN FLOUNDER	33,105	105	1,121	122,514	
2017	6	SOUTHERN FLOUNDER	74,973	115	1,906	154,090	
2017	7	SOUTHERN FLOUNDER	74,944	107	1,755	170,387	
2017	8	SOUTHERN FLOUNDER	102,877	116	2,366	201,862	
2017	9	SOUTHERN FLOUNDER	235,915	128	2,849	396,301	
2017	10	SOUTHERN FLOUNDER	548,723	142	3,970	781,717	
2017	11	SOUTHERN FLOUNDER	301,569	123	1,990	392,150	
2017	12	SOUTHERN FLOUNDER	166	7	8	37,303	
2018	1	SOUTHERN FLOUNDER	610	14	43	7,713	*
2018	2	SOUTHERN FLOUNDER	1,389	24	126	4,617	*
2018	3	SOUTHERN FLOUNDER	1,367	21	211	23,512	*
2018	4	SOUTHERN FLOUNDER	***	1	3	68,389	*

*2018 data are preliminary and only complete through January.

***data are confidential

Year	Species	Gear	Pounds	Dealers	Trips	
2012	SOUTHERN FLOUNDER	GIGS	149,387	112	3,000	
2012	SOUTHERN FLOUNDER	GILLNETS	879,373	168	14,713	
2012	SOUTHERN FLOUNDER	OTHER	47,989	105	1,462	
2012	SOUTHERN FLOUNDER	POUND NET	569,388	35	1,754	
2013	SOUTHERN FLOUNDER	GIGS	118,489	101	2,408	
2013	SOUTHERN FLOUNDER	GILLNETS	1,096,060	178	16,968	
2013	SOUTHERN FLOUNDER	OTHER	46,953	104	2,093	
2013	SOUTHERN FLOUNDER	POUND NET	924,889	41	2,112	
2014	SOUTHERN FLOUNDER	GIGS	135,273	109	2,655	
2014	SOUTHERN FLOUNDER	GILLNETS	659,394	145	11,778	
2014	SOUTHERN FLOUNDER	OTHER	18,628	115	1,887	
2014	SOUTHERN FLOUNDER	POUND NET	860,216	39	1,806	
2015	SOUTHERN FLOUNDER	GIGS	130,277	92	2,616	
2015	SOUTHERN FLOUNDER	GILLNETS	392,384	133	8,471	
2015	SOUTHERN FLOUNDER	OTHER	12,422	102	1,002	
2015	SOUTHERN FLOUNDER	POUND NET	667,847	40	1,803	
2016	SOUTHERN FLOUNDER	GIGS	126,983	92	2,657	
2016	SOUTHERN FLOUNDER	GILLNETS	361,570	126	8,422	
2016	SOUTHERN FLOUNDER	OTHER	10,953	84	838	
2016	SOUTHERN FLOUNDER	POUND NET	398,258	39	1,423	
2017	SOUTHERN FLOUNDER	GIGS	136,094	90	2,752	
2017	SOUTHERN FLOUNDER	GILLNETS	552,227	128	12,363	
2017	SOUTHERN FLOUNDER	OTHER	8,360	90	939	
2017	SOUTHERN FLOUNDER	POUND NET	697,870	45	1,912	
2018	SOUTHERN FLOUNDER	GIGS	958	7	44	*
2018	SOUTHERN FLOUNDER	GILLNETS	2,247	24	299	*
2018	SOUTHERN FLOUNDER	OTHER	149	11	25	*
2018	SOUTHERN FLOUNDER	POUND NET	***	2	15	*

*2018 data are preliminary and only complete through January.

***data are confidential

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Chris Batsavage, Protected Resources Section Chief/Special Assistant for Councils and John McConnaughey, Protected Resources Section

SUBJECT: Protected Resources Section Update

Observer Program
Tables summarizing observer coverage and protected species interactions from January through March 2018 are included. These tables provide the number of trips, observed trips, observer coverage, and protected species interactions for anchored large and small mesh gill nets by month and management unit. Please note that observer coverage is based on the average number of trips from previous years' finalized data, because 2018 trip data are preliminary.

No sea turtle interactions* were observed in large or small mesh gill nets from January through March 2018, and no self-reported sea turtle interactions by gill net fishermen occurred during this time.

A total of 12 (11 alive and one dead) Atlantic sturgeon interactions were observed in large mesh gill nets and zero in small mesh gill nets from January through March 2018, with all but two interactions occurring in March. No self-reported Atlantic sturgeon interactions by gill net fishermen occurred during this time.

Management Unit Openings and Closures
The following management units opened or closed as a requirement of the Sea Turtle and Atlantic Sturgeon Incidental Take Permits:

- Portions of Management Unit A reopened to large mesh gill nets on Mar. 3, 2018 after closing on Dec. 1, 2017 to minimize Atlantic sturgeon interactions. These areas closed again after the end of the American shad season in Management Unit A (Mar. 25
- No other management units closed during this time.

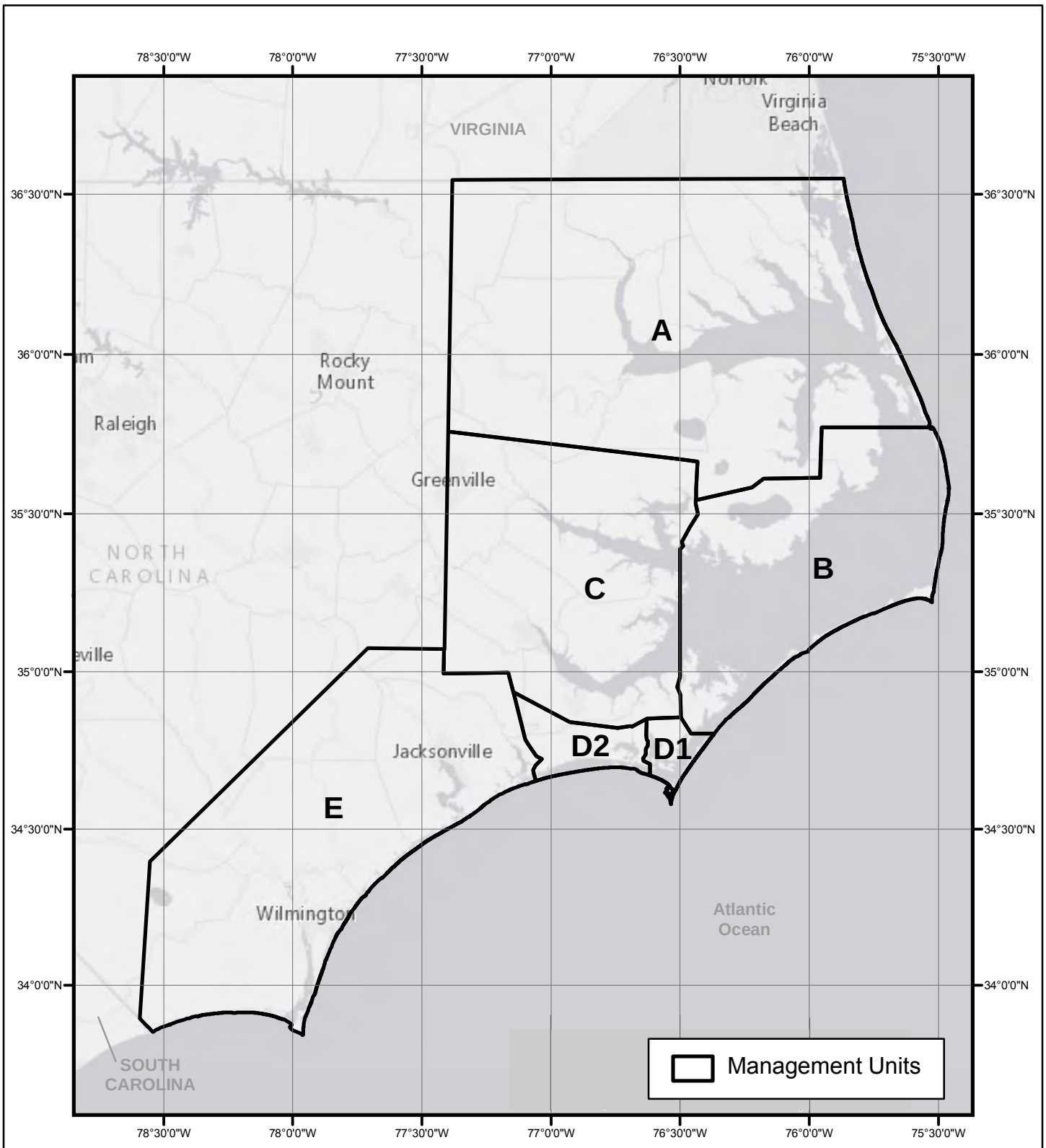
Annual Sea Turtle and Atlantic Sturgeon Incidental Take Permit Reports
Included in the briefing materials are the annual reports for the Sea Turtle and Atlantic Sturgeon Incidental Take Permits that were submitted to the National Marine Fisheries Service. The annual reports:

- Describe the methodology for monitoring sea turtle and Atlantic sturgeon takes in the estuarine anchored gill net fishery,
- Report the observer program activity by season,
- Provide the number of observed and fishermen-reported sea turtle and Atlantic sturgeon interactions, and
- Give the estimated total number of sea turtle and Atlantic sturgeon interactions based on percent observer coverage at the times the interactions occurred.

The reports also show maps of observer trips and protected species interactions and provide information on management unit closures, incidental take permit compliance, and outreach efforts.

***Definition**

Incidental Take Permit Interaction - when a protected species is caught or otherwise comes in contact with a gill net.



NCDMF ESTUARINE GILLNET PERMIT MAP

April 2015

0 12.5 25 50 Miles

Table 1. Preliminary data collected for large mesh gill nets by month and management unit through the NCDMF Observer Program through March 5, 2018.

								Observed Takes By Species								
		Trips		Observer Large Mesh				Kemp's		Green		Loggerhead		Unknown	A.Sturgeon [5]	
Month	Unit	Estimated [1]	Actual [2]	AP Attempts [3]	Trips	Yards	Coverage [4]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
January	A	265	209	8	15	10,260	5.7									
	B	30	2	14	0	0	0.0									
	C	15	4	5	1	50	6.7									
	D1	0	0	0	0	0	0.0									
	D2	0	3	1	0	0	0.0									
	E	6	4	35	0	0	0.0									
February	A	527	221	29	25	12,490	4.7								**1**	
	B	52	7	21	0	0	0.0									
	C	102	45	21	16	12,180	15.7								**1**	
	D1	0	0	0	0	0	0.0									
	D2	1	2	6	1	100	0.0									
	E	22	3	41	0	0	0.0									
March	A	1,146	1	24	91	41,640	7.9								**9**	**1**
	B	69	0	17	1	600	1.4									
	C	655	0	11	29	19,360	4.4									
	D1	1	0	4	0	0	0.0									
	D2	7	0	2	3	1,100	42.9									
	E	59	0	52	2	180	3.4									
Total		2,957	501	291	184	97,960	6.2	0	0	0	0	0	0	0	11	1

[1] Finalized trip ticket data averaged from 2012-2016

[2] Preliminary trip ticket data for 2018

[3] Alternative Platform trips where no fishing activity was found

[4] Based on estimated trips and observer large mesh trips

[5] A. Sturgeon numbers through March 2018

Table 2. Preliminary data collected for large mesh gill nets by month through the NCDMF Observer Program through March 5, 2018.

							Observed Takes By Species								
	Trips		Observer Large Mesh				Kemp's		Green		Loggerhead		Unknown	A. Sturgeon [5]	
Month	Estimated [1]	Actual [2]	AP Attempts [3]	Trips	Yards	Coverage [4]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
January	316	222	63	16	10,310	5.1	0	0	0	0	0	0	0	0	0
February	704	278	118	42	24,770	6.0	0	0	0	0	0	0	0	**2**	0
March	1,937	1	110	126	62,880	6.5	0	0	0	0	0	0	0	**9**	**1**
Total	2,957	501	291	184	97,960	6.2	0	0	0	0	0	0	0	11	1

[1] Finalized trip ticket data averaged from 2012-2016

[2] Preliminary trip ticket data for 2018

[3] Alternative Platform trips where no fishing activity was found

[4] Based on estimated trips and observer large mesh trips

[5] A. Sturgeon numbers through March 2018

Table 3. Preliminary data collected for small mesh gill nets by month and management unit through the NCDMF Observer Program through March 5, 2018.

							Observed Takes By Species								
		Trips		Observer Small Mesh			Kemp's		Green		Loggerhead		Unknown	A. Sturgeon	
Month	Unit	Estimated [1]	Actual [2]	Trips	Yards	Coverage [3]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
January	A	394	131	1	150	0.3									
	B	151	58	1	300	0.7									
	C	47	20	4	1,000	8.5									
	D1	1	0	0	0	0.0									
	D2	21	1	5	900	23.8									
	E	27	5	1	800	3.7									
February	A	515	184	12	3,700	2.3									
	B	108	225	1	700	0.9									
	C	64	77	8	3,130	12.5									
	D1	1	3	0	0	0.0									
	D2	13	0	3	400	23.1									
	E	14	0	1	300	7.1									
March	A	575	0	3	750	0.5									
	B	262	6	6	2,080	2.3									
	C	87	0	3	1,000	3.4									
	D1	6	0	0	0	0.0									
	D2	4	0	0	0	0.0									
	E	23	1	1	600	4.3									
Total		2,313	711	50	15,810	2.2	0	0	0	0	0	0	0	0	0

[1] Finalized trip ticket data averaged from 2013-2016

[2] Preliminary trip ticket data for 2018

[3] Based on estimated trips and observer small mesh trips

Table 4. Preliminary data collected for small mesh gill nets by month through the NCDMF Observer Program through March 5, 2018.

	Trips		Observer Small Mesh			Observed Takes By Species								
						Kemp's		Green		Loggerhead		Unknown	A. Sturgeon	
Month	Estimated [1]	Actual [2]	Trips	Yards	Coverage [3]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
January	641	215	12	3,150	1.9	0	0	0	0	0	0	0	0	0
February	715	489	25	8,230	3.5	0	0	0	0	0	0	0	0	0
March	957	7	13	4,430	1.4	0	0	0	0	0	0	0	0	0
Total	2,313	711	50	15,810	2.2	0	0	0	0	0	0	0	0	0

[1] Finalized trip ticket data averaged from 2013-2016

[2] Preliminary trip ticket data for 2018

[3] Based on estimated trips and observer small mesh trips

Annual Sea Turtle Interaction Monitoring of the Anchored Gill-Net Fisheries in North Carolina for Incidental Take Permit Year 2017

Annual Completion Report for Activities under Endangered Species Act
Section 10 Incidental Take Permit No. 16230

Jacob Boyd

North Carolina Department of Environmental Quality
North Carolina Division of Marine Fisheries
Protected Resources Section
3441 Arendell Street
Morehead City, NC 28557

February 2018

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Figure 12. Length-frequency (curved carapace width) from notch to tip of observed incidental captures of Kemp's ridley sea turtles where measurements were obtained (n = 8) collected by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017). 52

INTRODUCTION

The North Carolina Division of Marine Fisheries (NCDMF) applied for an Incidental Take Permit (ITP) under Section 10(a)(1)(B) of the Endangered Species Act of 1973 (Public Law 93-205) (ESA) on June 14, 2010 to address sea turtle interactions with anchored gill nets in North Carolina's internal coastal (estuarine) waters. Species of sea turtles found in the estuarine waters of North Carolina include green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), hawksbill sea turtle (*Eretmochelys imbricate*), and leatherback sea turtle (*Dermochelys coriacea*). This request was prompted by notification from the National Marine Fisheries Service (NMFS) - Southeast Regional Office (SERO) in July and November 2009 indicating the need for the state of North Carolina to address unauthorized takes of sea turtles occurring in inshore anchored gill-net fisheries. A revised ITP application was submitted on August 17, 2011 based on feedback received from the NMFS on May 12, 2011. Feedback on the revised application from the NMFS was provided again on May 2, 2012 after public and peer review comments had been compiled. In response to requested changes from the NMFS, and considering the public and peer review comments, including the comments made by the North Carolina Sea Turtle Advisory Committee (NCSTAC), the NCDMF made extensive revisions to its application and resubmitted it on September 6, 2012. After another round of public and peer review comments the NMFS requested more information and clarification on certain portions of the application. On November 14, 2012, the response to the information request was discussed via teleconference between the NMFS and the NCDMF and provided to them beforehand. The NMFS recommended that the NCDMF update the current ITP application with an appendix containing all the updated information requested.

During the November 14, 2012 teleconference, the NMFS suggested breaking down the annual requested takes for Kemp's ridley and loggerhead sea turtles cumulatively, similar to the previous ITPs for the Pamlico Sound Gill Net Restricted Area (PSGNRA). The NCDMF also suggested annual cumulative requested takes for all species of sea turtles for the exempt areas. A revised application was resubmitted on January 18, 2013.

On April 17, 2013, the NMFS set up a teleconference with the NCDMF to go over the revised ITP application that was submitted on January 18, 2013. Information was provided to the NMFS to clarify issues they had with the application. On April 22, 2013, the NMFS again asked for further clarification on various aspects of the ITP application which the NCDMF promptly responded to. At that time, the NCDMF was informed by the NMFS that they hoped to have a draft permit within a month to discuss with the NCDMF. On April 30, 2013, the NCDMF staff were contacted by the NMFS for further explanation on the methodologies of the Observer Program. Explanations were provided and the NMFS did not have any more questions at the time.

On May 20, 2013, the NCDMF had another teleconference with the NMFS concerning the ITP application status and to review the Biological Opinion and Environmental Assessment protocols. At this time, the NMFS raised concerns on the number of observed takes requested in the ITP application. During the May teleconference, the NCDMF and the NMFS agreed to base authorized takes by area on an annual basis instead of a seasonal basis. The number of requested observed takes was reduced by taking the seasonal component out of the equation. The NMFS brought up the idea of having an Implementing Agreement for the Sea Turtle ITP, similar to the Implementing Agreement the NMFS had suggested for the Atlantic Sturgeon ITP. The NMFS explained that an Implementing Agreement would provide more flexibility and could reduce the risk of the permit being suspended due to excessive takes, but it will not allow for additional takes. The NMFS explained that any new information could be provided in another appendix to the existing application. The NCDMF asked the NMFS to provide a copy of a draft Implementing Agreement for consideration.

The NCDMF received the Sea Turtle ITP (No. 16230) on September 11, 2013. The Sea Turtle ITP defined an ITP Year as beginning on September 1 and running through August 31 of the following year. This ITP authorized the implementation of adaptive management measures to protect threatened and endangered sea turtles and other ESA listed species, while allowing anchored gill-net fisheries to be prosecuted in the estuarine waters of North Carolina. The ITPs Conservation Plan specifies further measures, which the NMFS determined will minimize, monitor, and mitigate the impacts of incidental takes of ESA-listed sea turtle species associated with the otherwise lawful anchored gill-net fisheries operating in estuarine North Carolina waters. Anchored gill nets are passive sets deployed with an anchor, stake, or boat at one or both ends of the net shots or operation. Anchored gill nets do not include the following types of gill nets: run-around, strike, drop or drift gill nets.

On November 21, 2016, the NCDMF requested a minor modification to extend the annual report deadlines for the Sea Turtle and Atlantic Sturgeon (No. 18102) ITPs from January 31 to the last day in February. This extension was to benefit staff due to a lag time in data being uploaded and verified, the time of year, the deadline for the fall seasonal report, and staff availability. On January 4, 2017, the NMFS sent a letter to the NCDMF concurring with NCDMF's request for the minor modification encouraging staff to incorporate any further anticipated minor modifications into the application process for an updated ITP (Appendix A).

The NCDMF Observer Program data were updated using the finalized 2016 Trip Ticket Program (TTP) data in May 2017 (Appendix B). The Annual Completion Report for the Sea Turtle ITP No. 16230 was completed for ITP Year 2016 and submitted in February 2017. Using the finalized 2016 data, Tables 1, 5, 10, and 11 from the Completion Report were updated to reflect the final estimates of observer coverage and sea turtle takes. The fall 2015 season was based on

finalized 2016 TTP data and did not deviate from the previous report for both anchored large and small mesh gill nets (Appendix B).

METHODS

Observer Activity

The conservation plan includes managing the estuarine anchored gill-net fisheries by dividing North Carolina's estuarine waters into six management units (A, B, C, D1, D2, and E; Figure 1). Trip Ticket Program data along with Observer Program data from previous years are used when estimating the number of trips needed for the current year in each management unit and season. Also, real time TTP data are used for areas where effort may be increasing. Each year effort can potentially shift from one management unit to another making it important for the NCDMF to not base the observer effort solely on previous years' data, but also on current effort. To account for fluctuations in TTP data caused by management unit closings, a five-year average was used for estimating anchored large mesh gill-net fishing trips and a four-year average was used for estimating anchored small mesh gill-net fishing trips for ITP Year 2017. This method of estimating trips proves to more accurately reflect the current fishing effort. Once TTP data are finalized in May of 2018, the final observer coverage will be recalculated and the finalized estimates of observer coverage will be provided to the NMFS.

Observer coverage was calculated for each season in each management unit by estimating fishing trips using an average of the previous five years' TTP data (2012-2016) for anchored large mesh gill nets, and the average of the previous four years' (2013-2016) TTP data for anchored small mesh gill nets, while taking reduced season dates in each management unit into account by calculating the proportion of actual to possible fishing days. This calculated estimated fishing effort was compared to the observer trips completed throughout the ITP Year. The average, normalized effort was used when estimating fishing trips to account for the fluctuation of fishing effort throughout the years due to closures and other regulations put in place throughout the time series.

The onboard Observer Program, where observers ride onboard fishermen's vessels, is the preferred method of obtaining observer data and is used most frequently. Protected species interactions, gear parameters, as well as detailed gill-net catch, bycatch, and discard information for all species caught are recorded. The alternative platform Observer Program requires two observers in a state-owned vessel to monitor commercial fishermen as they fish their gill nets. The alternative platform observers document protected species interactions and provide catch and discard estimates for other species that are observed. The amount of biological data that are collected on alternative platform observer trips is notably less than onboard observer trips. Therefore, onboard observer trips are highly preferred due to the amount of biological data collected which are used when making management decisions, in stock assessments, in the development of fishery management plans, and for identifying bycatch (finfish, protected species) problem areas. For alternative platform trips, observers and Marine Patrol follow similar protocols using NCDMF vessels to observe the fishing trip. Each observer attempts to obtain a minimum of three to four trips per working week when fishing activity is occurring.

Observers are assigned a management unit to work weekly and the number of observers assigned to a management unit depends upon the season and fishing effort. Fishing effort is estimated from the previous 4-5 years' TTP data by week, month, and management unit to determine where and how much observer coverage is needed each week and for each management unit by month/season. Reports from observers and other staff are used to determine if effort is fluctuating between management units. Trends from the previous years' TTP data are also analyzed to determine if fishing effort is shifting from one management unit to another. Fishermen holding an Estuarine Gill Net Permit (EGNP) in North Carolina are pooled by management unit and further split into lists by geographic area within units. The contact information for these fishermen is then given to the observers assigned to that area and the observers contact the fishermen to set up trips from the list of names given. Preliminary TTP information is also used to refine the list to represent individuals who are actively participating in fishing activities. Observers also visit fish houses and dealers where they hand out business cards with their contact information and brochures explaining the Observer Program, giving the fishermen another outlet to allow observers on their vessels. Additionally, the Observer Program uses a website (http://portal.ncdenr.org/web/mf/observers-program) to provide outreach to fishermen to facilitate obtaining trips.

Alternative platform trips are used for areas that may be hard to get onboard trips (i.e., fishermen in remote locations that leave from their residence by boat) or when the fisherman's vessel is too small to safely accommodate an onboard observer. Alternative platform trips are also used in areas where fishing effort may increase quickly, where sea turtle abundance is high, and when observers are unable to set-up onboard trips due to fisherman non-compliance. Marine Patrol also conducts alternative platform trips weekly in all management units based on similar methodologies as the Observer Program. Coordination of onboard, alternative platform, and Marine Patrol alternative platform trips is done regularly to maximize efficiency by avoiding multiple observations of a single trip and to achieve the maximum amount of observer coverage possible for each management unit. Changes in effort, sea turtle abundance (i.e., observed and reported interactions), and other protected species interactions are monitored on a daily, weekly, and monthly basis to ensure proper observer coverage is being maintained. The ITP requires a minimum of 7% observer coverage, with a goal of 10% of the total anchored large mesh gill-net (≥4 inches stretched mesh-ISM) fishing trips, and a minimum of 1% coverage, with a goal of 2% of the total anchored small mesh gill-net (<4 ISM) fishing trips per management unit for the spring, summer, and fall seasons.

Observers are trained to identify, measure, evaluate condition, resuscitate, and tag sea turtles by the NMFS – Beaufort Lab and the NCDMF. Data collected on observed sea turtles includes: Date, time, tag numbers, location (latitude and longitude, when possible), condition (i.e., no apparent harm, injury including a description of the nature of the injury, or mortality), species, sex (if determinable), and curved carapace length (CCL) mm and curved carapace width (CCW)

mm are recorded for each sea turtle observed. Photographs and environmental parameters (i.e., salinity, water temperature) are also collected when feasible. Dead sea turtles are retained by the observer when possible. All live, debilitated sea turtles are retained by the observer and delivered to the North Carolina Sea Turtle Stranding Network for examination and treatment. Observers also collect data on location, gear parameters, catch, and bycatch for each haul depending on the observed trip type (onboard/alternative platform). The catch is sampled throughout each onboard trip including species, quantities, weights, lengths, and disposition (alive/dead). Data are coded onto NCDMF data sheets and uploaded to the NCDMF Biological Database for analysis. All observers are debriefed within 24 hours of each trip to obtain data on catch, set locations, gear parameters, and sea turtle interactions to provide estimates of sea turtle bycatch.

The total bycatch of sea turtles for each management unit was estimated using the stratified ratio method (SAS 2004). The bycatch rate (sea turtles caught per fishing trip) estimated from observer data was multiplied by the total fishing trips (average of the previous 3-5 years' TTP data). To estimate confidence intervals (95%), the bootstrap method was used to sample estimates. Strata consisted of the six management units (A, B, C, D1, D2, and E; Figure 1). Estimates were calculated by date of capture, management unit, species, and disposition. Estimates were accumulated each week to implement necessary management measures if authorized take thresholds were approached.

$$\text{Estimated Interactions} = \left(\frac{\text{\# of sea turtle interactions observed}}{\text{total gill-net trips observed}}\right) \text{total gill-net trips}$$

Seasons

The Observer Program's activities are reported on a weekly, seasonal, and annual basis. Seasons are defined as spring (March – May), summer (June – August), and fall (September – November). Weekly progress reports are required following a week in which a sea turtle interaction occurred and includes information such as take estimates, cumulative totals, number of observed trips, and observed takes with all associated information. The seasonal progress reports include a summary of the weekly reports, additional management measures if taken, compliance, violations that occurred, and any adaptive management actions taken during the season. Annual reports include actual and estimated takes including mortality and the level of uncertainty of the estimates (i.e., 95% confidence intervals) by management unit, size composition along with all other interaction information, one or more maps illustrating the geographic distribution of all observed anchored large and small mesh gill-net hauls and the locations of all interactions, and a description of the mitigation activities, adaptive management actions, and enforcement activities conducted during the ITP year.

Authorized Takes

Authorized levels of annual incidental takes are specified in Tables 1 - 5. The amount of incidental takes is expressed as either estimated or observed takes depending on the amount of data available for modeling predicted takes. Extrapolated sea turtle takes were computed by dividing the number of sea turtle interactions observed by the total anchored gill-net trips observed and then multiplying by the total anchored gill-net trips. Nonparametric confidence intervals (95%) were calculated using standard bootstrapping techniques (Efron and Tibshirani 1993) using the 'boot' package in R (Canty and Ripley 2015; Davison and Hinkley 1997; R Core Team 2015). Bootstrap replicates were generated by sampling observer trips with replacement 5,000 times within strata (mesh/season/management unit; Tables 1 - 5). Because reaching the estimated or observed level for any category of authorized takes for any species would end the incidental take authorization for all species; it is highly unlikely that all five species would be impacted at these full levels. Takes must be incidental to otherwise lawful activities associated with the anchored large and small mesh gill-net fisheries, and as conditioned herein. The permit covers incidental takes from the date of issuance through August 31, 2023. The NCDMF uses preliminary data to monitor the total number of live and dead takes by species per unit to determine if the fishery is approaching or has reached the authorized takes for any sea turtle species. Once TTP data are finalized in May of 2018, the final authorized estimated sea turtle takes will be recalculated and the finalized estimates will be provided to the NMFS.

Compliance

The NCDMF observers and Marine Patrol conduct weekly fish house visits, boat patrols, fisherman spot checks, gear checks, aerial surveys, and continual outreach to the industry attempting to ensure industry compliance and to determine anchored large and small mesh gill-net fishing effort throughout the state.

The Observer Program has various ways to contact fishermen to schedule trips. The most common method is by phone due to limited program resources, fishermen leaving from their residence, and efficiency. The Observer Program has a contact log which is filled out for every phone call or contact that is made when attempting to obtain a trip. Each contact was put into a specific category and other information was gathered (Table 6). The contact log was analyzed by month and category to determine what percentage of phone calls resulted in observer trips.

RESULTS

Observer activity

Fall 2016

The fall 2016 season for anchored large and small mesh gill nets in North Carolina is September 2016 through November 2016 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 16230. Portions of management unit A (western Albemarle Sound, Currituck Sound, and the rivers) opened to anchored large and small mesh gill nets for the new ITP Year 2017 via proclamation M-15-2016 on September 5, 2016 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles (Table 7; Boyd 2016b). Further portions of management unit A (western/central Albemarle Sound) opened to anchored large and small mesh gill nets for the new ITP Year 2017 via proclamation M-21-2016 on October 15, 2016 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles. As the fall 2016 season progressed, further portions of management unit A (central/eastern Albemarle Sound) opened to anchored large and small mesh gill nets for the new ITP Year 2017 via proclamation M-23-2016 on October 31, 2016 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles (Table 7; Boyd 2016b).

Portions of management unit B (subunits SGNRA2-4, MGNRA) opened to anchored large mesh gill nets for the new ITP Year 2017 via proclamation M-16-2016 on September 5, 2016 while maintaining the closure of subunits SGNRA1 and CGNRA to minimize interactions with sea turtles (Table 7; Boyd 2016b). Remaining portions of management unit B (subunits SGNRA2-4, MGNRA) opened to anchored large mesh gill nets for the new ITP Year 2017 via proclamation M-19-2016 on October 3, 2016. Management unit B closed to anchored large mesh gill nets via proclamation M-24-2016 on November 2, 2016 due to sea turtle interactions and the lack of fishermen compliance (Table 7; Boyd 2016b).

Management unit C closed to anchored large and small mesh gill nets via proclamation M-20-2016 on October 1, 2016 for the remainder of the fall 2016 season due to sea turtle interactions. Management unit D1 opened to anchored large mesh gill nets for the new ITP Year 2017 via proclamation M-22-2016 on October 17, 2016 (Table 7; Boyd 2016b).

Management unit E opened to anchored small mesh gill nets for the new ITP Year 2017 via proclamation M-16-2016 on September 5, 2016 while maintaining the closure of upper Cape Fear and Northeast Cape Fear rivers to anchored large mesh gill nets to minimize sturgeon interactions (Table 7; Boyd 2016b).

The Observer Program achieved an estimated 11.2% overall anchored large mesh gill-net coverage for the fall 2016 season meeting the minimum requirement (7.0%) in all management units based on finalized data (Table 8; Figures 2 - 8; Boyd 2016b).

The Observer Program achieved an estimated 3.3% overall anchored small mesh gill-net coverage for the fall 2016 season meeting the minimum requirement (1.0%) in all management units except management unit A (0.0%) based on finalized data (Table 9; Figures 2 - 8; Boyd 2016b).

There were 28 observed sea turtle interactions from anchored large mesh gill nets during the fall 2016 season (Table 10; Figures 2 - 8; Boyd 2016b). There were no observed sea turtle interactions from anchored small mesh gill nets during this period. The species composition was made up of green sea turtles (n = 15 alive; n = 6 dead) and Kemp's ridley sea turtles (n = 6 alive; n = 1 dead). The majority of the interactions occurred in management unit B (71.5%) with 14.3% in management unit E, 7.1% in management unit C, and 7.1% in management unit D1 (Table 10; Figures 2 - 8). Two fisherman self-reported sea turtle interactions occurred in anchored large mesh gill nets and one in anchored small mesh gill nets during this period (Table 11; Boyd 2016b).

Spring 2017

The spring 2017 season for anchored large and small mesh gill nets in North Carolina is March 2017 through May 2017 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 16230. Management unit A opened to the use of anchored large mesh gill nets with gill-net configurations for harvesting American shad by removing vertical height restrictions for up to 1,000 yards of gill net with stretched mesh lengths of 5 ¼ through 6 ½ inches via proclamation M-5-2017 on March 3, 2017 while implementing the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles. Gill-net configurations for harvesting American shad were removed in management unit A following the end of the shad season via proclamation M-7-2017 on March 25, 2017 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles (Table 7; Boyd 2017b).

Management unit B remained closed to anchored large mesh gill nets through the spring 2017 season to allow for the recalculation of allowable sea turtle takes once finalized 2016 Trip Ticket data were completed (Table 7; Boyd 2017b).

Management unit D1 closed to anchored large mesh gill nets as part of the annual closure outlined in the ITP via proclamation M-10-2017 on May 8, 2017 (Table 7; Boyd 2017b).

The Observer Program achieved an estimated 9.7% overall anchored large mesh gill-net coverage for the spring 2017 season meeting the minimum requirement (7.0%) in all management units except management unit D1 (0.0%) based on preliminary data (Table 8; Figures 2 – 8; Boyd 2017b).

The Observer Program achieved an estimated 2.2% overall anchored small mesh gill-net coverage for the spring 2017 season meeting the minimum requirement (1.0%) in all management units except management units A (0.8%) and D2 (0.0%) based on preliminary data (Table 9; Figures 2 - 8; Boyd 2017b).

There were no observed sea turtle interactions from anchored large or small mesh gill nets during the spring 2017 season (Boyd 2017b). Three fisherman self-reported sea turtle interactions occurred in anchored large mesh gill nets during this period (Table 11; Boyd 2017b).

Summer 2017

The summer 2017 season for anchored large and small mesh gill nets in North Carolina is June 2017 through August 2017 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 16230. Management unit B opened to anchored large mesh gill nets except for the Inlet Corridors via proclamation M-11-2017 on June 19, 2017 (Table 7; Boyd 2017c).

Management unit C closed to anchored large and small mesh gill nets for the remainder of the summer 2017 season on July 28, 2017 due to sea turtle interactions via proclamation M-12-2017 (Table 7; Boyd 2017c).

Management unit D1 remained closed through the summer 2017 season to anchored large mesh gill nets as part of the annual closure outlined in the Sea Turtle ITP (Table 7; Boyd 2017c).

The Observer Program achieved an estimated 11.3% overall anchored large mesh gill-net coverage for the summer 2017 season meeting the minimum requirement (7.0%) in all management units except management unit A (4.9%) and C (6.9%) based on preliminary data (Table 8; Figures 2 – 8; Boyd 2017c).

The Observer Program achieved an estimated 1.6% overall anchored small mesh gill-net coverage for the summer 2017 season meeting the minimum requirement (1.0%) in all management units except management unit D1 based on preliminary data (Table 9; Figures 2 – 8; Boyd 2017c).

There were 16 observed sea turtle interactions from anchored large mesh gill nets during the summer 2017 season (Table 10; Figures 2 - 8; Boyd 2017c). There was one observed sea turtle interaction from anchored small mesh gill nets during the summer 2017 season. The species

composition was made up of green sea turtles (n = 8 alive; n = 6 dead), Kemp's ridley sea turtles (n = 2 alive) and one alive loggerhead sea turtle. Interactions primarily occurred in management unit B (58.9%) with 17.6% in management unit C, 17.6% in management unit E, and 5.9% in management unit D2 (Table 10; Figures 2 - 8). Two fisherman self-reported sea turtle interactions occurred in anchored large mesh gill nets during this period (Table 11; Boyd 2017c).

Authorized Takes

There was a total of 44 observed sea turtle interactions in anchored large mesh gill nets and one in anchored small mesh gill nets for ITP Year 2017 (Table 10; Figures 2 – 8; Boyd 2016b, 2017b, 2017c). The species composition consisted of primarily green sea turtles (77.8%; n = 23 alive; n = 12 dead; Table 10; Figures 2 - 8). The remaining species consisted of Kemp's ridley sea turtles (20.0%; n = 8 alive; n = 1 dead), and one alive loggerhead sea turtle (Table 10; Figures 2 - 8). Observed interactions occurred in management unit B (66.7%), management unit C (11.1%), management unit D1 (4.4%), management unit D2 (2.2%), and management unit E (15.6%; Table 10; Figures 2 - 8). There was a total of eight fisherman self-reported sea turtle interactions for ITP Year 2017 (Table 11; Boyd 2016b, 2017b, 2017c).

The size distribution of green sea turtles (n = 25) ranged from a CCL of 263 mm to 395 mm and a CCW of 221 mm to 347 mm (Figures 9 and 10). The size distribution of Kemp's ridley sea turtles (n = 8) ranged from a CCL of 210 mm to 419 mm and a CCW of 205 mm to 429 mm (Table 10; Figures 11 and 12; Boyd 2016b, 2017b, 2017c).

The cumulative total estimated and observed takes for anchored large mesh gill nets did not reach the threshold of authorized takes for any management unit for ITP Year 2017 based on preliminary data. The cumulative total observed takes for anchored small mesh gill nets did not reach the threshold of authorized takes for any management unit for ITP Year 2017 based on preliminary data (Tables 1 - 5; Boyd 2016b, 2017b, 2017c).

The percentage of authorized takes that were used in ITP Year 2017 for anchored large mesh gill nets were calculated for estimated takes by species and disposition (green 51.1% alive, 35.5% dead; Kemp's ridley 53.5% alive, 0.0% dead; Boyd 2016b, 2017b, 2017c). The percentage of authorized takes that were used in ITP Year 2017 were also calculated for observed takes (green 28.6% alive/dead; Kemp's ridley 25.0% alive/dead). Overall, for both anchored large and small mesh gill nets, the percentage of estimated (51.1% alive, 27.4% dead) and observed (10.3% alive/dead) takes was below the authorized takes provided by the Sea Turtle ITP (Boyd 2016b, 2017b, 2017c).

Compliance

Marine Patrol made 366 gill-net checks during the fall 2016 season resulting in 44 citations issued (Tables 12 and 13; Boyd 2016b, 2017b, 2017c). Marine Patrol made 395 gill-net checks

for the spring 2017 season resulting in 10 citations issued. Marine Patrol made 960 gill-net checks for the summer 2017 season with no citations issued (Tables 12 and 13; Boyd 2016b, 2017b, 2017c).

For ITP Year 2017, phone calls (n = 7,776) were made with 57.0% (n = 4,430) categorized as 1, 8, 11, 12, 13, and 14 which inclusively represents not being able to get in touch with fishermen or fishermen refusing trips (Table 14; Boyd 2016b, 2017b, 2017c). In the fall 2016 season (n = 2,660), phone calls were made with 49.4% (n = 1,313) categorized as 1, 8, 11, 12, 13, and 14. In the spring 2017 season (n = 2,425), phone calls were made with 61.4% (n = 1,490) categorized as 1, 8, 11, 12, 13, and 14. In the summer 2017 season (n = 2,691), phone calls were made with 60.5% (n = 1,627) categorized as 1, 8, 11, 12, 13, and 14 (Table 14; Boyd 2016b, 2017b, 2017c).

Notice of Violations (NOV) were issued when fishermen were found to be out of compliance with the EGNP with eight NOVs issued during the fall 2016 season, six NOVs issued during the spring 2017 season, and five NOVs issued during the summer 2017 season (Table 15; Boyd 2016b, 2017b, 2017c).

Marine Mammals

There were no observed takes of marine mammals during ITP Year 2017.

DISCUSSION

Management history

The NCDMF has addressed protected sea turtle issues in the coastal waters since the 1970s. Sea turtle protection has been accomplished by cooperative agreements with the North Carolina Wildlife Resources Commission (NCWRC), establishment of a sea turtle sanctuary, proclamation authority delegated to the Director of the NCDMF, additional queries on recreational surveys, management of the PSGNRA, formation of the NCSTAC, implementation of an Observer Program, commercial bycatch reduction gear testing projects, outreach to the commercial and recreational fishing industries, and collaboration with the NMFS.

The NCDMF applied for and received four ITPs for the PSGNRA from 2000 to 2005 managing the area for sea turtle takes in the fall of each year through 2012 under these permits (Gearhart 2001, 2002, 2003; Price 2004, 2005, 2006, 2007a, 2008, 2009a, 2010a; Murphey 2011; Boyd 2012a, 2013). Between 2000 and 2012, a number of changes were made in the PSGNRA such as: adjustments to authorized fishing areas, modified restrictions (e.g., state closure and net length restriction), and authorized take levels reduced (Gearhart 2003; Price 2010a; Murphey 2011; Boyd 2012a). These adaptations were made feasible as a result of the extensive monitoring program conducted by the NCDMF in the PSGNRA. The NCDMF also observed limited trips in the large and small mesh gill-net fisheries outside of the PSGNRA from 2004 to 2010 (Brown and Price 2005; Price 2007b, Price 2009b, Price 2010b; Boyd 2012b). The information gathered from these direct observations authorized the NCDMF to generate requested estimated take numbers for observed fisheries and draft a functional Conservation Plan.

In June 2009, the NMFS began an Alternative Platform Observer Program in Core Sound, NC. The NMFS observers documented sea turtle interactions in anchored large mesh gill nets in this area beginning in late June and notified the NCDMF of their concern for these unauthorized takes. The NCDMF consulted with the NMFS-SERO via conference calls and correspondence to discuss short and long-term actions to address sea turtle takes in gill nets in Core Sound and throughout the state. In the short term, the agencies agreed for the NCDMF to implement gear restrictions (yardage limits, mesh depth reduction, and net shot reductions) and increased observer coverage in Core Sound and adjacent water bodies (NCDMF Proclamation M-16-2009). For the long-term, the NCDMF continued consultations with the NMFS-SERO concerning the preparation of an ITP application for all internal coastal waters while compiling sea turtle interaction data from gill-net surveys, research projects, and direct observations.

On October 20, 2009, the day that authorized sea turtle takes were reached in the 2009 PSGNRA, a 60-day Notice of Intent (NOI) to sue the NCDMF and the North Carolina Marine Fisheries Commission (NCMFC) was received from the Duke Environmental Law and Policy Clinic on behalf of the Karen Beasley Sea Turtle Rescue and Rehabilitation Center Foundation

(Beasley Center). The NOI stated that the NCDMF and the NCMFC violated Section 9 of the ESA by allowing gear in state waters that had unauthorized takes of threatened or endangered sea turtles.

The NCDMF consulted with the NMFS-SERO concerning this NOI while continuing to work toward the preparation of an application for a statewide ITP for gill-net fisheries in internal coastal waters. In November 2009, the NCDMF received further correspondence from the NMFS-SERO reiterating the need to "satisfy the requirements of the ESA" relative to Core Sound sea turtle interactions. The NCDMF continued to collect sea turtle interaction data while developing an interim plan to address sea turtle interactions in gill-net gear. As a result of discussions and correspondence with the NMFS-SERO, the NCDMF submitted an interim plan in January 2010 to address sea turtle interactions in gill-net fisheries prosecuted in internal coastal waters. The plan proposed to close large mesh gill-net fisheries throughout the majority of the estuarine waters of North Carolina from May to December 2010.

On February 18, 2010, the NCDMF presented the interim proposal to the NCMFC and the public at an emergency NCMFC meeting in New Bern, NC. During the meeting, numerous commercial fishery representatives expressed concern with the proposed closure on the basis of the negative economic impact that would result from such a closure. Representatives from the Coastal Conservation Association (CCA-NC) did not support the interim closure stating the plan was too limited in scope. After thoroughly debating the issue, the NCMFC voted to direct the NCDMF to implement alternative measures that included reductions in the number of days per week that large mesh gill nets were authorized to be fished, restricted soak times, reductions in the length of individual nets (shots), and reductions in total yardage.

On February 23, 2010, the Duke Environmental Law and Policy Clinic filed suit against the NCDMF and the NCMFC on behalf of the Beasley Center. Negotiations between the parties occurred between late February and March 23, 2010, when the NCMFC met again. During the meeting, the NCMFC directed the fisheries director to issue a gill-net proclamation effective May 15, 2010 restricting the number of days during the week that anchored large mesh gill nets would be authorized, limiting soak time, establishing a maximum yardage limit, mandating maximum mesh depth, requiring maximum individual gill-net (shot) lengths, establishing spacing between net shots, and eliminating the use of tie-downs and floats or corks along float lines. The NCDMF Director did not issue the proclamation because, as detailed below, ongoing negotiations with the Beasley Center and the Duke Environmental Law and Policy Clinic produced a settlement agreement which preempted this action.

The NCMFC met May 12 through 14, 2010 and discussed the parameters of the final Settlement Agreement between the Beasley Center (plaintiff) and the NCDMF and the NCMFC. At that meeting, the NCMFC reached an agreement concerning restrictions that would be implemented

in the anchored large mesh gill-net fishery in NC estuarine waters. As a result of the NCMFC action, the NCDMF issued Proclamation M-8-2010 effective May 15, 2010 implementing the provisions of the Settlement Agreement. Gill-net restrictions implemented by the proclamation included: a range of 4 ISM to, and including, 6 ½ ISM for anchored large mesh gill nets; soak times limited to overnight soaks an hour before sunset to an hour after sunrise, Monday evenings through Friday mornings; anchored large mesh gill nets were restricted to a height of no more than 15 meshes, constructed with a lead core or leaded bottom line and without corks or floats other than needed for identification; a maximum of 2,000 yards of anchored large mesh gill nets authorized to be used per vessel; and maximum individual net (shot) length of 100 yards with a 25-yard break between shots (except for exempted areas including management unit C and portions of management unit A).

The Settlement Agreement included gill nets from 4 ISM to less than 5 ISM in the large mesh category because of observed sea turtle takes in 4 ISM and 4 ½ ISM gill nets in the NCDMF Independent Gill Net Survey. The measures were modified slightly several times, with the concurrence of the Beasley Center, to improve gear efficiency or adjust fishing area boundaries without compromising the sea turtle conservation provisions of the Settlement Agreement with fishermen in the southern portion of the state authorized to set anchored large mesh gill nets an extra day (Sunday evenings through Friday mornings) and use floats on nets, but were restricted to the use of a maximum of 1,000 yards of anchored large mesh gill net per fishing operation.

The Annual Completion Report for ITP Year 2014 (September 1, 2013 – August 31, 2014) was submitted January 30, 2015 (Boyd 2015). During review of the 2014 Sea Turtle ITP Annual Completion Report, the NMFS requested modifications to certain tables and figures in the annual report. These modifications were addressed in the Annual Completion report for ITP Year 2015 (September 1, 2014 – August 31, 2015) which was submitted January 30, 2016 and included: maps for each management unit to include number of gill-net hauls and sea turtle interactions and tables which have all of the estimated/observed takes exactly as portrayed in the permit with 95% confidence intervals included (Boyd 2016a).

During the summer 2015 season a minor modification was enacted through the NMFS combining authorized takes for management units A (n = 4) and C (n = 4) for total authorized take limit of eight sea turtles from anchored large or small mesh gill nets and any species or disposition (Boyd 2016a).

Outreach

Staff from the NCDMF met with commercial industry leaders on July 11, 2016 to discuss the current ITPs and options for moving forward with amendments. The North Carolina Fisheries Association (NCFA) requested the meeting in response to NCDMF staff asking industry for their thoughts on potential ITP amendments and ways to further minimize sea turtle takes (in order to

keep management units open longer under the current ITPs). During the meeting, the NCFA discussed their interest in exploring gear modifications that are proven to reduce sea turtle interactions and would ultimately like to see the estuarine gill-net fishery managed under gear modifications (similar to the shrimp trawl fishery) without the constraints of the current ITPs. Staff from the NCDMF explained that while staff would be able to assist regarding the ITP permit process, the NCFA should work with researchers with expertise in gear development and apply for a research Section 10 permit. In order to reach their ultimate goal, the NCFA would like to work on minimizing takes and amending the current ITPs by soliciting feedback from commercial gill netters throughout the state.

The NCFA scheduled two meetings on August 30 and 31, 2016 that focused on potential ITP amendments and ways to further minimize sea turtle and sturgeon takes in the anchored gill-net fisheries. NCFA invited NCDMF staff to attend their meetings to hear the fishermen's feedback and to provide input on the feasibility of the fishermen's ideas. While discussing these meetings with the commercial industry leads, NCDMF staff raised the issue of the lack of fisherman compliance with the ITPs. NCFA fully agreed that it is a problem, and they plan on stressing the need for compliance at their meetings in order for the Observer Program to be successful. Another comment made by the NCFA was they felt that the onboard observations by the NCDMF are very important. They also mentioned that the onboard observations are needed to collect biological information from the catch as opposed to just monitoring protected species interactions.

Staff from the NCDMF attended both meetings NCFA held in Wanchese, NC on August 30, 2016 and in Morehead City, NC on August 31, 2016. While most of the meetings were discussions amongst fishermen or directed at NCFA members, NCDMF staff answered and/or clarified questions as needed. The questions and/or concerns from fishermen included: confusion that self-reporting sea turtle and sturgeon takes was a requirement of the ITPs, that the definition of a take includes live interactions, that the amount of restrictions already in place on the anchored gill-net fisheries were too great, and the belief that any further restrictions would lead to their inability to make a livelihood in the industry.

The North Carolina Watermen United (NCWU), which were in attendance at the August 30, 2016 meeting, sent the NCDMF a letter on September 2, 2016 listing many modifications that were already in place for the anchored gill-net fisheries and suggested another "more-inclusive" meeting for further discussion (Appendix C). The NCFA sent the NCDMF a follow-up email on September 19, 2016 with questions and concerns following the meetings (Appendix D). On November 30, 2016, the NCFA sent the NCDMF a commitment letter concerning their collaboration with Gettysburg College on a project titled, "Development of sensory-based bycatch reduction technologies to reduce sea turtle bycatch in North Carolina coastal gillnet and pound net fisheries" (Appendix E). The work on the project began in September 2017.

At the August 2016 NCMFC meeting, Chairman Sammy Corbett announced that he was disbanding the Sea Turtle Advisory Committee (STAC) because it is not statutorily required and the NCMFC committee system already has a multitude of committees which are statutorily mandated. Chairman Corbett sent a letter explaining his decision to the committee members on August 25, 2016 (Appendix F).

Observer Activity

There was turnover within the Observer Program with positions being filled as quickly as possible to maintain coverage. The Observer Program proportionally placed observers in areas with higher fishing effort. There were multiple closures of various management units throughout the state during ITP Year 2017 (Table 7). Fishermen are more elusive to attempts by observers contacting them to schedule trips after proclamations enacting stricter regulations are implemented. Therefore, making it harder to obtain observer trips. When a management unit closes for a portion of time, the observers are shifted to open management units. The contact log, which includes different categories to place each contact that was made to a fisherman, is beneficial for analyzing the type of contact that was being made and to see the number of observer trips that were obtained through the calling system.

During the fall 2016 season, attendance was required for anchored small mesh gill nets for the duration of the fall 2016 season in management unit A making it difficult to obtain observed trips (Boyd 2016b). In recent years, attendance requirements were lifted during the month of November allowing for observer trips to be obtained. Fishing practices for attended gill nets can be very different than other fishing practices, with fishing activity occurring throughout the night creating safety hazards for observers. Furthermore, fishing effort tends to be lower when attendance is required (Boyd 2016b).

During the spring 2017 season, no anchored large mesh gill-net trips were obtained in management unit D1 due to the management unit being closed for the latter portion of the spring 2017 season and minimal fishing effort (n = 25 fishing trips) while open. Observer coverage in the spring 2017 season for anchored small mesh gill-nets in management unit A was 0.8% and no anchored small mesh gill-net trips were obtained in management unit D2 due to minimal fishing effort (n = 42 fishing trips; Boyd 2017b).

During the summer 2017 season, observer coverage for anchored large mesh gill-nets in management unit A was 4.9% and C was 6.9% (Boyd 2017c). Management unit D1 was closed for the duration of the summer 2017 season as part of the annual closure outlined in the ITP. No anchored small mesh gill-net trips were obtained in management unit D1 due to minimal fishing effort (n = 10 fishing trips) for the summer 2017 season (Boyd 2017c).

Compliance

Although ITP Year 2017 is the fourth year for the statewide ITP, fishermen in many portions of the state are not as familiar with the Observer Program and requirements of the ITP as desired, so more time is needed to educate the industry. Alternative platform trips were employed in all management units more frequently throughout ITP Year 2017 to maintain observer coverage due to compliance issues with fishermen (i.e., not answering phone calls, not calling back). The required minimum 7% observer coverage for anchored large mesh gill nets is very difficult to achieve when observers must rely on alternative platform trips, as it requires two observers to obtain a trip. The NCDMF discussed the situation with industry leaders in an attempt to improve awareness and increase compliance. However, fisherman non-compliance continues to be a hurdle for ensuring the requirements for both ITPs are met. Each ITP Year (2015-2017) had >50% of contacts made by observers not being able to get in touch with fishermen or fishermen refusing trips with a 7.6% increase in non-compliance over the last three years (Boyd 2016a, 2017a).

Eight fishermen self-reported sea turtle takes occurred during ITP Year 2017 (Table 11; Boyd 2016b, 2017b, 2017c). NCDMF has discussed this situation with industry leads numerous times and has provided outreach to fishermen explaining the requirement in the ITP of self-reporting and further details on the subject to try and increase self-reporting throughout the industry as a whole with limited success.

Based on finalized data for ITP Years 2015-2016 and preliminary and finalized data for ITP Year 2017, the number of authorized sea turtle takes that were used by the anchored large and small mesh gill-net fisheries under the Sea Turtle ITP were analyzed to determine the percentage of unused takes for each ITP Year and therefore, remained in the populations of sea turtles. The percentage of authorized takes that remained for anchored large and small mesh gill nets was calculated for each species and disposition for estimated and observed takes for the last three years with variation between years. For ITP Year 2015, the percentage of estimated takes that remained for anchored large mesh gill nets was calculated by species and disposition (green 42.1% alive, 40.0% dead; Kemp's ridley 64.3% alive, 85.7% dead) with similar numbers for ITP Year 2016 (green 54.8% alive, 57.0% dead; Kemp's ridley 20.4% alive, 100.0% dead), and ITP Year 2017 (green 51.1% alive, 35.5% dead; Kemp's ridley 53.5% alive, 0.0% dead).

The percentage of authorized takes that remained in ITP Year 2015 for observed takes was calculated by species (green 50.0% alive/dead; Kemp's 91.7% alive/dead; loggerhead 83.3%; with no interactions with hawksbill or leatherback sea turtles) with similar numbers for ITP Year 2016 data (green 55.6% alive/dead; Kemp's 75.0% alive/dead; with no interactions hawksbill or leatherback sea turtles), and ITP Year 2017 (green 28.6% alive/dead; Kemp's ridley 25.0% alive/dead; with no interactions hawksbill or leatherback sea turtles).

The data clearly illustrate that while there are instances where the NCDMF have exceeded authorized sea turtle takes for specific species and dispositions, overall the management of the Sea Turtle ITP has led to less sea turtle takes in these fisheries. This is also due to management related to the Atlantic Sturgeon ITP as any closure of anchored large or small mesh gill nets from sturgeon interactions leads to infrequent sea turtle interactions with gear being out of the water for long periods of time. Also, as expected and discussed in the Sea Turtle ITP application, the requested authorized take numbers represent a worst-case scenario and it is highly unlikely, if not impossible, that the total authorized take levels would be approached for an ITP Year because the NCDMF will close a management unit for the remainder of that season or ITP Year if takes approached the authorized level for any of the five species for either disposition (alive/dead), not the authorized level for all species making it impossible to approach all five species authorized take levels for both dispositions. However, by not requesting the proper authorized amount for each species and disposition, the fisheries could close for long periods of time due to anomalous sea turtle events.

Estuarine Gill Net Permit

As per the ITP the NCDMF established an EGNP to register all fishermen participating in the anchored large and small mesh gill-net fisheries via proclamation M-24-2014 on September 1, 2014. The ITP's Implementing Agreement states that the NCDMF has two years to implement the EGNP to serve as a certificate of inclusion for fishermen. However, due to the compliance issues the NCDMF was facing during ITP Year 2014, the EGNP was developed and became effective September 1, 2014 (one year from ITP issuance; Boyd 2015). The multifaceted EGNP was enacted to attempt to allow the NCDMF to closely monitor compliance. The EGNP is also used as a tool to improve fishermen compliance by including Specific Permit Conditions requiring fishermen to allow the NCDMF observers aboard their vessels to monitor catches. Failure to comply with this permit provision can result in a permit suspension. There were 2,670 EGNPs issued for Fiscal Year 2017 (July 1, 2016 – June 30, 2017).

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TABLES

Table 1. Authorized and actual annual estimated takes with confidence intervals (95%) using a bootstrap method based on observer data for coverage and sea turtle interaction levels in anchored large mesh (≥4 inch stretched mesh) gill nets for ITP Year 2017 (September 1, 2016 - August 31, 2017).

	Management Unit											
	B				D1				Total			
	Estimated Takes				Estimated Takes							
	Authorized		Actual		Authorized		Actual		Authorized		Actual	
Species	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Green	225	112	162 (17,227)	40 (0,84)	9	5	1 (0,3)	1 (0,3)	234	117	163	41
Kemp's ridley	53	26	33 (0,69)	0	15	7	0	0	68	33	33	0
Total	278	138	195	40	24	12	1	1	302	150	196	41

	Management Unit											
	D2				E				Total			
	Estimated Takes				Estimated Takes							
	Authorized		Actual		Authorized		Actual		Authorized		Actual	
Species	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Green	n/a [1]	n/a [1]	n/a [1]	n/a [1]	96	48	6 (0,18)	17 (0,39)	96	48	6	17
Kemp's ridley	6	3	0	0	24	13	16 (0,55)	0	30	16	16	0
Total	6	3	0	0	120	61	22	17	126	64	22	17

[1] Insufficient observer data exist to model an estimated annual take level; therefore, for management unit D2, an annual observed take number has been identified for green turtles, and is found in Table 2

Table 2. Authorized and actual annual observed (not estimated) takes in anchored large mesh (≥4 inch stretched mesh) gill nets for ITP Year 2017 (September 1, 2016 - August 31, 2017).

	Management Unit									
	B		D1		D2		E			
	Observed (live/dead)		Observed (live/dead)		Observed (live/dead)		Observed (live/dead)		Total	
Species	Authorized	Actual	Authorized	Actual	Authorized	Actual	Authorized	Actual	Authorized	Actual
Green	n/a [1]	n/a [1]	n/a [1]	n/a [1]	6	1	n/a [1]	n/a [1]	6	1
Kemp's ridley	n/a [1]	n/a [1]	n/a [1]	n/a [1]	n/a [1]	n/a [1]	n/a [1]	n/a [1]	n/a [1]	n/a [1]
Hawksbill	1	0	1	0	1	0	1	0	4	0
Leatherback	1	0	1	0	1	0	1	0	4	0
Loggerhead	3	1	3	0	3	0	3	0	13	1
Total	5	1	5	0	11	1	5	0	28	2

[1] Insufficient observer data exist to model an estimated annual take level for Kemp's ridley sea turtles in management units B, D1, D2 and E. See Table 1 for the authorized annual estimated take level

Table 3. Authorized and actual annual observed (not estimated) takes in anchored large mesh (≥4 inch stretched mesh) and anchored small mesh (<4 inch stretched mesh) gill nets combined for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Species	Management Unit				Total	
	A		C			
	Authorized (live/dead)	Actual (live/dead)	Authorized (live/dead)	Actual (live/dead)	Authorized (live/dead)	Actual (live/dead)
Green, Hawksbill, Kemp's ridley, Leatherback, Loggerhead	4 (any species)	0 (any species)	4 (any species)	5 (any species)	8 (any species)	5 (any species)
Total	4	0	4	5	8	5

Table 4. Authorized and actual annual observed (not estimated) takes in anchored small mesh (<4 inch stretched mesh-ISM) gill nets for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Species	Management Unit								Total	
	B		D1		D2		E			
	Observed (live/dead)		Observed (live/dead)		Observed (live/dead)		Observed (live/dead)			
	Authorized	Actual	Authorized	Actual	Authorized	Actual	Authorized	Actual	Authorized	Actual
Green	3	0	3	0	3	0	3	1	12	1
Hawksbill	1	0	1	0	1	0	1	0	4	0
Kemp's ridley	3	0	3	0	3	0	3	0	12	0
Leatherback	1	0	1	0	1	0	1	0	4	0
Loggerhead	3	0	3	0	3	0	3	0	12	0
Total	11	0	11	0	11	0	11	1	44	1

Table 5. Total annual authorized and actual takes (estimated and observed) by species and condition for ITP Year 2017 (September 1, 2016 - August 31, 2017).

	Observed (live/dead)		Estimated			
			Authorized		Actual	
Species	Authorized	Actual	Alive	Dead	Alive	Dead
Green	18	5	330	165	169	59
Hawksbill	8	0	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Kemp's ridley	12	2	98	49	50	0
Leatherback	8	0	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Loggerhead	24	1	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Any Species	8	0	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Total	78	8	428	214	219	59

[1] Insufficient observer data exist to model an estimated annual take level; therefore, takes are expressed as observed

Table 6. Categories and descriptions of fisherman responses for the Observer Program's contact logs used for analysis.

Categories	Category description
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

Table 7. Regulations for management units by date and regulation change for anchored large and small mesh gill nets for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Year	Date(s)	Regulation change
2016	Sept 5	Management unit A open to large and small mesh gill nets for the new ITP Year 2017 for the western part of the sound, Currituck Sound, and the rivers. All the eastern/southern areas (Croatan and Roanoke Sounds) will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-15-2016).
2016	Sept 5	Portions of management unit B (subunits SGNRA2-4, MGNRA) open to large mesh gill nets for the new ITP Year 2017. Subunits SGNRA1 and CGNRA will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-16-2016).
2016	Sept 5	Management unit E open to small mesh gill nets (large mesh gill nets continually open through summer for the new ITP Year 2017. Portions of upper Cape Fear River and Northeast Cape Fear River remain closed to large mesh gill nets due to sturgeon interactions (M-16-2016).
2016	Oct 3	Remaining portions of management unit B (subunits SGNRA1 and CGNRA) open to large mesh gill nets for the new ITP Year 2017 (M-19-2016).
2016	Oct 1	Closed management unit C to large and small mesh gill nets due to sea turtle interactions (M-20-2016).
2016	Oct 15	Further portions of management unit A open to large and small mesh gill nets for the new ITP Year 2017 for the central part of the sound. All the eastern/southern areas (Croatan and Roanoke Sounds) will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-21-2016).
2016	Oct 17	Management unit D1 open to anchored large mesh gill nets (M-22-2016).
2016	Oct 31	Further portions of management unit A open to anchored large and small mesh gill nets for the new ITP Year 2017 for the central and eastern part of the sound. Croatan and Roanoke sounds will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-23-2016).
2016	Nov 2	Management unit B closed to anchored large mesh gill nets due to sea turtle interactions and the lack of fishermen compliance (M-24-2016).
2016	Dec 1	Management unit A small mesh anchored gill nets 3 though 3 3/4 ISM restrictions while removing attendance requirements for those small mesh anchored gill nets, and requiring small mesh anchored gill nets to be set so as to fish on the bottom and not exceed a vertical height of 48 inches (M-25-2016).
2016	Dec 5	Management unit C open to anchored large and small mesh gill nets (M-27-2016).
2016	Dec 13	Management unit A closed to anchored large mesh gill nets due to reaching allowable Atlantic sturgeon takes (M-32-2016).
2017	Jan 29	Portions of management unit A open to anchored large mesh gill nets (northern rivers) while maintaining closure of anchored large mesh gill nets in all other portions to allow directed gill-net fisheries for catfish while minimizing interactions with Atlantic sturgeon (M-1-2017).
2017	Feb 6	Further portions of management unit A open to anchored large mesh gill nets (Alligator River/Currituck Sound) while maintaining closure of anchored large mesh gill nets in all other portions to allow directed gill-net fisheries for catfish while minimizing interactions with Atlantic sturgeon (M-2-2017).

Table 7. (cont.).

Year	Date(s)	Regulation change
2017	Feb 15	Further portions of management unit A open to anchored large mesh gill nets (Alligator River/Currituck Sound) while maintaining closure of anchored large mesh gill nets in all other portions to allow directed gill-net fisheries for catfish while minimizing interactions with Atlantic sturgeon (M-2-2017).
2017	Feb 15	Management units C, D1, D2, and E implements gear restrictions for the shad fishery (M-4-2017).
2017	Mar 3	Management Unit A open to the use of gill nets and allows gill-net configurations for harvesting American shad by removing vertical height restrictions for up to 1,000 yards of gill net with stretched mesh lengths of 5 ¼ through 6 ½ inches while implementing additional gill-net restrictions for management subunit A-South of US-64-BYP/US-64, in accordance with the Sea Turtle and Atlantic Sturgeon ITPs (M-5-2017).
2017	Mar 25	Removes management Unit A gill-net configurations for harvesting American shad and maintains gill-net restrictions for management subunit A-South of US-64-BYP/US-64, in accordance with the Sea Turtle and Atlantic Sturgeon ITPs (M-7-2017).
2017	Apr 3	Gill nets with mesh length greater than 5 inches must be equipped with tie downs 10 yards apart and cannot be within 50 yards of the shore in the Neuse, Pamlico, and Pungo Rivers through December 31, 2017. Use of gill nets 5 inches or greater is prohibited within 10 feet of any point on the shoreline while set or deployed unless the net is attended from June to October (proclamation M-8-2017)
2017	May 1	Management unit A small mesh anchored gill-net attendance requirement (through November 30, 2017) and closes portions of management unit A (Subunit A-South of US-64-BYP/US-64) to the use of anchored large and small mesh gill nets (M-9-2017).
2017	May 8	Management unit D1 closed to large mesh gill nets and implements attendance requirements for gill nets with a stretched mesh length less than 4 inches in Management Subunit B. 1. (proclamation M-10-2017). **Annual ITP closure***
2017	Jun 19	Management unit B open to large mesh gill nets with a stretched mesh length of 4 inches through 6 1/2 inches. Portions of management unit B (Inlet Corridors) remain closed to the use of gill nets with a stretched mesh length of 4 inches through 6 1/2 inches to minimize interactions with threatened and/or endangered species (M-11-2017).

Table 8. Observer coverage calculated from previous years' trip ticket data and observer data for anchored large mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

		Large Mesh		
Season [1]	Management Unit [2]	Fishing Trips	Observed Trips	Coverage [3]
Fall 2016	A	2,234	175	7.8
	B	950	131	13.8
	C	266	37	13.9
	D1	49	15	30.6
	D2	295	33	11.2
	E	461	85	18.5
Spring 2017	A	2,277	181	7.9
	B	n/a	n/a	n/a
	C	878	96	10.9
	D1	25	0	0.0
	D2	67	10	14.8
	E	279	55	19.7
Summer 2017	A	1,338	66	4.9
	B	812	128	15.8
	C	403	28	6.9
	D1	n/a	n/a	n/a
	D2	123	24	19.6
	E	505	112	22.2
Total		10,961	1,176	10.7

[1] Final trip ticket data for 2016 (Fall 2016) and preliminary trip ticket data for 2017 (Spring and Summer 2017)

[2] Table 7 contains all the openings and closings for each management unit

[3] Based on final trips for 2016 (Fall 2016) and estimated trips for 2017 (Spring and Summer 2017) compared to observer large mesh trips

Table 9. Observer coverage calculated from previous years' trip ticket data and observer data for anchored small mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

		Small Mesh		
Season [1]	Management Unit [2]	Fishing Trips	Observed Trips	Coverage [3]
Fall 2016	A	380	0	0.0
	B	1,058	18	1.7
	C	79	7	8.9
	D1	60	10	16.7
	D2	240	15	6.3
	E	483	27	5.6
Spring 2017	A	1,311	10	0.8
	B	1,295	21	1.6
	C	263	16	6.1
	D1	39	8	20.3
	D2	42	0	0.0
	E	201	14	7.0
Summer 2017	A	280	4	1.4
	B	1,048	10	1.0
	C	312	10	3.2
	D1	10	0	0.0
	D2	54	4	7.5
	E	253	4	1.6
Total		7,406	178	2.4

[1] Final trip ticket data for 2016 (Fall 2016) and preliminary trip ticket data for 2017 (Spring and Summer 2017)

[2] Table 7 contains all the openings and closings for each management unit

[3] Based on final trips for 2016 (Fall 2016) and estimated trips for 2017 (Spring and Summer 2017) compared to observer large mesh trips

Table 10. Summary of observed sea turtle interactions in anchored large (n = 44) and small (n = 1) mesh gill nets through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

						Tag		Curved Carapace (mm)	
Date [1]	Management Unit	Latitude	Longitude	Species	Disposition	PIT	Inconel	Length	Width
9/7/2016	B	35.65913	75.52035	kemp's	alive	n/a	n/a	410	420
9/7/2016	B	35.65847	75.51970	kemp's	alive	n/a	n/a	370	380
9/13/2016	E	34.59066	77.40371	green	alive	989.001001951909	n/a	n/a	n/a
9/14/2016	B	35.30472	75.60518	green	alive	989.001001951749	EFT822	354	321
9/14/2016	E	34.47231	77.49011	kemp's	alive	989.001001951912	n/a	340	330
9/22/2016	B	35.13381	75.99700	green	alive	982.000364358025	n/a	315	245
9/22/2016	B	35.13408	75.99580	green	alive	982.000364301028	n/a	337	263
9/22/2016	B	35.13388	75.99703	green	dead	n/a	n/a	317	245
9/28/2016	B	35.17496	75.84647	green	dead	n/a	n/a	310	240
9/30/2016	C	35.51297	76.63842	kemp's	alive	n/a	n/a	406	429
9/30/2016	C	35.51297	76.63842	kemp's	dead	n/a	n/a	419	425
9/30/2016	B	35.28333	75.53361	green	dead	n/a	n/a	n/a	n/a
10/6/2016	B	35.02762	76.11351	green	alive	982.000364301837	n/a	290	250
10/6/2016	B	35.02029	76.11481	green	alive	n/a	n/a	n/a	n/a
10/12/2016	B	34.81970	76.36897	green	alive	n/a	n/a	n/a	n/a
10/12/2016	B	34.82031	76.36897	green	alive	989.001001952695	n/a	300	255
10/12/2016	B	35.01688	76.13003	green	dead	n/a	n/a	330	285
10/13/2016	B	34.81567	76.37873	green	alive	n/a	n/a	n/a	n/a
10/13/2016	B	35.04165	76.10800	green	alive	982.000364298693	n/a	347	304
10/14/2016	B	34.81885	76.36508	kemp's	alive	982.000364296939	n/a	210	205
10/18/2016	D1	34.79901	76.48180	green	alive	n/a	n/a	n/a	n/a
10/18/2016	D1	34.79735	76.48749	green	dead	n/a	n/a	350	310
10/20/2016	B	35.14932	75.90034	green	alive	n/a	n/a	n/a	n/a
10/25/2016	B	34.80941	76.38654	green	alive	982.000364297135	XXP661/XXP662	340	280
10/28/2016	E	34.12214	77.86340	kemp's	alive	989.001001951766	EET844/EET875	336	335
11/1/2016	B	35.14508	75.92924	green	alive	n/a	n/a	n/a	n/a
11/1/2016	B	35.14551	75.92901	green	alive	n/a	n/a	n/a	n/a

[1] No interactions occurred during the spring 2017 season

[2] Interaction occurred in anchored small mesh gill nets

Table 10. (cont.).

Date [1]	Management Unit	Latitude	Longitude	Species	Disposition	Tag		Curved Carapace (mm)	
						PIT	Inconel	Length	Width
11/4/2016	E	34.41676	77.57641	green	dead	n/a	n/a	263	221
6/14/2017	D2	34.68267	77.04958	green	dead	n/a		315	270
6/21/2017	E	33.97268	77.92255	green [2]	alive	3DD.003BB895A4/ 989.001001952676	EET846/ EET847	352	301
6/22/2017	B	35.30167	75.60813	green	alive	3DD.003BB895FE/ 989.001001952766	EET830/ EET831	320	290
6/27/2017	B	34.86224	76.37999	green	alive	3DD.003BB891EA/ 989.001001951722	EET821/ EET826	328	286
6/27/2017	E	33.93750	77.95202	green	dead	n/a	n/a	281	252
6/27/2017	E	33.93965	77.95006	green	dead	n/a	n/a	342	281
6/30/2017	C	35.19890	76.52740	green	dead	n/a	n/a	300	265
7/5/2017	B	35.61508	75.48758	loggerhead	alive	n/a	n/a	n/a	n/a
7/11/2017	B	35.20396	75.81295	kemp's	alive	n/a	n/a	n/a	n/a
7/11/2017	B	35.20090	75.80848	green	dead	n/a	n/a	372	302
7/13/2017	B	35.38477	75.54202	kemp's	alive	3D6.0015B6BAE5/ 982.000364296933	XXP659/ UUE037	325	332
7/25/2017	B	35.19176	75.83566	green	alive	n/a	n/a	304	254
7/26/2017	C	35.15580	76.57945	green	alive	3D6.001596B818/ 982.000362199064	UUE079/ UUE044	395	347
7/26/2017	C	35.15540	76.57973	green	dead	n/a	n/a	280	245
7/27/2017	B	35.20288	75.81908	green	alive	n/a	n/a	n/a	n/a
8/24/2017	B	35.14482	75.92638	green	alive	3D6.0015B2EFDE/ 982.000364048350	n/a	291	232
8/25/2017	B	35.06642	76.07711	green	alive	3D6.0015B2F2CC/ 982.000364049100	n/a	303	257

[1] No interactions occurred during the spring 2017 season

[2] Interaction occurred in anchored small mesh gill nets

Table 11. Summary of reported sea turtle interactions in anchored large and small mesh gill nets through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

						Curved Carapace (mm)	
Date	Management Unit	Latitude	Longitude	Species	Disposition	Length	Width
9/26/2016	E	n/a	n/a	green	alive	n/a	n/a
10/25/2016	D1	n/a	n/a	unknown	alive	n/a	n/a
11/8/2016	D2	34.68254	77.03699	green [1]	alive	n/a	n/a
5/2/2017	D2	n/a	n/a	unknown	alive	n/a	n/a
5/2/2017	D2	n/a	n/a	unknown	alive	n/a	n/a
5/8/2017	E	n/a	n/a	green	alive	n/a	n/a
7/10/2017	E	n/a	n/a	green	alive	n/a	n/a
8/1/2017	E	n/a	n/a	unknown	alive	n/a	n/a

[1] Indicates small mesh gear

Table 12. Number of gill-net checks made and citations issued by Marine Patrol for large and small mesh gill nets by season during ITP Year 2017 (September 1, 2016 - August 31, 2017).

Season	# Gill Net Checks	# Citations
Fall 2016	366	44
Spring 2017	395	10
Summer 2017	960	0
Total	1,721	54

Table 13. Citations written by Marine Patrol for large and small mesh gill nets by season and violation code during ITP Year 2017 (September 1, 2016 - August 31, 2017).

	Violation		
Season [1]	Date	Code	Description
Fall 2016	9/1/2016	NETG04	Leave gill net in waters when could not be legally fished
	9/8/2016	NETG03	Using gill net with improper buoys or identification
	9/13/2016	NETG01	Leave gill net in coastal waters unattended
	9/14/2016	NETG03	Using gill net with improper buoys or identification
	9/15/2016	NETG03	Using gill net with improper buoys or identification
	9/15/2016	NETG03	Using gill net with improper buoys or identification
	9/17/2016	NETG04	Leave gill net in waters when could not be legally fished
	9/20/2016	NETG03	Using gill net with improper buoys or identification
	9/20/2016	NETG53	Use large mesh gill net with corks or floats on top line
	9/22/2016	NETG03	Using gill net with improper buoys or identification
	9/22/2016	NETG08	Gill net within 200 yards of pound net
	9/25/2016	NETG03	Using gill net with improper buoys or identification
	9/29/2016	NETG03	Using gill net with improper buoys or identification
	10/2/2016	NETG04	Leave gill net in waters when could not be legally fished
	10/3/2016	NETG04	Leave gill net in waters when could not be legally fished
	10/17/2016	NETG01	Leave gill net in coastal waters unattended
	10/17/2016	NETG03	Using gill net with improper buoys or identification
	10/18/2016	NETG03	Using gill net with improper buoys or identification
	10/20/2016	NETG03	Using gill net with improper buoys or identification
	10/20/2016	NETG33	Violate provisions of Proc M-19-09 setting gill net more than 15 meshes deep in Core Sound
	10/20/2016	NETG53	Use large mesh gill net with corks or floats on top line
	10/22/2016	NETG03	Using gill net with improper buoys or identification
	10/23/2016	NETG03	Using gill net with improper buoys or identification
	10/29/2016	NETG17	Sink net in Neuse River during closed season
	10/30/2016	NETG34	Use unattended gill net w/mesh less than 5" in commercial operation from May 1 through Nov 30
	10/31/2016	NETG04	Leave gill net in waters when could not be legally fished
	11/3/2016	NETG03	Using gill net with improper buoys or identification
	11/3/2016	NETG03	Using gill net with improper buoys or identification
	11/3/2016	NETG30	Leave RCGL gill net unattended
	11/5/2016	NETG03	Using gill net with improper buoys or identification
	11/5/2016	NETG16	Use an unattended gill net in a restricted area
	11/5/2016	NETG30	Leave RCGL gill net unattended
	11/6/2016	NETG01	Leave gill net in coastal waters unattended
	11/6/2016	NETG04	Leave gill net in waters when could not be legally fished
	11/17/2016	NETG37	Leave small mesh gill nets unattended
	11/17/2016	NETG37	Leave small mesh gill nets unattended
	11/17/2016	NETG37	Leave small mesh gill nets unattended

[1] There were no citations written during the summer 2017 season

Table 13. (cont.).

Season [1]	Violation		
	Date	Code	Description
Fall 2016	11/19/2016	NETG02	Using gill net without buoys or identification
	11/19/2016	NETG03	Using gill net with improper buoys or identification
	11/22/2016	NETG01	Leave gill net in coastal waters unattended
	11/22/2016	NETG02	Using gill net without buoys or identification
	11/22/2016	NETG03	Using gill net with improper buoys or identification
	11/22/2016	NETG37	Leave small mesh gill nets unattended
	11/22/2016	NETG37	Leave small mesh gill nets unattended
Spring 2017	3/28/2017	NETG46	Set or retrieve large mesh gill nets later than one hour after sunrise on Tuesday through Friday
	3/28/2017	NETG53	Use large mesh gill net with corks or floats on top line
	4/10/2017	NETG22	Improperly set gill net
	4/15/2017	NETG03	Using gill net with improper buoys or identification
	4/15/2017	NETG60	Use gill nets with a mesh size of more than 6.5 inches (stretched mesh) in violation of proclamation
	4/20/2017	NETG03	Using gill net with improper buoys or identification
	4/20/2017	NETG29	RCGL gear without proper buoys
	4/21/2017	NETG22	Improperly set gill net
	5/7/2017	NETG29	RCGL gear without proper buoys
	5/17/2017	NETG45	Set or retrieve large mesh gill nets no sooner than one hour before sunset on Monday through Friday

[1] There were no citations written during the summer 2017 season

Table 14. Contacts attempted (n = 7,776) by the observers trying to set up trips by season categorized by contact type (0-14) and by total number, percent for each season, and percent for the entire ITP Year 2017 for ITP Year 2017 (September 1, 2016 - August 31, 2017).

	Categories (%) [1]														
Season	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Fall 2016	63	514	181	66	47	34	160	5	284	61	53	11	296	885	2,660
	2.4%	19.3%	6.8%	2.5%	1.8%	1.3%	6.0%	0.2%	10.7%	2.3%	2.0%	0.4%	11.1%	33.3%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Spring 2017	61	440	171	30	18	28	98	9	130	20	93	16	320	991	2,425
	2.5%	18.1%	7.1%	1.2%	0.7%	1.2%	4.0%	0.4%	5.4%	0.8%	3.8%	0.7%	13.2%	40.9%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Summer 2017	64	482	161	24	26	37	104	4	177	53	107	17	385	1,050	2,691
	2.4%	17.9%	6.0%	0.9%	1.0%	1.4%	3.9%	0.1%	6.6%	2.0%	4.0%	0.6%	14.3%	39.0%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Total	188	1,436	513	120	91	99	362	18	591	134	253	44	1,001	2,926	7,776
	2.4%	18.5%	6.6%	1.5%	1.2%	1.3%	4.7%	0.2%	7.6%	1.7%	3.3%	0.6%	12.9%	37.6%	100.0%

[1] Contact type categories: 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

Table 15. Notice of Violations issued by season, date and violation code for the Estuarine Gill Net Permit for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Season	Date	Code	Description
Fall 2016	11/3/2016	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	11/3/2016	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	11/3/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	11/3/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	11/29/2016	EGNP11	Failure to attend nets
	11/29/2016	EGNP11	Failure to attend nets
	11/29/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	11/29/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
Spring 2017	3/6/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	4/24/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	4/24/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	4/24/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	4/28/2017	EGNP10	Set more than the legal length of gill net
	4/28/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
Summer 2017	6/28/2017	EGNP10	Set more than the legal length of gill net
	6/28/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	8/24/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation

FIGURES

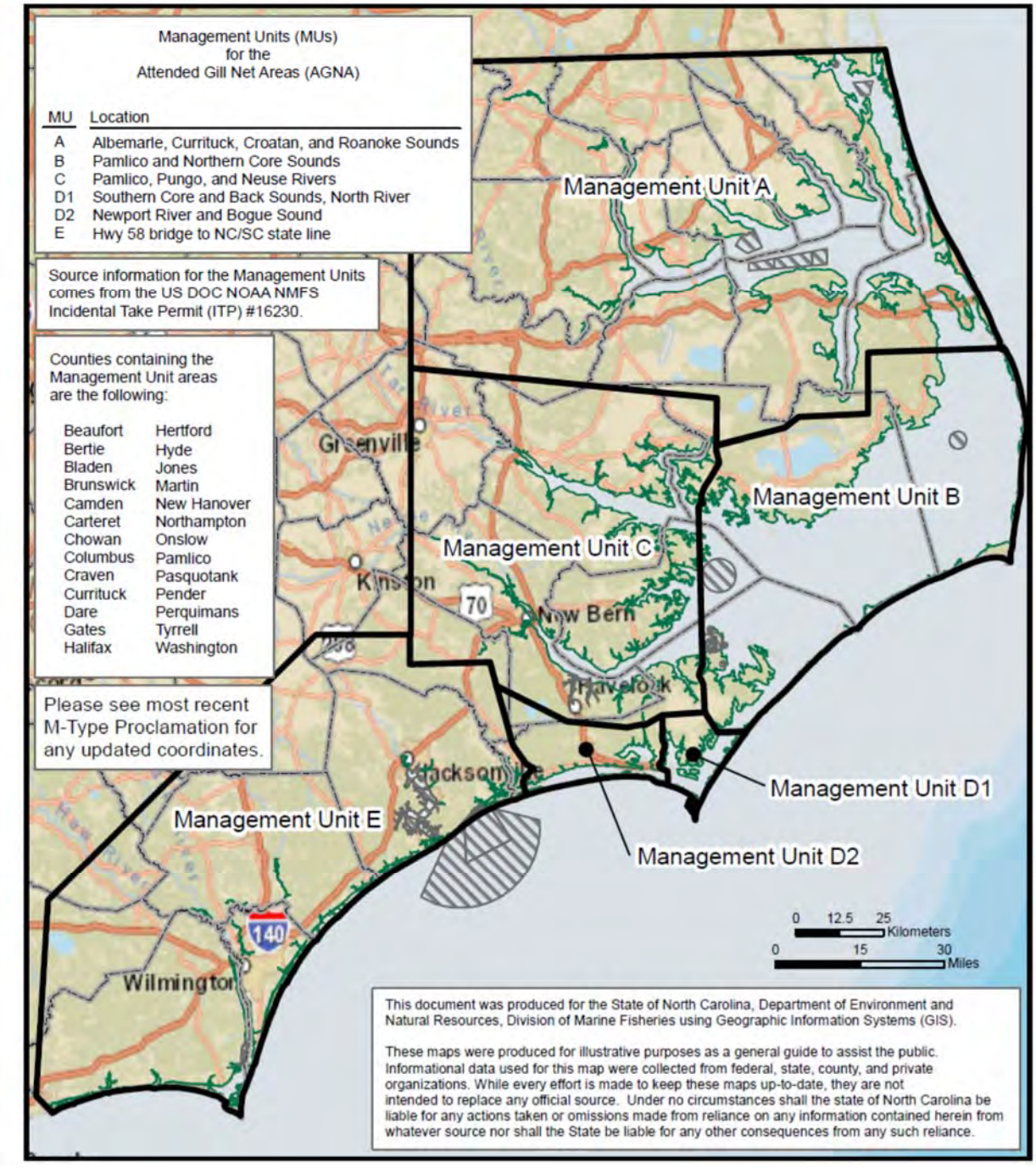


Figure 1. Management units (A, B, C, D1, D2, and E) as outlined in the Conservation Plan and utilized by the Observer Program for ITP Year 2017 (September 1, 2016 – August 31, 2017).

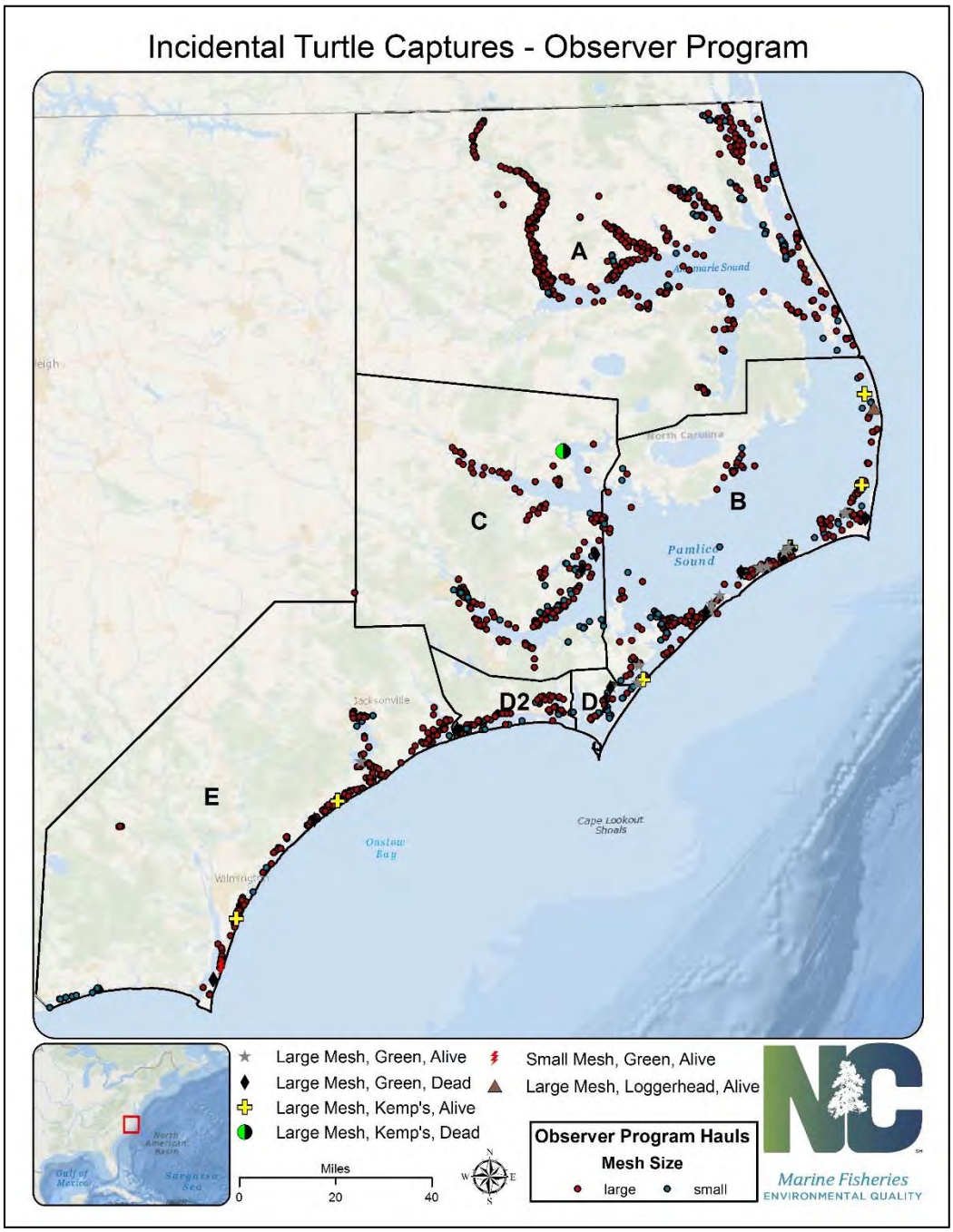


Figure 2. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear throughout all management units for ITP Year 2017 (September 1, 2016 – August 31, 2017).

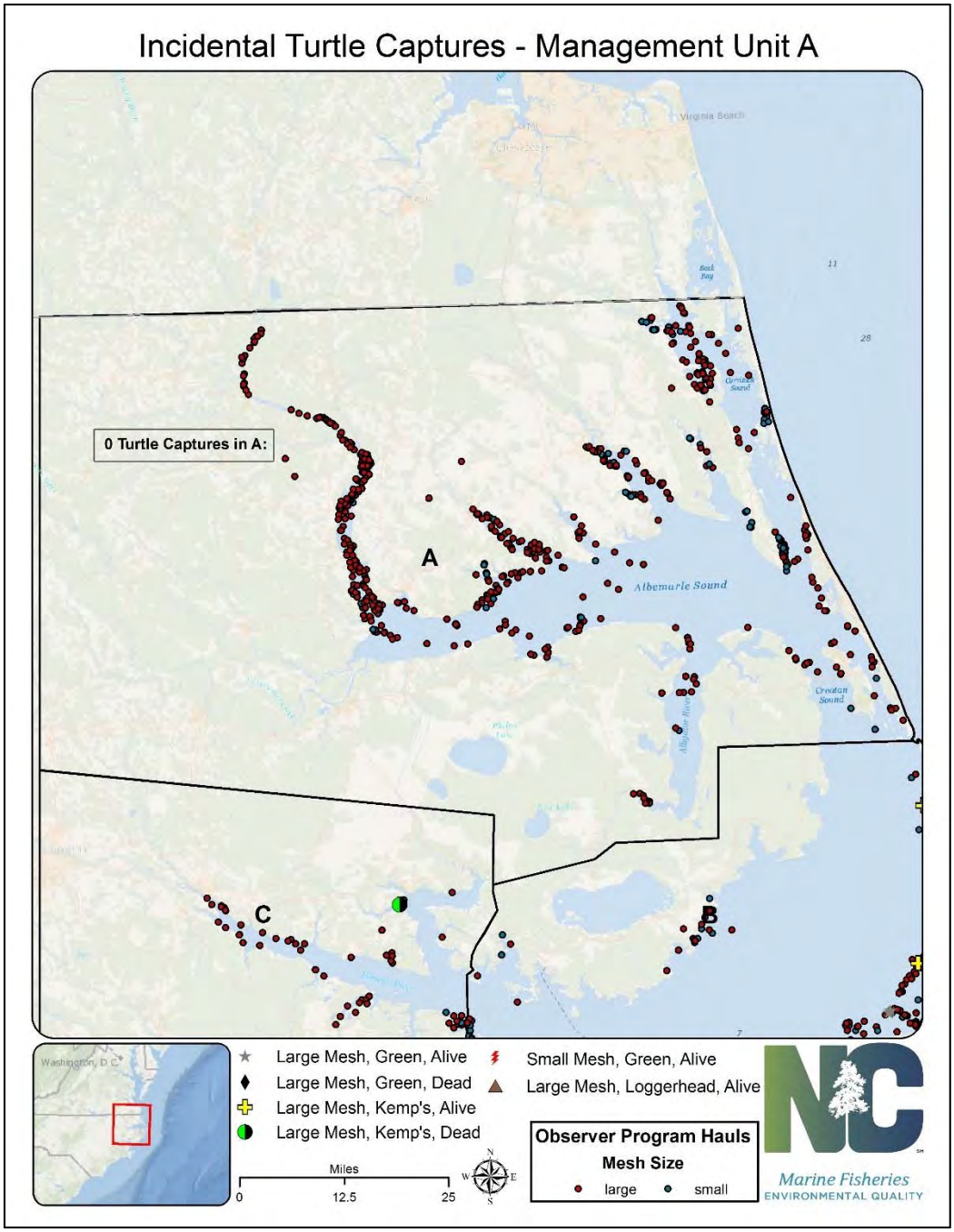


Figure 3. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit A for ITP Year 2017 (September 1, 2016 – August 31, 2017).

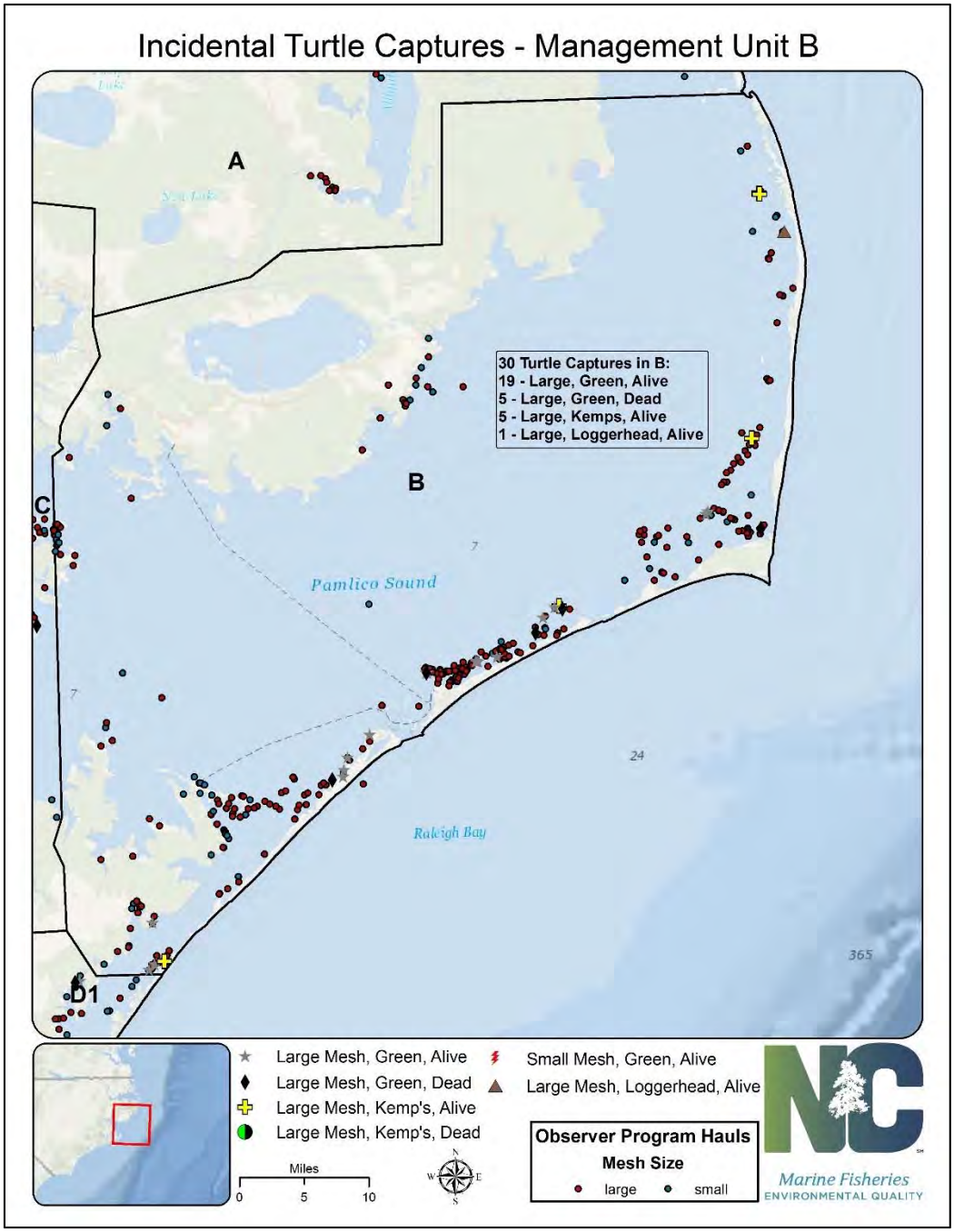


Figure 4. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit B for ITP Year 2017 (September 1, 2016 – August 31, 2017).

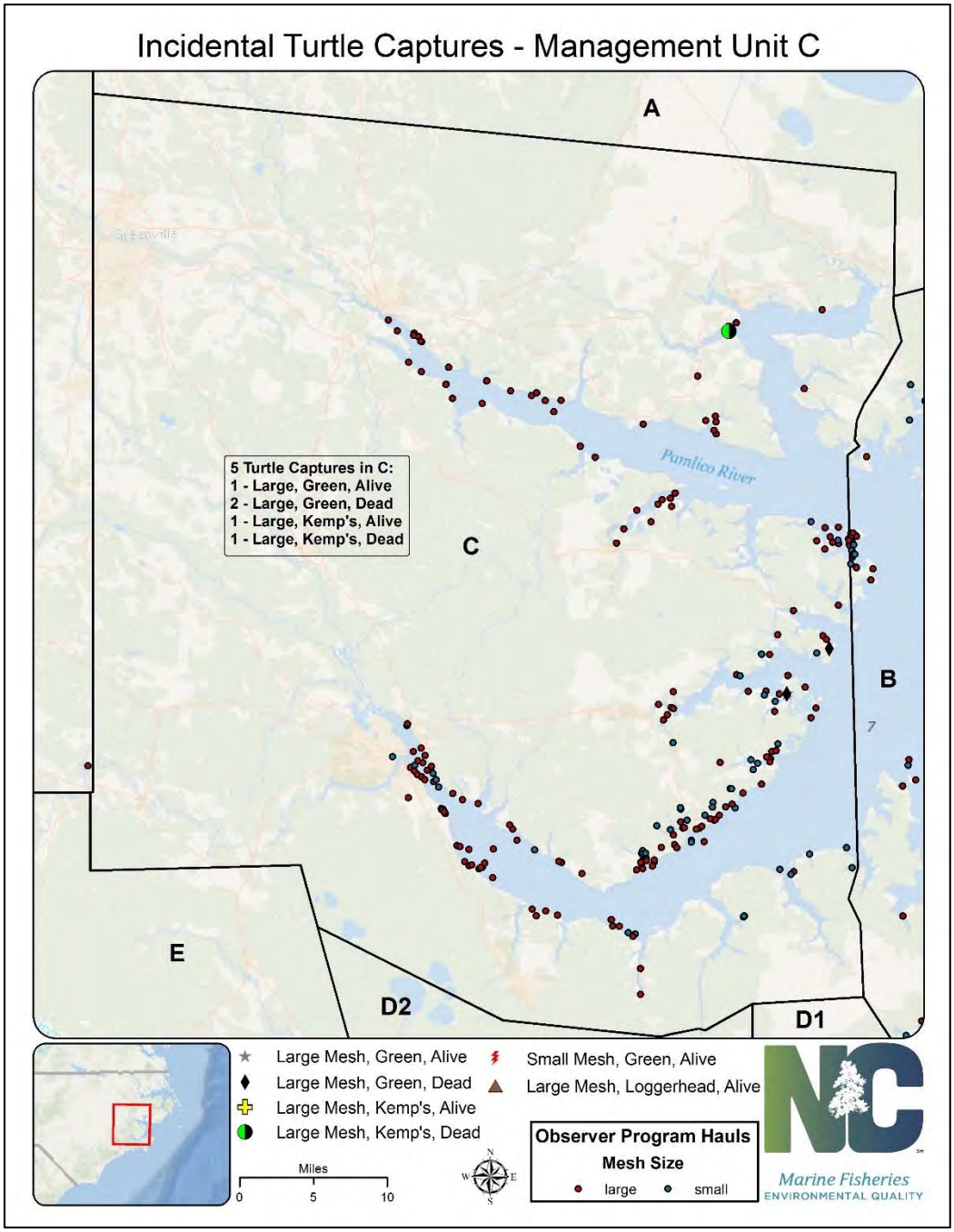


Figure 5. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit C for ITP Year 2017 (September 1, 2016 – August 31, 2017).

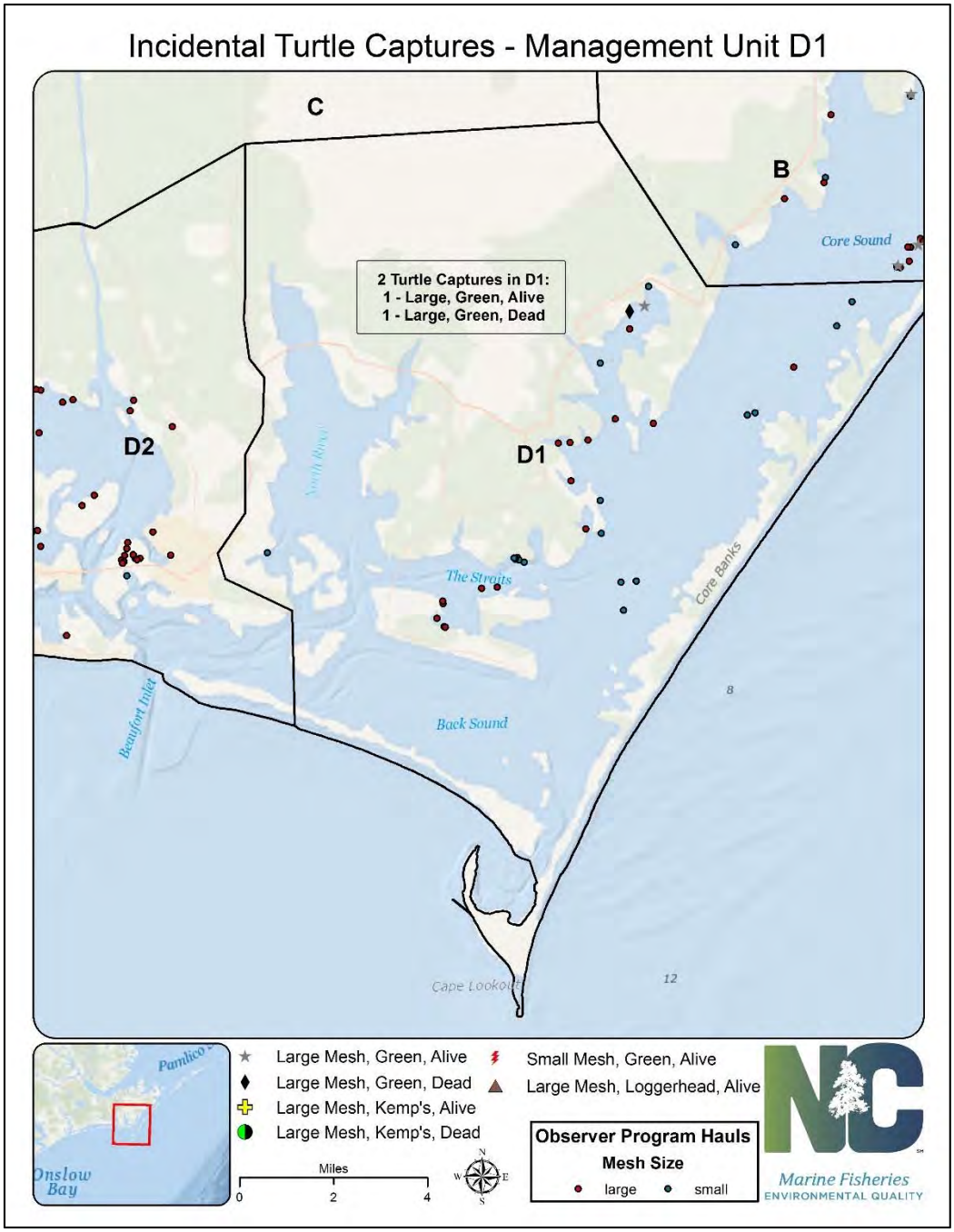


Figure 6. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit D1 for ITP Year 2017 (September 1, 2016 – August 31, 2017).

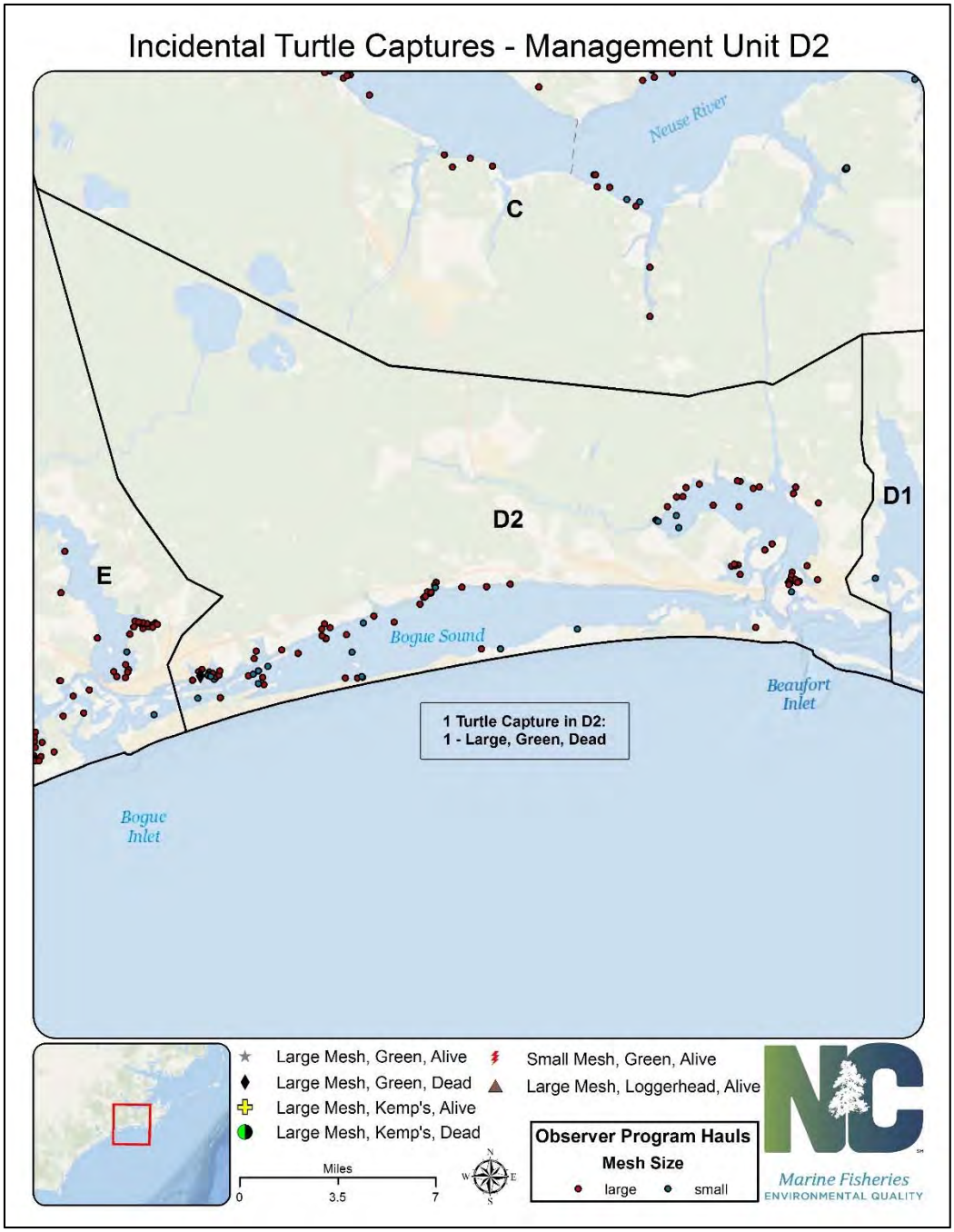


Figure 7. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit D2 for ITP Year 2017 (September 1, 2016 – August 31, 2017).

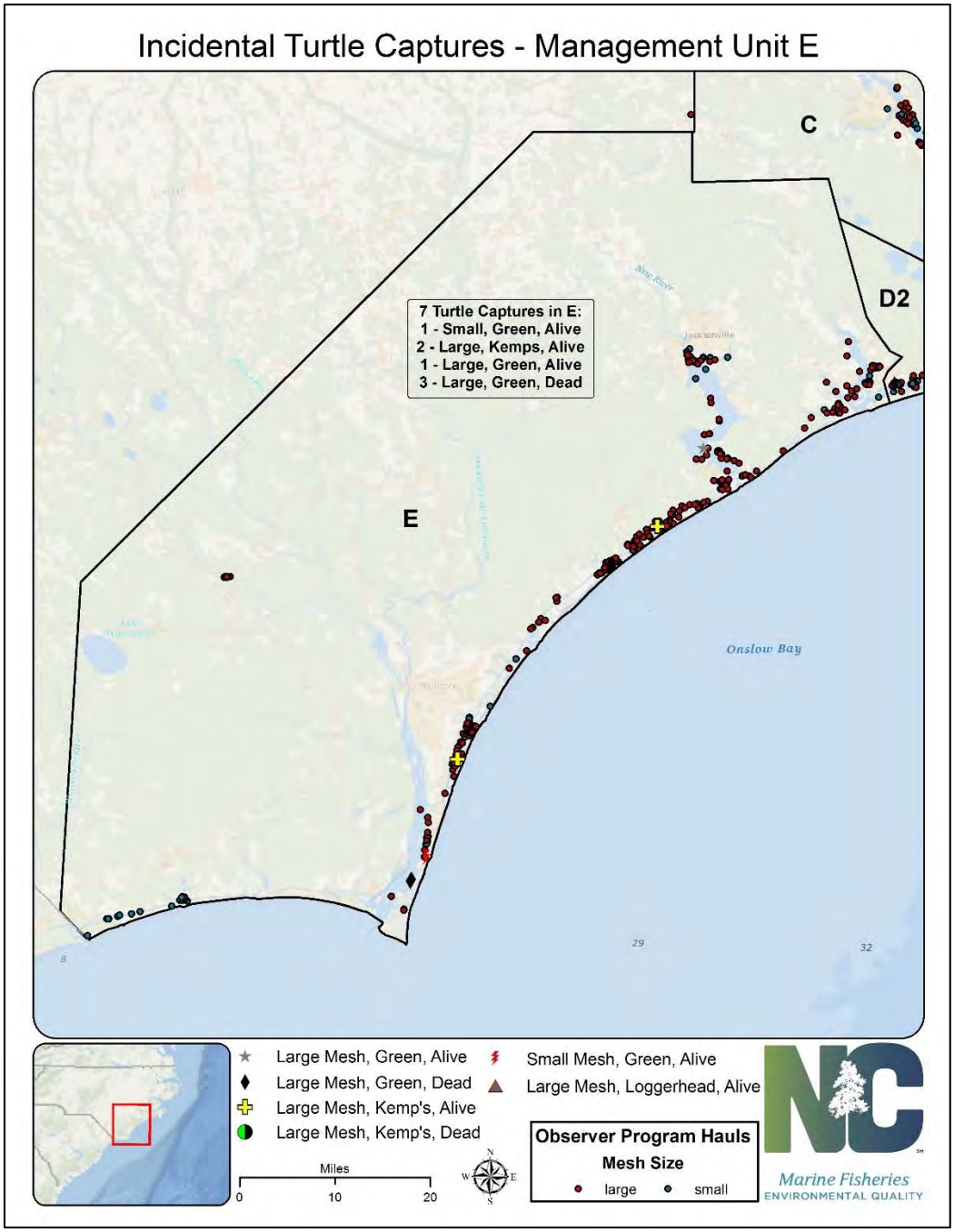


Figure 8. Sea turtle interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit E for ITP Year 2017 (September 1, 2016 – August 31, 2017).

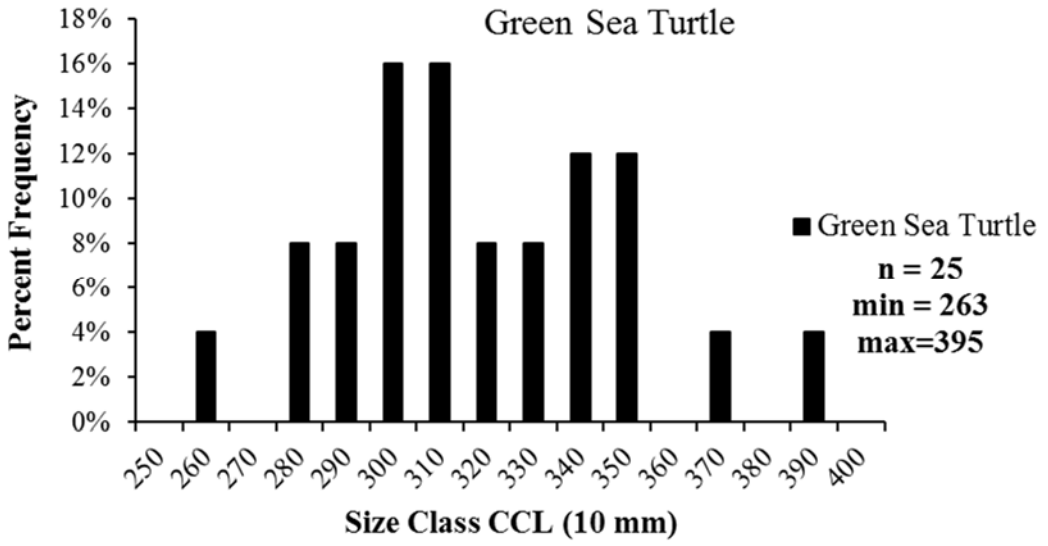


Figure 9. Length-frequency (curved carapace length) from notch to tip of observed incidental captures of green sea turtles where measurements were obtained (n = 25) collected by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017).

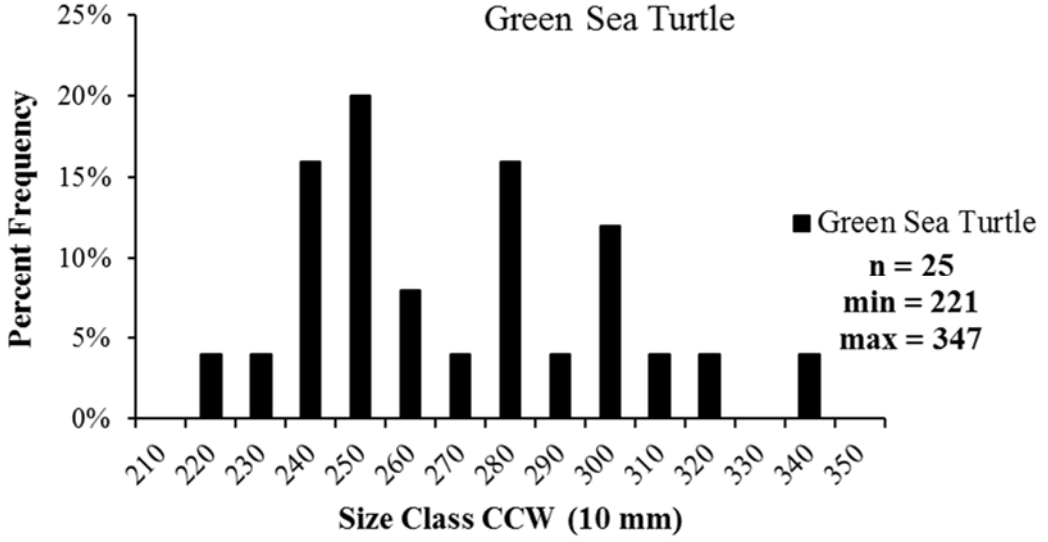


Figure 10. Length-frequency (curved carapace width) of observed incidental captures of green sea turtles where measurements were obtained (n = 25) collected by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017).

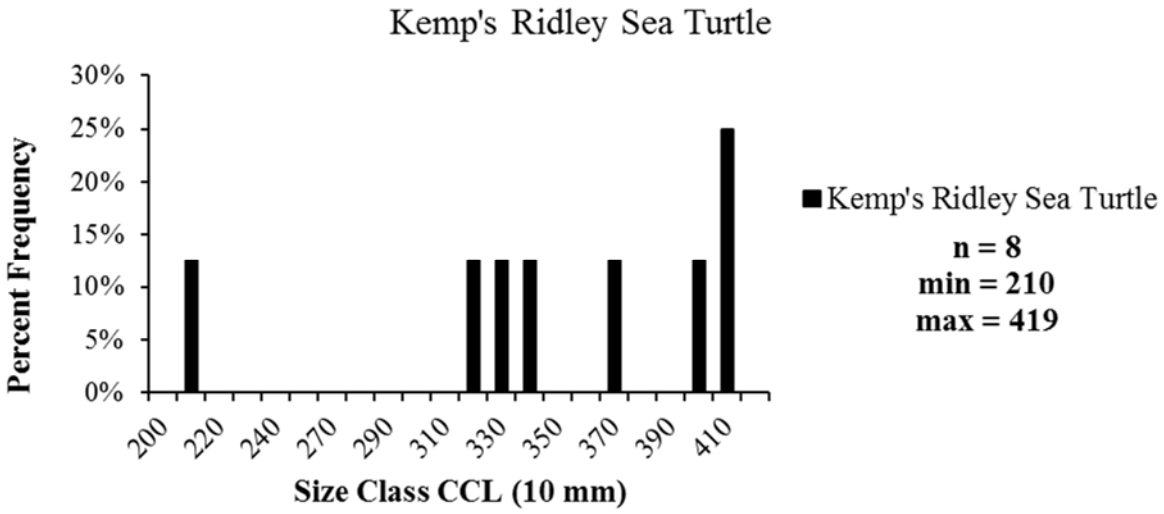


Figure 11. Length-frequency (curved carapace length) from notch to tip of observed incidental captures of Kemp's ridley sea turtles where measurements were obtained (n = 8) collected by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017).

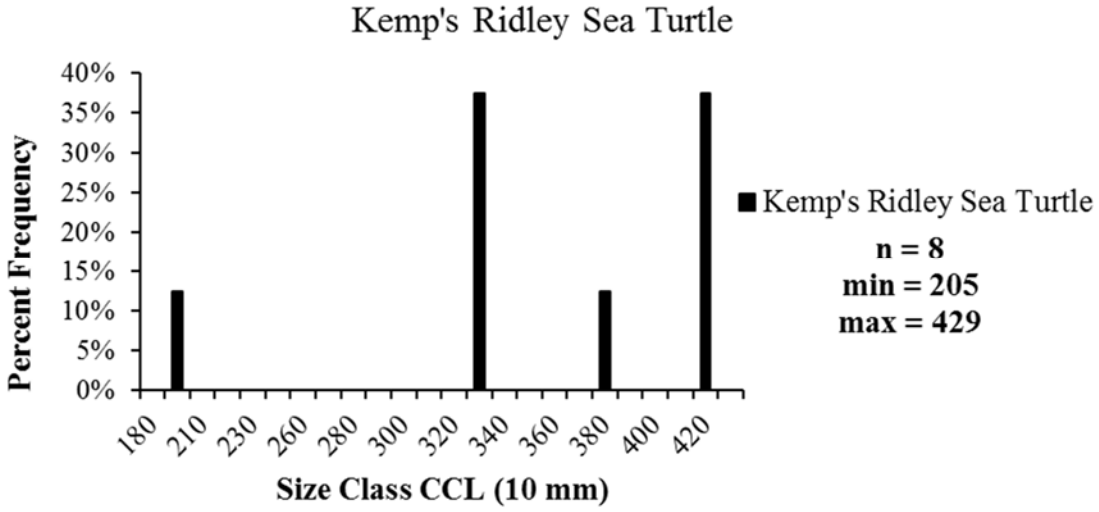
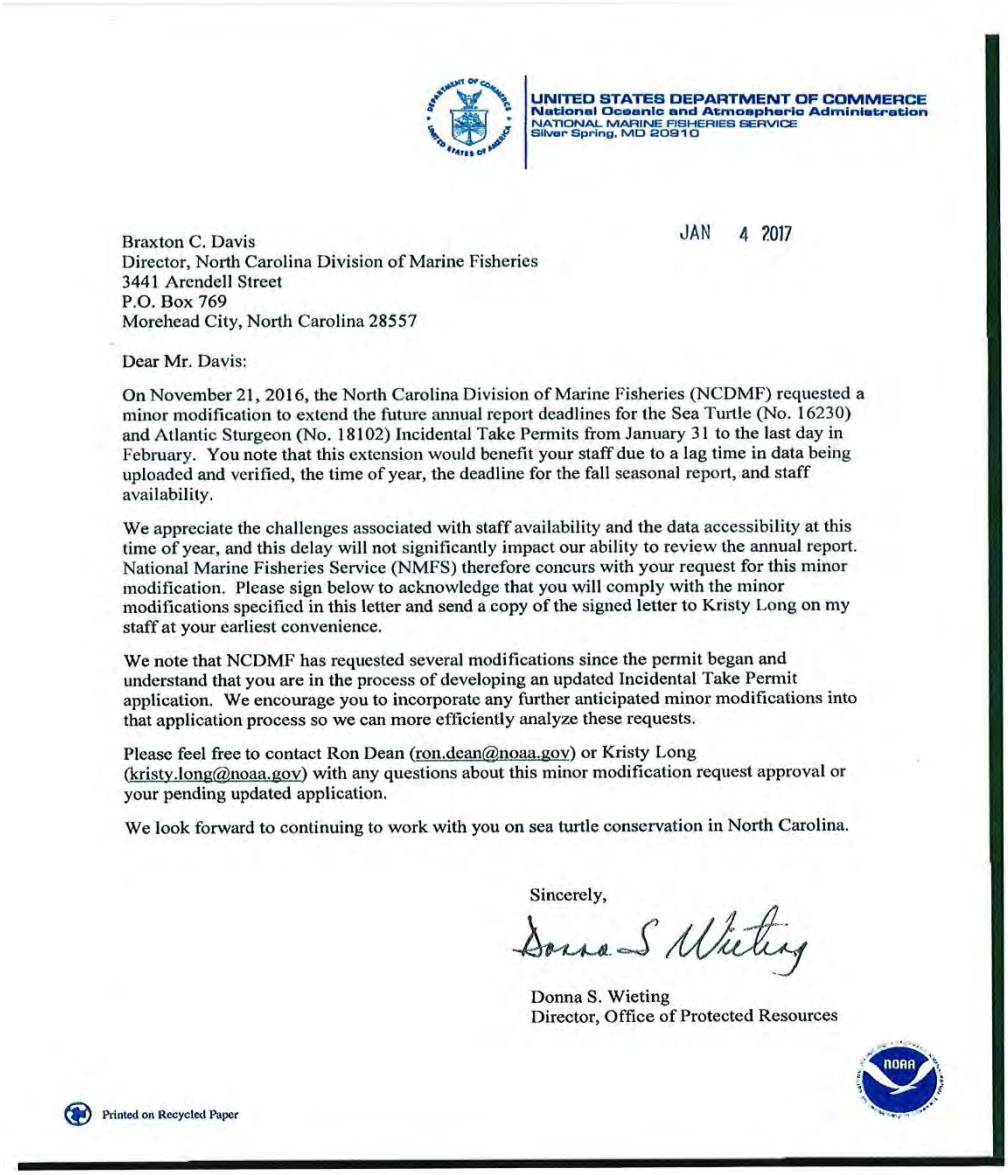


Figure 12. Length-frequency (curved carapace width) from notch to tip of observed incidental captures of Kemp's ridley sea turtles where measurements were obtained (n = 8) collected by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017).

APPENDIX A



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JAN 4 2017

Braxton C. Davis
Director, North Carolina Division of Marine Fisheries
3441 Arendell Street
P.O. Box 769
Morehead City, North Carolina 28557

Dear Mr. Davis:

On November 21, 2016, the North Carolina Division of Marine Fisheries (NCDMF) requested a minor modification to extend the future annual report deadlines for the Sea Turtle (No. 16230) and Atlantic Sturgeon (No. 18102) Incidental Take Permits from January 31 to the last day in February. You note that this extension would benefit your staff due to a lag time in data being uploaded and verified, the time of year, the deadline for the fall seasonal report, and staff availability.

We appreciate the challenges associated with staff availability and the data accessibility at this time of year, and this delay will not significantly impact our ability to review the annual report. National Marine Fisheries Service (NMFS) therefore concurs with your request for this minor modification. Please sign below to acknowledge that you will comply with the minor modifications specified in this letter and send a copy of the signed letter to Kristy Long on my staff at your earliest convenience.

We note that NCDMF has requested several modifications since the permit began and understand that you are in the process of developing an updated Incidental Take Permit application. We encourage you to incorporate any further anticipated minor modifications into that application process so we can more efficiently analyze these requests.

Please feel free to contact Ron Dean (ron.dean@noaa.gov) or Kristy Long (kristy.long@noaa.gov) with any questions about this minor modification request approval or your pending updated application.

We look forward to continuing to work with you on sea turtle conservation in North Carolina.

Sincerely,

Donna S. Wieting

Donna S. Wieting
Director, Office of Protected Resources

Printed on Recycled Paper

I acknowledge the minor modification specified above to Permit No. 16230 issued under Section 10 (a)(l)(B) of the Endangered Species Act to incidentally take threatened and endangered sea turtles in gillnet fisheries operating in inshore waters of North Carolina.

Braxton C. Davis
Director
N.C. Division of Marine Fisheries

1-5-17
Date

APPENDIX B

Marine Fisheries
ENVIRONMENTAL QUALITY

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
BRAXTON C. DAVIS
Director

Kristy Long
Office of Protected Resources (F/PR)
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

Dear Kristy:

The North Carolina Division of Marine Fisheries (NCDMF) Observer Program data have been updated using the finalized 2016 Trip Ticket Program (TTP) data. The Annual Completion Report for the Sea Turtle Incidental Take Permit (ITP) No. 16230 was completed for ITP Year 2016 and submitted in February 2017. Using the finalized 2016 data, Tables 1, 5, 8, and 9 from the Completion Report were updated to reflect the final estimates of observer coverage and sea turtle takes (Tables 1 - 4). The fall 2015 season was based on finalized 2015 TTP data and did not deviate from the previous report for both anchored large and small mesh gill nets (Tables 1 and 2).

Anchored Large Mesh

The spring 2016 season had an increase in fishing trips for anchored large mesh gill nets than previously estimated in management units A, C, and D2 with all other management units having a decrease in fishing trips (Table 1). Observer coverage goals for anchored large mesh gill nets were met in all management units except management units D1 and D2 for the spring 2016 season. No trips were obtained in management unit D1 during the spring 2016 season due to the management unit being closed for the latter portion of the spring 2016 season and minimal fishing effort (n = 5 fishing trips) while open. Fishing effort (n = 92 fishing trips) in management unit D2 was also low compared to other management units during the same period. While observer coverage goals were not met in management units D1 and D2, they were far exceeded in management units B (15.8%) and E (30.2%) for anchored large mesh gill nets (Table 1).

The summer 2016 season had an increase in fishing trips for anchored large mesh gill nets than previously estimated in all management units except for C (Table 1). Observer coverage goals for anchored large mesh gill nets were met in all management units except management units A and B for the summer 2016 season (management unit D1 is closed annually from May 8 through October 14 as described in the ITP). Management unit A was open for only seven days before being closed to anchored large and small mesh gill nets for the remainder of the summer 2016 season allowing for only five trips to be obtained before the closure was implemented. Management unit B was open for only three days before being closed to anchored large mesh gill

nets for the remainder of the summer 2016 season allowing for only three trips to be obtained before the closure was implemented. While observer coverage goals were not met in management units A and B, they were exceeded in management units C (11.0%), D2 (13.5%), and E (19.8%) for anchored large mesh gill nets (Table 1).

Anchored Small Mesh

The spring 2016 season had an increase in fishing trips for anchored small mesh gill nets than previously estimated in management unit B (Table 2). Management unit E closed to anchored small mesh gill nets on May 4, 2016 for the remainder of ITP Year 2016 due to reaching allowable sea turtle takes. Observer coverage goals for anchored small mesh gill nets were met in all management units for the spring 2016 season. Furthermore, observer coverage goals were far exceeded in management units A (4.1%), C (7.4%), D1 (17.6%), D2 (10.0%), and E (8.3%) for anchored small mesh gill nets (Table 2).

The summer 2016 season had an increase in fishing trips for anchored small mesh gill nets than previously estimated in management units A and B (Table 2). Management unit E remained closed to anchored small mesh gill nets for the duration of the summer 2016 season. Observer coverage goals for anchored small mesh gill nets were met in all management units except management units A and B. Management unit A was open for only seven days before being closed to anchored large and small mesh gill nets for the duration of the summer 2016 season. Therefore, no anchored small mesh trips were able to be obtained during this short time frame. Attendance requirements for anchored small mesh gill nets during the summer season made it difficult to obtain trips in management unit B. While observer coverage goals were not met in management units A and B, they were far exceeded in management units C (4.5%), D1 (25.0%), D2 (18.8%) and E (7.8%) for anchored small mesh gill nets (Table 2).

Sea Turtle Takes

Annual estimated allowable sea turtle takes were recalculated using the finalized 2016 TTP data (Tables 3 and 4). The estimates of sea turtle takes decreased or remained constant from previous estimates for all species and dispositions except for alive green sea turtles in management unit E which increased by an estimated four takes. The anchored large mesh gill-net fishery remained below the annual estimated allowable sea turtle takes for all species and dispositions for ITP Year 2016 (Tables 3 and 4).

Table 1. Observer coverage calculated from finalized 2016 Trip Ticket data and observer data for anchored large mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2016 (September 1, 2015 - August 31, 2016).

		Anchored Large Mesh		
Season	Management Unit	Fishing Trips	Observed Trips	Coverage
Fall 2015	A	2,258	205	9.1
	B	424	63	14.9
	C	366	58	15.8
	D1	7	7	100.0
	D2	320	27	8.4
	E	518	36	6.9
Spring 2016	A	1,510	138	9.1
	B	273	43	15.8
	C	996	73	7.3
	D1	5	0	0.0
	D2	92	4	4.3
	E	179	54	30.2
Summer 2016	A	148	5	3.4
	B	159	3	1.9
	C	528	58	11.0
	D1	0	0	0.0
	D2	163	22	13.5
	E	500	99	19.8
Total		8,446	895	10.6

Table 2. Observer coverage calculated from finalized 2016 Trip Ticket data and observer data for anchored small mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2016 (September 1, 2015 - August 31, 2016).

		Anchored Small Mesh		
Season	Management Unit	Fishing Trips	Observed Trips	Coverage
Fall 2015	A	358	10	2.8
	B	706	9	1.3
	C	95	7	7.4
	D1	26	6	23.1
	D2	195	17	8.7
	E	547	29	5.3
Spring 2016	A	675	28	4.1
	B	1,478	29	2.0
	C	95	7	7.4
	D1	34	6	17.6
	D2	20	2	10.0
	E	133	11	8.3
Summer 2016	A	51	0	0.0
	B	1,084	7	0.6
	C	157	7	4.5
	D1	4	1	25.0
	D2	16	3	18.8
	E [1]	n/a	n/a	n/a
Total		5,674	179	3.2

[1] Management unit E closed to anchored small mesh gill nets for the duration of the summer 2016 season

Table 3. Authorized and actual annual estimated takes with confidence intervals (95%) using a bootstrap method based on observer data for coverage and sea turtle interaction levels in anchored large mesh (≥4 inch stretched mesh) gill nets for ITP Year 2016 (September 1, 2015 - August 31, 2016).

	Management Unit											
	B				D1				Total			
	Estimated Takes				Estimated Takes							
	Authorized		Actual		Authorized		Actual		Authorized		Actual	
Species	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Green	225	112	59 (0,132)	26 (33,62)	9	5	1 (0,4)	0	234	117	60	26
Kemp's ridley	53	26	22 (12,121)	0	15	7	0	0	68	33	22	0
Total	278	138	81	26	24	12	1	0	302	150	82	26

	Management Unit											
	D2				E				Total			
	Estimated Takes				Estimated Takes							
	Authorized		Actual		Authorized		Actual		Authorized		Actual	
Species	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Green	n/a [1]	n/a [1]	n/a [1]	n/a [1]	96	48	73 (7,136)	19 (0,30)	96	48	73	19
Kemp's ridley	6	3	0	0	24	13	11 (0,26)	0	30	16	11	0
Total	6	3	0	0	120	61	84	19	126	64	84	19

[1] Insufficient observer data exist to model an estimated annual take level; therefore, for management unit D2, an annual observed take number has been identified for green turtles

Table 4. Total annual authorized and actual takes (estimated and observed) by species and condition for ITP Year 2016 (September 1, 2015 - August 31, 2016).

			Estimated			
	Observed (live/dead)		Authorized		Actual	
Species	Authorized	Actual	Alive	Dead	Alive	Dead
Green	18	8	330	165	133	45
Hawksbill	8	0	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Kemp's ridley	12	3	98	49	33	0
Leatherback	8	0	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Loggerhead	24	0	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Any Species	8	3 [2]	n/a[1]	n/a[1]	n/a[1]	n/a[1]
Total	78	14	428	214	166	45

[1] Insufficient observer data exist to model an estimated annual take level; therefore, takes are expressed as observed

[2] Species identification unknown

Sincerely,

Jacob Boyd, Protected Species Biologist
Division of Marine Fisheries, NCDEQ

cc: Chris Batsavage
Braxton Davis
Dee Lupton
John McConnaughey

APPENDIX C

September 2, 2016

David,

The North Carolina Watermen United (NCWU) would like to thank you setting up the meeting with gill- and pound- netters. We appreciate your efforts to help re-open closed areas and keep others from being closed.

However, as many of the attendees at the meeting in Wanchese on Tuesday, August 30, 2016 mentioned, every possible action has been in effect for years to reduce interactions with endangered sea turtles under the regulations of the Sea Turtle ITPs since 2002. We already have many gear modifications, closures in high turtle interaction areas, a reduction in fishing times and a reduction in fishing efforts that include -

- 1. The state is divided into 6 Unit Areas and 4 of those 6 units have 4 days a week fishing only; night-time soaks only; 15-mesh deep nets and no floats. These are year-round restrictions in the 4 areas.

- 2. The southern portion of Unit A is also under these same restrictions. The entire deep-water area of Pamlico Sound is closed to the use of large mesh gillnet from September 1 until January of the next year.

- 3. All inlet corridors are closed to large mesh gillnets after September 1 each year.

- 4. Unit E is closed to the use of large mesh gillnets every May until October.

- 5. In all internal waters, the only areas that do not have gear modifications and further restrictions under the ITP are the northern parts of Unit A and Unit C – both of which have minimal interactions with sea turtles, and still only 4 interactions per unit per year are authorized.

At this time, NCWU would like to ask again that a meeting be set up with NCWU and NCFA fishermen, especially gill- and pound- netters, with representatives from the NC Division of Marine Fisheries and with Jean Beasley from the Karen Beasley Sea Turtle Foundation. Jean Beasley and NCWU asked the previous DMF Director for this meeting many times, but he never acted on our request. It is the perfect time to listen to her ideas and experiment with the devices that she has been advocating for years that she believes would help lessen the number of turtle interactions. I am a gillnetter and very willing to help test and monitor these devices.

We are hopeful that the cooperation between NCWU, NCFA and the NCDMF with Jean Beasley may help us all to solve some of the problems that our state's gillnet fishermen are experiencing.

Thank you.

Yours truly,

Andrew Berry

Andrew Berry
NCWU Board Member
252-722-4293
bowhunterab14@gmail.com

AB: mm
cc: NCDMF Director Braxton Davis, Chris Batsavage; Jacob Berg
NCDEQ Secretary van der Vaart
NCFA Director Jerry Schill, Chairman Brent Fulcher

APPENDIX D

Chris,

I am following up on the Protected Species Workgroup meetings. As was discussed at both meetings, there have been more than substantial measures directly, and indirectly, reducing mitigation of turtle interactions, but those measures need quantified.

I am requesting per the direction of the fishermen, that NCDFM quantify the total sea turtle mitigation reduction that has taken place from prior to the sea turtle lawsuit to present. It should also include impacts by other regulations such as fishery effort/harvest reductions. For the information to be useful, it may be necessary to separate reductions based on ITP closures from other reductions, so that we can determine how effective all of the other measures have been without closures. You may even include one total with, and one without closures.

It is also requested that a biological opinion be completed relating to those measures, once quantified, addressing the successful mitigation of sea turtles. It should include any potential measures that might be necessary, and only if necessary, to reduce interactions sufficiently, without relying on a set number to base closures on. This opinion should address both large and small mesh fisheries that have substantial interaction with turtles.

These items are being requested to work towards an ITP that sufficiently protects the species, while preventing unnecessary closures to the fishery.

I was just directed to make this request and wanted to get it to you as soon as possible. If in my haste I was unclear and need to clarify anything, please contact me anytime.

Take care,

David Bush
Fisheries Biologist,
NC Fisheries Association
(910)777-1605

APPENDIX E

November 23, 2016

Laura Runyan, Director
Foundation, Government and Faculty Grants Gettysburg College
300 North Washington Street
Gettysburg, PA 17325

Subj: Saltonstall-Kennedy Competitive Research Program Grant Proposal

Title: Development of sensory-based bycatch reduction technologies to reduce sea turtle bycatch in North Carolina coastal gillnet and pound net fisheries.

North Carolina Fisheries Association (NCFA) is excited at the opportunity to collaborate with Gettysburg College on the above referenced project. As a primary goal of our organization, we attempt to support all possible efforts to solidify the future of one of the oldest and proudest of professions, the commercial fishing industry. NCFA understands that to accomplish this, sustainable fishing efforts to harvest public trust resources is an absolute requirement.

The goal of this research, sea turtle bycatch reduction, is an important yet very complicated issue. It is one that NC fishermen understand, supporting substantial research efforts and enduring the subsequent changes to their fisheries to accomplish. The Turtle Excluder Device, or TED, is a prime example of successful collaboration between fishermen, academia, government scientists and management. The positive results of these efforts compound the issue within our internal water fisheries where the ever-increasing numbers of these animals are now encountered. This research is vital in finding ways to coexist with these endangered species, and it is hopeful that technology derived from this research will also be applicable to other industries and projects that affect them.

NCFA is experienced and knowledgeable in supporting research to develop bycatch reduction methods for finfish and sea turtles, and is eager to contribute to this project's successful implementation. We are currently in our second of three years of research concerning finfish bycatch reduction in the shrimp trawl industry. In collaboration with our state management agency, our preliminary results surpass all state and federal requirements. We support this proposed research methodology, and will also support the project to completion if awarded the requested grant.

We (NCFA) agree to act as subcontractor with Gettysburg College to complete the work plan as outlined in the proposal. It is understood that general concept of this work will involve coordination of the appropriate industry and state management personnel, facilitate workshops

as required, train and supervise independent observer efforts, directly contribute to this research utilizing accepted scientific methodology, and travel as required in performance of these duties.

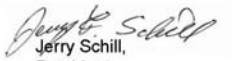
NCFA Fisheries Biologist David Bush will perform that work. He will coordinate with his Co-PI Wendy Piniak of Gettysburg College and report to his board of directors with work results and updates as outlined in the scope of work enclosed within the application.

It is our understanding that, in the event this proposal is awarded, a subcontract will be issued in the estimated amount of $12,505 for the period covering 9/1/2017 through 8/31/2019. While this amount and dates appear in the application, the actual amount and project dates awarded to NCFA will be determined based on Gettysburg College's executed award.

The appropriate programmatic and administrative personnel of each institution involved in this grant application are aware of the sponsor's guidelines and pertinent regulations and policies and are prepared to establish the necessary inter-institutional agreement(s) consistent with all such policies. NCFA hereby certifies that neither it nor its principles nor those performing services under this application are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency from participation in this transaction.

Thank you for the opportunity to contribute to this project and we look forward to working with Dr. Piniak and Gettysburg College.

Respectfully,



Jerry Schill,
President,
NC Fisheries Association
2807 Neuse Blvd Suite 11
New Bern, NC 28562
252-633-6232 Ext. 100

cc: NCDMF - Director Braxton Davis, Biologists: Chris Batsavage, Jacob Boyd
NCFA - Board and Director

APPENDIX F

NORTH CAROLINA MARINE FISHERIES COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY

Aug. 25, 2016

Mr. Bob Lorenz
P.O. Box 10512
Wilmington, NC 28404

Dear Bob:

I wanted to let you know at last week's Marine Fisheries Commission meeting I announced the Sea Turtle Advisory Committee was being disbanded. I wanted to contact you directly and let you know I had taken this action and the reason why.

The commission has a multitude of committees, many of which are statutorily mandated, such as the Northern and Southern regional advisory committees and the Finfish, Shellfish/Crustacean and Habitat and Water Quality advisory committees. These committees require a great deal of attention, both in staff time and in resources. In looking for efficiencies in our committee system, I felt our regional and pertinent standing advisory committees could serve as venues to review and provide the needed input on sea turtle issues. So, after much consideration, I decided to disband the Sea Turtle Advisory Committee, because it is not statutorily required. This was a difficult decision, especially since I served on the Sea Turtle Advisory Committee prior to being appointed to the Marine Fisheries Commission.

Later this fall we will be doing our annual solicitation for advisers. If any of you are interested in serving on other committees, please let me know and I will make every effort to place you on one of these committees as openings become available.

In closing, please know how much I appreciate your dedication and service to the state. I encourage you to please stay involved in fisheries issues and I hope to see you or hear from you in the future.

Sincerely,

Sammy Corbett, Chairman
N.C. Marine Fisheries Commission

cc: Chris Batsavage, Division of Marine Fisheries

Annual Atlantic Sturgeon Interaction Monitoring of the Gill-Net Fisheries in North Carolina for Incidental Take Permit Year 2017

Annual Completion Report for Activities under Endangered Species Act
Section 10 Incidental Take Permit No. 18102

Jacob Boyd

North Carolina Department of Environmental Quality
North Carolina Division of Marine Fisheries
Protected Resources Section
3441 Arendell Street
Morehead City, NC 28557

February 2018

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Figure 9. Length-frequency (fork length) of observed incidental captures of Atlantic sturgeon where measurements were obtained (n = 86) by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017). 50

INTRODUCTION

The North Carolina Division of Marine Fisheries (NCDMF) applied for an Incidental Take Permit (ITP) under Section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973 (Public Law 93-205, ESA) on April 5, 2012 for Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) interactions with the anchored gill-net fisheries in North Carolina's internal coastal (estuarine) waters. This request was prompted by notification from the National Marine Fisheries Service (NMFS) in February 2012 indicating the intent to list the Carolina Distinct Population Segment (DPS) of Atlantic sturgeon as endangered under the ESA. The NCDMF requested an ITP to implement a proposed conservation plan that ensured only a reasonable level of authorized Atlantic sturgeon incidental takes will occur, while allowing North Carolina's estuarine gill-net fisheries to operate. The NCDMF requested the NMFS to authorize such takes that are incidental to normal fishing activity with increased public outreach by the NCDMF to help fishermen avoid, minimize, and mitigate incidental takes of Atlantic sturgeon.

Feedback on the ITP application was received from the NMFS on May 29, 2012 via a teleconference with the NCDMF and the NMFS staff. After further review, on July 20, 2012 the NMFS requested the NCDMF to submit a revised permit application and Conservation Plan that addressed issues that were provided. In response to requested changes from the NMFS, the NCDMF made extensive revisions and resubmitted the application on December 20, 2012. Upon further review the NMFS provided the NCDMF with a list of questions they had regarding the application. On February 4, 2013, the NMFS and the NCDMF went over questions regarding the ITP application and Conservation Plan. Another revised ITP application was resubmitted to the NMFS on June 28, 2013 encompassing all comments and concerns raised by the NMFS. On July 9, 2013, the NMFS published a notice of receipt of the NCDMF application (File No. 18102) in the Federal Register (78 FR 41034). The comment period ended August 8, 2013. After further deliberation with the NMFS another revision of the Atlantic Sturgeon ITP was resubmitted on January 2, 2014.

The NCDMF received the Atlantic Sturgeon ITP (No. 18102) on July 22, 2014. The Atlantic Sturgeon ITP defined an ITP Year as beginning on September 1 and running through August 31 of the following year. This ITP authorized the implementation of adaptive management measures to protect endangered Atlantic sturgeon and other ESA listed species, while allowing anchored gill-net fisheries to be prosecuted in the estuarine waters of North Carolina. The ITPs Conservation Plan specifies further measures, which the NMFS determined will minimize, monitor, and mitigate the impacts of incidental takes of ESA-listed Atlantic sturgeon from the Gulf of Maine, New York Bight, Chesapeake, Carolina, and South Atlantic DPSs, associated with the otherwise lawful anchored gill-net fisheries operating in estuarine North Carolina waters. Anchored gill nets are passive sets deployed with an anchor, stake, or boat at one or both ends of the net shots or operation. Anchored gill nets do not include the following types of gill nets: run-around, strike, drop or drift gill nets.

On November 21, 2016, the NCDMF requested a minor modification to extend the future annual report deadlines for the Atlantic Sturgeon and Sea Turtle (No. 16230) ITPs from January 31 to the last day in February. This extension was to benefit staff due to a lag time in data being uploaded and verified, the time of year, the deadline for the fall seasonal report, and staff availability. On January 4, 2017, the NMFS sent a letter to the NCDMF concurring with NCDMF's request for the minor modification encouraging staff to incorporate any further anticipated minor modifications into the application process for an updated ITP (Appendix A).

The NCDMF Observer Program data were updated using the finalized 2016 Trip Ticket Program (TTP) data in May 2017 (Appendix B). The Annual Completion Report for the Atlantic Sturgeon ITP was completed for ITP Year 2016 and submitted in February 2017. Using the finalized 2016 data, Tables 1, 2, 5, and 6 from the Completion Report were updated to reflect the final estimates of observer coverage and Atlantic sturgeon takes. The fall 2015 season was based on finalized 2016 TTP data and did not deviate from the previous report for both anchored large and small mesh gill nets (Appendix B).

On July 13, 2017, the NCDMF requested a minor modification to the Atlantic Sturgeon ITP to modify the allocation of allowed Atlantic sturgeon takes in management units A and C as annual takes rather than seasonal takes. Discussions with NMFS staff noted the number of allowed seasonal takes is very low in some cases, and the seasonal takes have been reached on a few occasions (resulting in seasonal closures). Further discussions with NMFS staff concluded that a minor modification would be feasible. However, there was a concern noted on the issue of warmer water temperatures (20°C – 30°C) being correlated with more mortalities. The NCDMF addressed this concern describing how by using adaptive management, the NCDMF has more flexibility in managing the fishery with annual allocated takes to ensure the allowed takes are not exceeded for any management unit during the ITP Year. Lower fishing effort in the summer season (compared to the fall season) due to increasing water temperatures and fish availability should not create an issue for Atlantic sturgeon mortalities going over the allowed mortalities levels for takes. The NCDMF further explained that by actively monitoring the fisheries and take levels daily, it better ensures take levels (including limiting mortality levels) are not exceeded. On July 19, 2017, the NMFS sent a letter to the NCDMF concurring with NCDMF's request for the minor modification encouraging staff to incorporate any further anticipated minor modifications into the application process for an updated ITP (Appendix C).

METHODS

Observer Activity

The conservation plan includes managing inshore gill-net fisheries by dividing estuarine waters into seven management units (A1, A2, A3, B, C, D, and E; Figure 1). Trip Ticket Program data along with Observer Program data from previous years are used when estimating the number of trips needed for the current year in each management unit and season. Also, real time TTP data are used for areas where effort may be increasing. Each year effort can potentially shift from one management unit to another making it important for the NCDMF to not base the observer effort solely on previous years' TTP data, but also on current effort changes. To account for fluctuations in TTP data caused by management unit closings, a five-year average was used for estimating anchored large mesh gill-net fishing trips and a four-year average was used for estimating anchored small mesh gill-net fishing trips for ITP Year 2017. This method of estimating trips proves to more accurately reflect the current fishing effort. Once TTP data are finalized in May of 2018, the final observer coverage will be recalculated and the finalized estimates of observer coverage will be provided to the NMFS.

Observer coverage was calculated for each season in each management unit by estimating fishing trips using an average of the previous five years' TTP data (2012-2016) for anchored large mesh gill nets and the average of the previous four years' (2013-2016) TTP data for anchored small mesh gill nets, while taking reduced season dates in each management unit into account by calculating the proportion of actual to possible fishing days. This calculated estimated fishing effort was compared to the observer trips completed throughout the ITP Year. The average, normalized effort was used when estimating fishing trips to account for the fluctuation of fishing effort throughout the years due to closures and other regulations put in place throughout the time series.

The onboard Observer Program, where observers ride onboard fishermen's vessels, is the preferred method of obtaining observer data and is used most frequently. Protected species interactions, gear parameters, as well as detailed gill-net catch, bycatch, and discard information for all species caught are recorded. The alternative platform Observer Program requires two observers in a state-owned vessel to monitor commercial fishermen as they fish their gill nets. The alternative platform observers document protected species interactions and provide catch and discard estimates for other species that are observed. The amount of biological data that are collected on alternative platform observer trips is notably less than onboard observer trips. Therefore, onboard observer trips are highly preferred due to the amount of biological data collected which are used when making management decisions, in stock assessments, in the development of fishery management plans, and for identifying bycatch (finfish, protected species) problem areas. For alternative platform trips, observers and Marine Patrol follow similar protocols using NCDMF vessels to observe the fishing trip. Each observer attempts to obtain a minimum of three to four trips per working week when fishing activity is occurring.

Observers are assigned a management unit to work weekly and the number of observers assigned to a management unit depends upon the season and fishing effort. Fishing effort is estimated from the previous 4-5 years' TTP data by week, month, and management unit to determine where and how much observer coverage is needed each week and for each management unit by month/season. Reports from observers and other staff are used to determine if effort is fluctuating between management units. Trends from the previous years' TTP data are also analyzed to determine if fishing effort is shifting from one management unit to another. Fishermen holding an Estuarine Gill Net Permit (EGNP) in North Carolina are pooled by management unit and further split into lists by geographic area within units. The contact information for these fishermen is then given to the observers assigned to that area and the observers contact the fishermen to set up trips from the list of names given. Preliminary TTP information is also used to refine the list to represent individuals who are actively participating in fishing activities. Observers also visit fish houses and dealers where they hand out business cards with their contact information and brochures explaining the Observer Program, giving the fishermen another outlet to allow observers on their vessels. Additionally, the Observer Program uses a website (http://portal.ncdenr.org/web/mf/observers-program) to provide outreach to fishermen to facilitate obtaining trips.

Alternative platform trips are used for areas that may be hard to get onboard trips (i.e., fishermen in remote locations that leave from their residence by boat) or when the fisherman's vessel is too small to safely accommodate an onboard observer. Alternative platform trips are also used in areas where fishing effort may increase quickly, where Atlantic sturgeon abundance is high, and when observers are unable to set-up onboard trips due to fisherman non-compliance. Marine Patrol also conducts alternative platform trips weekly in all management units based on the same methodology as the Observer Program. Coordination of onboard, alternative platform, and Marine Patrol alternative platform trips is done regularly to maximize efficiency and to achieve the maximum amount of observer coverage possible for each management unit. Changes in effort, Atlantic sturgeon abundance (i.e., observed and reported interactions), and other protected species interactions are monitored on a daily, weekly, and monthly basis to ensure proper observer coverage is being maintained. The ITP requires a minimum of 7% observer coverage with a goal of 10% of the total anchored large mesh gill-net (≥5 inches stretched mesh-ISM) fishing trips and 1% coverage with a goal of 2% of the total anchored small mesh gill-net (<5 ISM) fishing trips per management unit for the spring, summer, fall, and winter seasons.

Observers are trained to identify, measure, evaluate condition, and tag Atlantic sturgeon by the NCDMF. Date, time, tag numbers, location (latitude and longitude, when possible), condition (i.e., no apparent harm, injury including a description of the nature of the injury, or mortality), species, total length (TL mm), and fork length (FL mm) are recorded for each sturgeon observed. Photographs and environmental parameters (i.e., salinity, water temperature) are also collected when feasible. Dead Atlantic sturgeon are retained by the observer when possible. Observers

also collect data on location, gear parameters, catch, and bycatch for each haul depending on the observed trip type (onboard/alternative platform). The catch is sampled throughout each onboard trip including species, quantities, weights, lengths, and disposition (alive/dead). Data are coded on the NCDMF data sheets and uploaded to the NCDMF Biological Database for analysis. All observers are debriefed within 24 hours of each trip to obtain data on catch, set locations, gear parameters, and Atlantic sturgeon interactions to provide estimates of Atlantic sturgeon bycatch.

The total bycatch of Atlantic sturgeon for each management unit was estimated using the stratified ratio method (SAS 2004). The bycatch rate (Atlantic sturgeon caught per fishing trip) estimated from observer data was multiplied by the total fishing trips. To estimate confidence intervals (95%), the bootstrap method was used to sample estimates. Strata consisted of five management units (A, B, C, D, and E) where management unit A1-A3 (A) and D1-D2 (D) were combined for analysis (Figure 1). Estimates were calculated by date of capture, management unit, and disposition. Estimates were accumulated each week to implement necessary management measures if authorized take thresholds were approached.

$$\text{Estimated Interactions} = \left(\frac{\text{\# of Atlantic sturgeon interactions observed}}{\text{total gill-net trips observed}}\right) \text{total gill-net trips}$$

Seasons

The Observer Program's activities are reported on a monthly and annual basis. Seasons are defined as spring (March – May), summer (June – August), fall (September – November), and winter (December – February). Monthly progress reports include information such as take estimates, cumulative totals, number of observed trips, and observed takes with all associated. Annual reports include actual and estimated takes including mortality and the level of uncertainty of the estimates (i.e., 95% confidence intervals) by management unit, size composition along with all other interaction information, one or more maps illustrating the geographic distribution of all observed anchored large and small mesh gill-net hauls and the locations of all interactions, and a description of the mitigation activities, adaptive management actions, and enforcement activities conducted during the ITP year.

Authorized Takes

Authorized levels of annual incidental takes are specified in Tables 1 and 2. The amount of incidental takes is expressed as either estimated or observed takes depending on the amount of data available for modeling predicted takes. Management unit A has estimated allowable takes per season for both anchored large and small mesh gill nets due to having robust data sets for the area. All other management units (i.e., B, C, D, E) have observed allowable takes which are actual takes and not estimated due to the lack of data for modeling estimated takes. Extrapolated Atlantic sturgeon takes were computed by dividing observed interactions by observer coverage.

Nonparametric confidence intervals (95%) were calculated using standard bootstrapping techniques (Efron and Tibshirani 1993) using the 'boot' package in R (Canty and Ripley 2015; Davison and Hinkley 1997; R Core Team 2015). Bootstrap replicates were generated by sampling observer trips with replacement 5,000 times within strata (mesh/season/management unit; Tables 1 and 2). Takes must be incidental to otherwise lawful activities associated with the anchored large and small mesh gill-net fisheries, and as conditioned herein. The permit covers incidental takes from the date of issuance through July 17, 2024. The NCDMF uses preliminary data to monitor the total number of live and dead takes per unit and season to determine if the NCDMF is approaching or has reached the allowable Atlantic sturgeon takes. However, there is no "real time" method to determine the actual DPS taken. The genetic sampling required by the ITP will provide the actual take numbers per DPS, but this will not be determined until after genetic samples are processed and if funding allows. Once TTP data are finalized in May of 2018, the final authorized estimated Atlantic sturgeon takes will be recalculated and the finalized estimates will be provided to the NMFS.

Compliance

The NCDMF observers and Marine Patrol conduct weekly fish house visits, boat patrols, fisherman spot checks, gear checks, aerial surveys, and continual outreach to the industry attempting to ensure industry compliance and to determine anchored large and small mesh gill-net fishing effort throughout the state.

The Observer Program has various ways to contact fishermen to schedule trips. The most common method is by phone due to limited program resources, fishermen leaving from their residence, and efficiency. The Observer Program has a contact log which is filled out for every phone call or contact that is made when attempting to obtain a trip. Each contact was put into a specific category and other information was gathered (Table 3). The contact log was analyzed by month and category to determine what percentage of phone calls resulted in observer trips.

RESULTS

Observer activity

Fall 2016

The fall 2016 season for anchored large and small mesh gill nets in North Carolina is September 2016 through November 2016 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 18102. Portions of management unit A (western Albemarle Sound, Currituck Sound, and the rivers) opened to anchored large and small mesh gill nets for the new ITP Year 2017 via proclamation M-15-2016 on September 5, 2016 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles (Table 4; Boyd 2016b). Further portions of management unit A (western/central Albemarle Sound) opened to anchored large and small mesh gill nets for the new ITP Year 2017 via proclamation M-21-2016 on October 15, 2016 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles. As the fall 2016 season progressed, further portions of management unit A (central/eastern Albemarle Sound) opened to anchored large and small mesh gill nets for the new ITP Year 2017 via proclamation M-23-2016 on October 31, 2016 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles (Table 4; Boyd 2016b).

Portions of management unit B (subunits SGNRA2-4, MGNRA) opened to anchored large mesh gill nets for the new ITP Year 2017 via proclamation M-16-2016 on September 5, 2016 while maintaining the closure of subunits SGNRA1 and CGNRA to minimize interactions with sea turtles (Table 4; Boyd 2016b). Remaining portions of management unit B (subunits SGNRA2-4, MGNRA) opened to anchored large mesh gill nets for the new ITP Year 2017 via proclamation M-19-2016 on October 3, 2016. Management unit B closed to anchored large mesh gill nets via proclamation M-24-2016 on November 2, 2016 due to sea turtle interactions and the lack of fishermen compliance (Table 4; Boyd 2016b).

Management unit C closed to anchored large and small mesh gill nets via proclamation M-20-2016 on October 1, 2016 for the remainder of the fall 2016 season due to sea turtle interactions. Management unit D1 opened to anchored large mesh gill nets for the new ITP Year 2017 via proclamation M-22-2016 on October 17, 2016 (Table 4; Boyd 2016b).

Management unit E opened to anchored small mesh gill nets for the new ITP Year 2017 via proclamation M-16-2016 on September 5, 2016 while maintaining the closure of upper Cape Fear and Northeast Cape Fear rivers to anchored large mesh gill nets to minimize sturgeon interactions (Table 4; Boyd 2016b).

The Observer Program achieved an estimated 11.2% overall anchored large mesh gill-net coverage for the fall 2016 season meeting the minimum requirement (7.0%) in all management units based on finalized data (Table 5; Figures 2 - 7; Boyd 2016b).

The Observer Program achieved an estimated 3.3% overall anchored small mesh gill-net coverage for the fall 2016 season meeting the minimum requirement (1.0%) in all management units except management unit A (0.0%) based on finalized data (Table 6; Figures 2 – 7; Boyd 2016b).

There were 53 observed Atlantic sturgeon interactions from anchored large mesh gill nets for the fall 2016 season (Table 7; Figures 2 – 7; Boyd 2016b). Of the 53 interactions, 96.2% were alive. The majority of the interactions (98.1%) occurred in management unit A. Management unit E had one alive interaction during this period (Table 7; Figures 2 - 7). A shortnose sturgeon was also observed alive in management unit A during this period. There were two fisherman self-reported reported Atlantic sturgeon interactions during this period (Table 8; Boyd 2016b).

Winter 2016-2017

The winter 2016-2017 season for anchored large and small mesh gill nets in North Carolina is December 2016 through February 2017 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 18102. Management unit A implemented restrictions on anchored small mesh gill nets requiring nets to be set so as to fish on the bottom and not exceed a vertical height of 48 inches on December 1, 2016 via proclamation M-25-2016 (Table 4). Management unit A closed to anchored large mesh gill nets on December 13, 2016 via proclamation M-32-2016 due to reaching allowable Atlantic sturgeon takes. Portions of management unit A (northern rivers) reopened to anchored large mesh gill nets via proclamation M-1-2017 on January 29, 2017 to allow fishermen to participate in the catfish fishery while maintaining a closure of all anchored gill nets in the eastern portions to avoid interactions with Atlantic sturgeon. Further portions of management unit A (Alligator River/Currituck Sound) reopened to anchored large mesh gill nets via proclamation M-2-2017 on February 6, 2017 (Table 4).

Management unit C opened to anchored large and small mesh gill nets on December 5, 2016 via proclamation M-27-2016 (Table 4).

Gear exemptions implemented on February 15, 2017 via proclamation M-4-2017 for portions of the Internal Coastal Waters south of management unit A to allow large mesh gill nets for the shad fishery. All other management units remained open to anchored large and small mesh gill nets for the duration of the winter 2016-2017 season (Table 4).

The flounder commercial harvest season in internal coastal waters closed on December 1, 2016 via proclamation FF-53-2016 as per Amendment 1 to the Southern Flounder Fishery Management Plan (Table 4).

The Observer Program achieved an estimated 8.6% overall anchored large mesh gill-net coverage for the winter 2016-2017 season meeting the minimum requirement (7.0%) in all management units except for management unit B based on preliminary data. Observer coverage for management unit B was 1.1% for the winter 2016-2017 season (Table 5; Figures 2 – 7).

The Observer Program achieved an estimated 5.6% overall anchored small mesh gill-net coverage for the winter 2016-2017 season meeting the minimum requirement (1.0%) in each management unit based on preliminary data (Table 6; Figures 2 - 7).

There were 10 observed Atlantic sturgeon interactions from anchored large mesh gill nets and one from anchored small mesh gill nets during the winter 2016-2017 season. All 11 Atlantic sturgeon interactions were alive with 10 observed in management unit A and one in management unit C during this period (Table 7; Figures 2 - 7). There was one reported Atlantic sturgeon interaction from illegally set gill net during this period (Table 8).

Spring 2017

The spring 2017 season for anchored large and small mesh gill nets in North Carolina is March 2017 through May 2017 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 18102. Management unit A opened to the use of anchored large mesh gill nets with gill net configurations for harvesting American shad by removing vertical height restrictions for up to 1,000 yards of gill net with stretched mesh lengths of 5 ¼ through 6 ½ inches via proclamation M-5-2017 on March 3, 2017 while implementing the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles. Gill-net configurations for harvesting American shad were removed in management unit A following the end of the shad season via proclamation M-7-2017 on March 25, 2017 while maintaining the closure of all anchored gill nets in the eastern portions of the management unit (eastern/southern Albemarle Sound and Croatan and Roanoke sounds) to avoid interactions with sea turtles (Table 4; Boyd 2017b).

Management unit B remained closed to anchored large mesh gill nets through the spring 2017 season to allow for the recalculation of allowable sea turtle takes once finalized 2016 Trip Ticket data were completed (Table 4; Boyd 2017b).

Management unit D1 closed to anchored large mesh gill nets as part of the annual closure outlined in the ITP via proclamation M-10-2017 on May 8, 2017 (Table 4; Boyd 2017b).

The Observer Program achieved an estimated 9.7% overall anchored large mesh gill-net coverage for the spring 2017 season meeting the minimum requirement (7.0%) in all management units based on preliminary data (Table 5; Figures 2 - 7; Boyd 2017b).

The Observer Program achieved an estimated 2.2% overall anchored small mesh gill-net coverage for the spring 2017 season meeting the minimum requirement (1.0%) in all management units except management unit A (0.8%) based on preliminary data (Table 6; Figures 2 – 7; Boyd 2017b).

There were 37 observed Atlantic sturgeon interactions from anchored large mesh gill nets and two from anchored small mesh gill nets for the spring 2017 season. All 39 Atlantic sturgeon interactions were alive during this period (Table 7; Figures 2 – 7). There was one fisherman self-reported Atlantic sturgeon interaction during this period (Table 8; Boyd 2017b).

Summer 2017

The summer 2017 season for anchored large and small mesh gill nets in North Carolina is June 2017 through August 2017 for ITP Year 2017 (September 1, 2016 – August 31, 2017) as defined in ITP No. 18102. Management unit B opened to anchored large mesh gill nets except for the Inlet Corridors via proclamation M-11-2017 on June 19, 2017 (Table 4; Boyd 2017c).

Management unit C closed to anchored large and small mesh gill nets for the remainder of the summer 2017 season on July 28, 2017 due to sea turtle interactions via proclamation M-12-2017 (Table 4; Boyd 2017c).

Management unit D1 remained closed through the summer 2017 season to anchored large mesh gill nets as part of the annual closure outlined in the Sea Turtle ITP (Table 4; Boyd 2017c).

The Observer Program achieved an estimated 11.3% overall anchored large mesh gill-net coverage for the summer 2017 season meeting the minimum requirement (7.0%) in all management units except management unit A (4.9%) and C (6.9%) based on preliminary data (Table 5; Figures 2 – 7; Boyd 2017c).

The Observer Program achieved an estimated 1.6% overall anchored small mesh gill-net coverage for the summer 2017 season meeting the minimum requirement (1.0%) in all management units based on preliminary data (Table 6; Figures 2 – 7; Boyd 2017c).

There was one alive observed Atlantic sturgeon interaction from anchored large mesh gill nets for the summer 2017 season (Table 7; Figures 2 - 7). There were no reported Atlantic sturgeon interactions during this period (Table 8; Boyd 2017c).

Authorized Takes

There was a total of 101 observed Atlantic sturgeon interactions in anchored large mesh gill nets and three in anchored small mesh gill nets for ITP Year 2017 (Table 7; Figures 2 – 8; Boyd 2016b, 2017b, 2017c). Of the 104 interactions, 98.1% were alive. Observed interactions mostly occurred in management unit A (93.3%), with interactions in management unit B (1.0%), management unit C (3.9%), and management unit E (1.9%; Table 7; Figures 2 - 7). Of the four reported Atlantic sturgeon interactions for ITP Year 2017, three were fisherman self-reported and one was reported by Marine Patrol from illegally set gill nets (Table 8; Boyd 2016b, 2017b, 2017c).

The size distribution of Atlantic sturgeon (n = 98) ranged from a TL (n = 98) of 406 mm to 1,580 mm and a FL (n = 86) of 376 mm to 1,420 mm (Table 7; Figures 8 and 9; Boyd 2016b, 2017b, 2017c).

The cumulative total estimated and observed takes for anchored large and small mesh gill nets did not reach the threshold of allowed takes for any management unit for ITP Year 2017 except for alive takes in management unit A for the winter 2016-2017 season based on preliminary data (Table 1 and 2; Boyd 2016b, 2017b, 2017c). However, once finalized data were used to estimate takes, the total estimated takes for the winter 2016-2017 season in management unit A were below the allowed take level (Table 1).

The percentage of authorized takes that were used in ITP Year 2017 for anchored large mesh gill nets were calculated for estimated takes by season and disposition for management unit A (fall 27.3% alive, 32.8% dead; winter 45.9% alive, 0.0% dead; spring 68.1% alive, 0.0% dead; summer 7.2% alive, 0.0% dead). The percentage of authorized takes that were used in ITP Year 2017 for anchored small mesh gill nets were calculated for estimated takes by season and disposition for management unit A (fall 0.0% alive/dead; winter 5.3% alive, 0.0% dead; spring 0.0% alive/dead; summer 0.0% alive/dead (Boyd 2016b, 2017b, 2017c).

The percentage of authorized takes that were used in ITP Year 2017 were also calculated for anchored large mesh gill nets for observed takes by management unit, season, and disposition (management unit C fall 0.0% alive/dead; winter 33.3% alive, 0.0% dead; spring 60.0% alive, 0.0% dead; summer 0.0% alive/dead; Boyd 2016b, 2017b, 2017c). Management unit E, which are under annual allowed take allocations, had 10.0% alive, 0.0% dead. Management units B and D did not have any observed takes for ITP Year 2017 in anchored large mesh gill nets. The percentage of authorized takes that were used in ITP Year 2017 were also calculated for anchored small mesh gill nets for observed takes by management unit, season, and disposition (management unit B fall 0.0% alive/dead; winter 0.0% alive/dead; spring 11.1% alive, 0.0% dead; summer 0.0% alive/dead). Management unit E, which are under annual allowed take

allocations, had 10.0% alive, 0.0% dead. Management units C and D did not have any observed takes for ITP Year 2017 in anchored small mesh gill nets (Boyd 2016b, 2017b, 2017c).

Compliance

Marine Patrol made 366 gill-net checks during the fall 2016 season resulting in 44 citations being issued (Tables 9 and 10; Boyd 2016b, 2017b, 2017c). Marine Patrol made 274 gill-net checks during the winter 2016-2017 season resulting in 144 citations being issued. Marine Patrol made 395 gill-net checks for the spring 2017 season resulting in 10 citations being issued. Marine Patrol made 960 gill-net checks for the summer 2017 season with no citations being issued (Tables 9 and 10; Boyd 2016b, 2017b, 2017c).

For ITP Year 2017, phone calls (n = 9,132) were made with 56.3% (n = 5,144) being categorized as 1, 8, 11, 12, 13, and 14 which inclusively represents not being able to get in touch with fishermen or fishermen refusing trips (Table 11; Boyd 2016b, 2017b, 2017c). In the fall 2016 season (n = 2,660), phone calls were made with 49.4% (n = 1,313) being categorized as 1, 8, 11, 12, 13, and 14. In the winter 2016-2017 season (n = 1,356), phone calls were made with 52.7% (n = 714) being categorized as 1, 8, 11, 12, 13, and 14. In the spring 2017 season (n = 2,425), phone calls were made with 61.4% (n = 1,490) being categorized as 1, 8, 11, 12, 13, and 14. In the summer 2017 season (n = 2,691), phone calls were made with 60.5% (n = 1,627) being categorized as 1, 8, 11, 12, 13, and 14 (Table 11; Boyd 2016b, 2017b, 2017c).

Notices of Violations (NOV) were issued when fishermen were found to be out of compliance with the EGNP with eight NOVs issued during the fall 2016 season, 18 NOVs issued during the winter 2016-2017 season, six NOVs issued during the spring 2017 season, and three NOVs issued during the summer 2017 season (Table 12; Boyd 2016b, 2017b, 2017c).

Marine Mammals

There were no observed takes of marine mammals during ITP Year 2017.

DISCUSSION

Management history

Initial reviews of the Atlantic sturgeon status began in 1977, when the Research Management Division of the NMFS sponsored the preparation of a report on the biology and status of Atlantic sturgeon (Murawski and Pacheco 1977). In 1980 at the request of the NMFS, another document was prepared by Hoff (1980) to assist in making future Atlantic sturgeon fisheries decisions and to determine what action was required, if any, to conserve the species under the ESA. In 1988, the NMFS requested information regarding the status of Atlantic sturgeon. The NMFS added Atlantic sturgeon to its candidate species list published in the Federal Register (FR) in 1997 (62 FR 37560, 14 July 1997, NMFS 1997a). Prior to the federal listing, North Carolina had taken steps to protect Atlantic sturgeon. The NCDMF implemented a statewide moratorium on the possession of Atlantic sturgeon in 1991 (15A NCAC 03M.0508).

In April 2004, the NMFS published a subsequent notice announcing that the NMFS "candidate species list" was being changed to the "Species of Concern (SOC) list" to better reflect the ESA definition of candidate species while maintaining a separate list of species potentially at risk (69 FR 19975 -15 April 2004, NMFS 2004a; ASSRT 2007).

On June 2, 1997, a petition dated May 29, 1997 was received by the NMFS from the Biodiversity Legal Foundation. The petitioner requested that the NMFS list Atlantic sturgeon, where it continues to exist in the United States, as threatened or endangered and designate critical habitat. The NMFS reviewed the request and determined that the petition presented substantial information indicating that the petitioned action may be warranted and announced the initiation of a status review (62 FR 54018, 12 October 1997, NMFS 1997b; ASSRT 2007).

The NMFS and United States Fish and Wildlife Service (USFWS) completed their status review in 1998 and concluded at that time Atlantic sturgeon were not threatened or endangered based on any of the five factors (NMFS and USFWS 1998). Concurrently, the Atlantic States Marine Fisheries Commission (ASMFC) completed Amendment 1 to the 1990 Atlantic Sturgeon FMP in 1998 that imposed a 20–40-year moratorium on all Atlantic sturgeon fisheries until the Atlantic Coast spawning stocks could be restored to a level where 20 subsequent year-classes of adult females were protected (ASMFC 1998). The NMFS followed this action by closing the Exclusive Economic Zone (EEZ) to Atlantic sturgeon harvest in 1999. In 2003, a workshop on the "Status and Management of Atlantic Sturgeon" was held to discuss the current status of Atlantic sturgeon along the Atlantic Coast and determine what obstacles, if any, were impeding the recovery of Atlantic sturgeon (Kahnle et al. 2005; ASSRT 2007).

Based on the information gathered from the 2003 workshop on Atlantic sturgeon, the NMFS decided that a second review of Atlantic sturgeon status was needed to determine if listing as threatened or endangered under the ESA was warranted. The 2007 analysis from the Atlantic

Sturgeon Status Review Team (ASSRT) determined that at least three (New York Bight, Chesapeake Bay, and Carolina) of the five DPSs should be considered threatened under the ESA, as it was determined that they had a moderately high risk of becoming threatened in the foreseeable future (next 20 years). The ASSRT determined that the remaining two DPSs (Gulf of Maine, South Atlantic) had a moderate risk of becoming extinct, though there were insufficient data to allow for a full assessment of these subpopulations; thus, a listing recommendation was not provided (ASSRT 2007).

On October 6, 2009, the NMFS received a petition from the Natural Resources Defense Council to list Atlantic sturgeon throughout its range as endangered under the ESA. As an alternative, the petitioner requested that the species be listed as the five DPSs described in the 2007 Atlantic sturgeon status review (ASSRT 2007), with the Gulf of Maine and South Atlantic DPSs listed as threatened and the remaining three DPSs listed as endangered. The petitioner also requested that critical habitat be designated for Atlantic sturgeon under the ESA. The NMFS published a Notice of 90-Day Finding on January 6, 2010 (75 FR 838, 6 January 2010, NMFS 2010) stating that the petition presented substantial scientific or commercial information indicating that the petitioned actions may be warranted. The NMFS considered the information provided in the status review report, the petition, other new information available since completion of the status review report, and information submitted in response to the Federal Register announcement of the 90-day finding (75 FR 838, 6 January 2010, NMFS 2010). On October 6, 2010, the NMFS published a proposed rule to list the Carolina DPS of Atlantic sturgeon as endangered under the ESA (75 FR 61871, 6 January 2010, NMFS 2010). On February 6, 2012, the NMFS issued a final determination to list the Carolina DPS of Atlantic sturgeon as an endangered species under the ESA (77 FR 5914, 6 February 2012, NMFS 2012).

Prior to the listing of Atlantic sturgeon, NCDMF has addressed protected species issues in the coastal waters of North Carolina since the 1970s. The NCDMF applied for and received four ITPs for the Pamlico Sound Gill Net Restricted Area (PSGNRA) from 2000 to 2005 to address sea turtle takes in the anchored large and small mesh gill-net fisheries for the Pamlico Sound portion of the state during the fall months (Gearhart 2001, 2002, 2003; Price 2004, 2005, 2006, 2007, 2008, 2009, 2010; Murphey 2011; Boyd 2012, 2013). The NCDMF applied for and received a 10-year ITP addressing sea turtle takes in the anchored large and small mesh gill-net fisheries statewide on September 11, 2013. This ITP authorized the implementation of adaptive management measures to protect threatened and endangered sea turtles and other ESA listed species, while allowing the anchored gill-net fisheries prosecuted by license holders to occur in the estuarine waters of North Carolina. The Sea Turtle ITP No. 16230 defined an ITP Year as beginning on September 1 and running through August 31 of the following year.

Implementation of management actions such as gear restrictions, fishing seasons, soak times, area closures, mesh size restrictions, FMPs, and ITPs (Sea Turtle ITP No. 16230) for other

species have likely had a positive effect on reducing takes and minimizing the mortality associated with the incidental bycatch of Atlantic sturgeon. The North Carolina management system has shown the ability to effectively manage fisheries throughout the state and reduce incidental bycatch of finfish and protected species. Anchored gill-net restrictions implemented by the proclamations for the Sea Turtle ITP include: a range of 4 ISM to, and including, 6 ½ ISM for anchored large mesh gill nets; soak times limited to overnight soaks an hour before sunset to an hour after sunrise, Monday evenings through Friday mornings; anchored large mesh gill nets were restricted to a height of no more than 15 meshes, constructed with a lead core or leaded bottom line and without corks or floats other than needed for identification; a maximum of 2,000 yards of anchored large mesh gill nets allowed to be used per vessel; and maximum individual net (shot) length of 100 yards with a 25-yard break between shots. Fishermen in the southern portion of the state were allowed to set anchored large mesh gill nets an extra day (Sunday evenings through Friday mornings) and use floats on nets, but were restricted to the use of a maximum of 1,000 yards of anchored large mesh gill net per fishing operation.

The Annual Completion Report for ITP Year 2014 was submitted January 30, 2015 (Boyd 2015). During review of the 2014 Atlantic Sturgeon ITP Annual Completion Report, the NMFS requested modifications to certain tables and figures in the annual report. These modifications were addressed in the Annual Completion report for ITP Year 2015 (September 1, 2014 – August 31, 2015) which was submitted January 30, 2016 and included: maps for each management unit to include number of gill-net hauls and sea turtle interactions and tables which have all of the estimated/observed takes exactly as portrayed in the permit with 95% confidence intervals included (Boyd 2016a).

Outreach

Staff from the NCDMF met with commercial industry leaders on July 11, 2016 to discuss the current ITPs and options for moving forward with amendments. The North Carolina Fisheries Association (NCFA) requested the meeting in response to NCDMF staff asking industry for their thoughts on potential ITP amendments and ways to further minimize sea turtle takes (in order to keep management units open longer under the current ITPs). During the meeting, the NCFA discussed their interest in exploring gear modifications that are proven to reduce sea turtle interactions and would ultimately like to see the estuarine gill-net fishery managed under gear modifications (similar to the shrimp trawl fishery) without the constraints of the current ITPs. Staff from the NCDMF explained that while staff would be able to assist regarding the ITP permit process, the NCFA should work with researchers with expertise in gear development and apply for a research Section 10 permit. In order to reach their ultimate goal, the NCFA would like to work on minimizing takes and amending the current ITPs by soliciting feedback from commercial gill netters throughout the state.

The NCFA scheduled two meetings on August 30 and 31, 2016 that focused on potential ITP amendments and ways to further minimize sea turtle and sturgeon takes in the anchored gill-net fisheries. NCFA invited NCDMF staff to attend their meetings to hear the fishermen's feedback and to provide input on the feasibility of the fishermen's ideas. While discussing these meetings with the commercial industry leads, NCDMF staff raised the issue of the lack of fisherman compliance with the ITPs. NCFA fully agreed that it is a problem, and they plan on stressing the need for compliance at their meetings in order for the Observer Program to be successful. Another comment made by the NCFA was they felt that the onboard observations by the NCDMF are very important. They also mentioned that the onboard observations are needed to collect biological information from the catch as opposed to just monitoring protected species interactions.

Staff from the NCDMF attended both meetings NCFA held in Wanchese, NC on August 30, 2016 and in Morehead City, NC on August 31, 2016. While most of the meetings were discussions amongst fishermen or directed at NCFA members, NCDMF staff answered and/or clarified questions as needed. The questions and/or concerns from fishermen included: confusion that self-reporting sea turtle and sturgeon takes was a requirement of the ITPs, that the definition of a take includes live interactions, that the amount of restrictions already in place on the anchored gill-net fisheries were too great, and the belief that any further restrictions would lead to their inability to make a livelihood in the industry.

The North Carolina Watermen United (NCWU), which were in attendance at the August 30, 2016 meeting, sent NCDMF a letter on September 2, 2016 listing many modifications that were already in place in the gill-net fisheries, but suggests another "more-inclusive" meeting for further discussion (Appendix D). The NCFA sent NCDMF a follow-up email on September 19, 2016 with questions and concerns following the meetings (Appendix E). On November 30, 2016, the NCFA sent the NCDMF a commitment letter concerning their collaboration with Gettysburg College on a project titled, "Development of sensory-based bycatch reduction technologies to reduce sea turtle bycatch in North Carolina coastal gillnet and pound net fisheries" (Appendix F). The work on the project began in September 2017.

At the August 2016 NCMFC meeting, Chairman Sammy Corbett announced that he was disbanding the Sea Turtle Advisory Committee (STAC) because it is not statutorily required and the NCMFC committee system already has a multitude of committees which are statutorily mandated. Chairman Corbett sent a letter explaining his decision to the committee members on August 25, 2016 (Appendix G).

Observer Activity

There was turnover within the Observer Program with positions being filled as quickly as possible to maintain coverage. The Observer Program proportionally placed observers in areas with higher fishing effort. There were multiple closures of various management units throughout

the state during ITP Year 2017 (Table 4). Fishermen are more elusive to attempts by observers contacting them to schedule trips after proclamations enacting stricter regulations are implemented. Therefore, making it harder to obtain observer trips. When a management unit closes for a portion of time, the observers are shifted to the open management units. The contact log, which includes different categories to place each contact that was made to a fisherman, is beneficial for analyzing the type of contact that was being made and to see the number of observer trips that were obtained through the calling system.

During the fall 2016 season, attendance was required for anchored small mesh gill nets for the duration of the fall 2016 season in management unit A making it difficult to obtain observed trips (Boyd 2016b). In recent years, attendance requirements were lifted during the month of November allowing for observer trips to be obtained. Fishing practices for attended gill nets can be very different than other fishing practices, with fishing activity occurring throughout the night creating safety hazards for observers. Furthermore, fishing effort tends to be lower when attendance is required (Boyd 2016b).

During the winter 2016-2017 season, observer coverage for anchored large mesh gill nets in management unit B was 1.1% due to minimal fishing effort (n = 90 fishing trips) during the winter months.

During the spring 2017 season, observer coverage for anchored small mesh gill-nets in management unit A was 0.8% due to minimal fishing effort (n = 42 fishing trips; Boyd 2017b).

During the summer 2017 season, observer coverage for anchored large mesh gill-nets in management unit A was 4.9% and C was 6.9% (Boyd 2017c).

Compliance

Although ITP Year 2017 is the fourth year for the statewide ITP, fishermen in many portions of the state are not as familiar with the Observer Program and requirements of the ITP as desired, so more time is needed to educate the industry. Alternative platform trips were employed in all management units more frequently throughout ITP Year 2017 to maintain observer coverage due to compliance issues with fishermen (i.e., not answering phone calls, not calling back). The required minimum 7% observer coverage for anchored large mesh gill nets is very difficult to achieve when observers must rely on alternative platform trips, as it requires two observers to obtain a trip. The NCDMF discussed the situation with industry leaders in an attempt to improve awareness and increase compliance. However, fisherman non-compliance continues to be a hurdle for ensuring the requirements for both ITPs are met. Each ITP Year (2015-2017) had >50% of contacts made by observers not being able to get in touch with fishermen or fishermen refusing trips with a 7.6% increase in non-compliance over the last three years (Boyd 2016a, 2017a).

There were no fisherman self-reported Atlantic sturgeon takes during the winter 2016-2017 and summer 2017 seasons with only two fisherman self-reported takes during the fall 2016 season and one in the spring 2017 season (Table 8; Boyd 2016b, 2017b, 2017c). NCDMF has discussed this situation with industry leads numerous and has provided outreach to fishermen explaining the requirement in the ITP of self-reporting and further details on the subject to try and increase self-reporting throughout the industry as a whole with limited success.

Estuarine Gill Net Permit

As per the ITP, the NCDMF established an EGNP to register all fishermen participating in the anchored large and small mesh gill-net fisheries via proclamation M-24-2014 on September 1, 2014. The ITP's Implementing Agreement states that the NCDMF has two years to implement the EGNP to serve as a certificate of inclusion for fishermen. However, due to the compliance issues the NCDMF was facing during ITP Year 2014, the EGNP was developed and became effective September 1, 2014 (one year from ITP issuance; Boyd 2015). The multifaceted EGNP was enacted to attempt to allow the NCDMF to closely monitor compliance. The EGNP is also used as a tool to improve fishermen compliance by including Specific Permit Conditions requiring fishermen to allow the NCDMF observers aboard their vessels to monitor catches. Failure to comply with this permit provision can result in a permit suspension. There were 2,670 EGNPs issued for Fiscal Year 2017 (July 1, 2016 – June 30, 2017).

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TABLES

Table 1. Authorized and actual annual estimated incidental takes per fishing year (for a total of 10 years; the life of the permit) with confidence intervals (95%) using a bootstrap method based on observer data for coverage and Atlantic sturgeon interaction levels in North Carolina's anchored large mesh (≥5.0 ISM) inshore gill net fishery for ITP Year 2017 (September 1, 2016 - August 31, 2017).

		Total Interactions			
		Authorized (Mortality)		Actual All DPS [2]	
Management Unit	Season	Carolina DPS	Other DPS	Alive	Dead
A	Winter	149 (6)	50 (2)	91 [25,254]	0
	Spring	460 (19)	154 (6)	418 [221,790]	0
	Summer	157 (6)	52 (2)	15 [0,45]	0
	Fall	838 (34)	279 (11)	305 [174,538]	15 [0,45]
B	Winter	2 (1)[1]	n/a	0	0
	Spring	1 (1)[1]	1 (0)	0	0
	Summer	4 (2)[1]	2 (0)	0	0
	Fall	17 (2)[1]	6 (0)	0	0
C	Winter	2 (1)[1]	n/a	1	0
	Spring	3 (1)[1]	1 (0)	3	0
	Summer	2 (1)[1]	1 (0)	0	0
	Fall	4 (2)[1]	2 (0)	0	0
D	Annual	8 (2)[1]	n/a	0	0
E	Annual	8 (2)[1]	n/a	1	0
Total		1,655 (80)	548 (21)	834	15

[1] Total interaction number represents actual observed and not estimated based on observer coverage. Mortality estimates could not be completed for management units B-E due to low take; thus, if observed interactions were ≤ 5 mortality was one; if observed interactions were >5 mortality was two.

[2] Fin clip samples have been sent to the lab for genetic analysis

Table 2. Authorized and actual annual estimated incidental takes per fishing year (for a total of 10 years; the life of the permit) with confidence intervals (95%) using a bootstrap method based on observer data for coverage and Atlantic sturgeon interaction levels in North Carolina's anchored small mesh (<5.0 ISM) inshore gill net fishery for ITP Year 2017 (September 1, 2016 - August 31, 2017).

		Total Interactions			
		Authorized (Mortality)		Actual All DPS [2]	
Management Unit	Season	Carolina DPS	Other DPS	Alive	Dead
A	Winter	175 (14)	35 (3)	11 [0,33]	0
	Spring	219 (17)	44 (4)	0	0
	Summer	72 (6)	14 (1)	0	0
	Fall	103 (8)	21 (2)	0	0
B	Winter	2 (1)[1]	n/a	0	0
	Spring	6 (2)[1]	1 (0)	1	0
	Summer	3 (1)[1]	1 (0)	0	0
	Fall	3 (1)[1]	1 (0)	0	0
C	Winter	2 (1)[1]	n/a	0	0
	Spring	2 (1)[1]	n/a	0	0
	Summer	2 (1)[1]	n/a	0	0
	Fall	2 (1)[1]	n/a	0	0
D	Annual	8 (2)[1]	n/a	0	0
E	Annual	8 (2)[1]	n/a	1	0
Total		607 (58)	117 (10)	13	0

[1] Total interaction number represents actual observed and not estimated based on observer coverage. Mortality estimates could not be completed for management units B-E due to low take; thus, if observed interactions were $\leq$ 5 mortality was one; if observed interactions were >5 mortality was two.

[2] Fin clip samples have been sent to the lab for genetic analysis

Table 3. Categories and descriptions of fisherman responses for the Observer Program's contact logs used for analysis.

Categories	Category description
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

Table 4. Regulations for management units by date and regulation change for anchored large and small mesh gill nets for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Year	Date(s)	Regulation change
2016	Sept 5	Management unit A open to large and small mesh gill nets for the new ITP Year 2017 for the western part of the sound, Currituck Sound, and the rivers. All the eastern/southern areas (Croatan and Roanoke Sounds) will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-15-2016).
2016	Sept 5	Portions of management unit B (subunits SGNRA2-4, MGNRA) open to large mesh gill nets for the new ITP Year 2017. Subunits SGNRA1 and CGNRA will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-16-2016).
2016	Sept 5	Management unit E open to small mesh gill nets (large mesh gill nets continually open through summer for the new ITP Year 2017. Portions of upper Cape Fear River and Northeast Cape Fear River remain closed to large mesh gill nets due to sturgeon interactions (M-16-2016).
2016	Oct 3	Remaining portions of management unit B (subunits SGNRA1 and CGNRA) open to large mesh gill nets for the new ITP Year 2017 (M-19-2016).
2016	Oct 1	Closed management unit C to large and small mesh gill nets due to sea turtle interactions (M-20-2016).
2016	Oct 15	Further portions of management unit A open to large and small mesh gill nets for the new ITP Year 2017 for the central part of the sound. All the eastern/southern areas (Croatan and Roanoke Sounds) will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-21-2016).
2016	Oct 17	Management unit D1 open to anchored large mesh gill nets (M-22-2016).
2016	Oct 31	Further portions of management unit A open to anchored large and small mesh gill nets for the new ITP Year 2017 for the central and eastern part of the sound. Croatan and Roanoke sounds will remain closed until sea turtle abundance decreases to minimize interactions with sea turtles (M-23-2016).
2016	Nov 2	Management unit B closed to anchored large mesh gill nets due to sea turtle interactions and the lack of fishermen compliance (M-24-2016).
2016	Dec 1	Management unit A small mesh anchored gill nets 3 though 3 3/4 ISM restrictions while removing attendance requirements for those small mesh anchored gill nets, and requiring small mesh anchored gill nets to be set so as to fish on the bottom and not exceed a vertical height of 48 inches (M-25-2016).
2016	Dec 5	Management unit C open to anchored large and small mesh gill nets (M-27-2016).
2016	Dec 13	Management unit A closed to anchored large mesh gill nets due to reaching allowable Atlantic sturgeon takes (M-32-2016).

Table 4. (cont.).

Year	Date(s)	Regulation change
2017	Jan 29	Portions of management unit A open to anchored large mesh gill nets (northern rivers) while maintaining closure of anchored large mesh gill nets in all other portions to allow directed gill net fisheries for catfish while minimizing interactions with Atlantic sturgeon (M-1-2017).
2017	Feb 6	Further portions of management unit A open to anchored large mesh gill nets (Alligator River/Currituck Sound) while maintaining closure of anchored large mesh gill nets in all other portions to allow directed gill net fisheries for catfish while minimizing interactions with Atlantic sturgeon (M-2-2017).
2017	Feb 15	Management units C, D1, D2, and E implements gear restrictions for the shad fishery (M-4-2017).
2017	Mar 3	Management Unit A open to the use of gill nets and allows gill net configurations for harvesting American shad by removing vertical height restrictions for up to 1,000 yards of gill net with stretched mesh lengths of 5 ¼ through 6 ½ inches while implementing additional gill net restrictions for management subunit A-South of US-64-BYP/US-64, in accordance with the Sea Turtle and Atlantic Sturgeon ITPs (M-5-2017).
2017	Mar 25	Removes management Unit A gill net configurations for harvesting American shad and maintains gill net restrictions for management subunit A-South of US-64-BYP/US-64, in accordance with the Sea Turtle and Atlantic Sturgeon ITPs (M-7-2017).
2017	Apr 3	Gill nets with mesh length greater than 5 inches must be equipped with tie downs 10 yards apart and cannot be within 50 yards of the shore in the Neuse, Pamlico, and Pungo Rivers through December 31, 2017. Use of gill nets 5 inches or greater is prohibited within 10 feet of any point on the shoreline while set or deployed unless the net is attended from June to October (proclamation M-8-2017)
2017	May 1	Management unit A small mesh anchored gill net attendance requirement (through November 30, 2017) and closes portions of management unit A (Subunit A-South of US-64-BYP/US-64) to the use of anchored large and small mesh gill nets (M-9-2017).
2017	May 8	Management unit D1 closed to large mesh gill nets and implements attendance requirements for gill nets with a stretched mesh length less than 4 inches in Management Subunit B. 1. (proclamation M-10-2017). **Annual ITP closure***
2017	Jun 19	Management unit B open to large mesh gill nets with a stretched mesh length of 4 inches through 6 1/2 inches. Portions of management unit B (Inlet Corridors) remain closed to the use of gill nets with a stretched mesh length of 4 inches through 6 1/2 inches to minimize interactions with threatened and/or endangered species (M-11-2017).
2017	Jul 28	Closed management unit C to large and small mesh gill nets due to sea turtle interactions for remainder of ITP Year 2017 (M-12-2017).

Table 5. Observer coverage calculated from previous years' trip ticket data and observer data for anchored large mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

		Large Mesh		
Season [1]	Management Unit [2]	Fishing Trips	Observed Trips	Coverage [3]
Fall 2016	A	2,234	175	7.8
	B	950	131	13.8
	C	266	37	13.9
	D	344	48	14.0
	E	461	85	18.5
Winter 2016-2017	A	1,066	81	7.6
	B	90	1	1.1
	C	188	29	15.4
	D	5	1	20.0
	E	29	6	20.7
Spring 2017	A	2,277	181	7.9
	B	n/a	n/a	n/a
	C	878	96	10.9
	D	93	10	10.8
	E	279	55	19.7
Summer 2017	A	1,338	66	4.9
	B	812	128	15.8
	C	403	28	6.9
	D	123	24	19.6
	E	505	112	22.2
Total		12,340	1,294	10.5

[1] Final trip ticket data for 2016 (September - December) and preliminary trip ticket data for 2017 (January - August)

[2] Table 4 contains all the openings and closings for each management unit

[3] Based on final trips for 2016 (September - December) and estimated trips for 2017 (January - August) compared to observer large mesh trips

Table 6. Observer coverage calculated from previous years' trip ticket data and observer data for anchored small mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

		Small Mesh		
Season [1]	Management Unit [2]	Fishing Trips	Observed Trips	Coverage [3]
Fall 2016	A	380	0	0.0
	B	1,058	18	1.7
	C	79	7	8.9
	D	300	25	8.3
	E	483	27	5.6
Winter 2016-2017	A	1,028	49	4.8
	B	406	9	2.2
	C	124	22	17.7
	D	63	8	12.7
	E	49	6	12.2
Spring 2017	A	1,311	10	0.8
	B	1,295	21	1.6
	C	263	16	6.1
	D	82	8	9.8
	E	201	14	7.0
Summer 2017	A	280	4	1.4
	B	1,048	10	1.0
	C	312	10	3.2
	D	64	4	6.3
	E	253	4	1.6
Total		9,077	272	3.0

[1] Final trip ticket data for 2016 (September - December) and preliminary trip ticket data for 2017 (January - August)

[2] Table 4 contains all the openings and closings for each management unit

[3] Based on final trips for 2016 (September - December) and estimated trips for 2017 (January - August) compared to observer small mesh trips

Table 7. Summary of observed Atlantic sturgeon interactions in anchored large and small mesh gill nets through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Date	Management Unit	Latitude	Longitude	Species	Disposition	Tag	Length	
						PIT	Total	Fork
9/8/2016	A	36.03066	76.67515	Atlantic	alive	n/a	n/a	n/a
9/10/2016	A	36.41691	75.96635	Atlantic	alive	989.001001951870	880	810
9/13/2016	A	36.08490	76.35124	Atlantic	alive	982.000364295072	670	610
9/13/2016	A	35.99855	76.67548	Atlantic	alive	989.001001951959	860	755
9/13/2016	A	36.00041	76.67593	Atlantic	alive	989.001001951905	889	801
9/13/2016	A	36.00366	76.57590	Atlantic	alive	989.001001951876	1,580	1,420
9/13/2016	A	36.00841	76.67751	Atlantic	alive	989.001001951968	775	607
9/16/2016	A	36.05366	76.41378	Atlantic	alive	989.001001951957	524	450
9/16/2016	A	36.05366	76.41378	Atlantic	alive	989.001001951942	445	385
9/16/2016	A	36.04910	76.42170	Atlantic	alive	989.001001951899	750	670
9/16/2016	A	36.05366	76.41378	Atlantic	dead	n/a	431	376
9/19/2016	A	36.08719	76.31416	Atlantic	alive	982.000364296879	543	470
9/19/2016	A	36.00366	76.31114	Atlantic	alive	989.001001951960	439	395
9/22/2016	A	36.06849	76.38303	Atlantic	alive	989.001001951932	741	659
9/22/2016	A	36.06849	76.38303	Atlantic	alive	989.001001951903	494	439
9/22/2016	A	36.01826	76.68929	Atlantic	alive	n/a	n/a	n/a
9/22/2016	A	36.01826	76.68929	Atlantic	alive	989.001001951933	831	770
9/22/2016	A	36.01952	76.69128	Atlantic	alive	982.000362056039	1,160	1,025
9/22/2016	A	36.02375	76.69531	Atlantic	alive	384M 187	973	872
9/22/2016	A	36.02974	76.69764	Atlantic	alive	982.000364306544	700	655
9/22/2016	A	36.03482	76.69846	Atlantic	alive	982.000362056100	775	690
9/22/2016	A	36.03425	76.69804	Atlantic	dead	989.001001951964	1,020	910
9/29/2016	A	35.99757	76.39628	Atlantic	alive	n/a	812	n/a
9/29/2016	A	36.00136	76.39521	Atlantic	alive	n/a	406	n/a
9/29/2016	A	36.00226	76.39524	Atlantic	alive	n/a	1,016	n/a
10/4/2016	A	36.00159	76.68110	Atlantic	alive	982.000364296196	467	400
10/4/2016	A	36.00411	76.68220	Atlantic	alive	982.000364298284	445	382
10/4/2016	A	36.00430	76.68220	Atlantic	alive	982.000364306468	540	470
10/4/2016	A	36.00873	76.68284	Atlantic	alive	982.000364297640	482	405
10/4/2016	A	36.02487	76.70173	Atlantic	alive	982.000364297239	450	385
10/4/2016	A	36.02487	76.70173	Atlantic	alive	982.000364358743	455	388
10/4/2016	A	36.02487	76.70173	Atlantic	alive	982.0003364296489	420	380
10/14/2016	E	34.53754	77.37932	Atlantic	alive	982.000364301750	991	855
10/19/2016	A	35.99030	76.39303	Atlantic	alive	n/a	n/a	n/a
10/19/2016	A	35.99042	76.39438	Atlantic	alive	n/a	n/a	n/a
10/19/2016	A	35.99067	76.39503	Atlantic	alive	982.000362198455	496	438
10/19/2016	A	35.99036	76.39541	Atlantic	alive	982.000362056063	546	451

Table 7. (cont.).

Date	Management Unit	Latitude	Longitude	Species	Disposition	Tag	Length	
						PIT	Total	Fork
10/19/2016	A	35.99073	76.39649	Atlantic	alive	982.000362199051	495	451
10/19/2016	A	35.99127	76.39980	Atlantic	alive	982.000362190435	493	448
10/19/2016	A	35.99134	76.40063	Atlantic	alive	982.000362056540	415	394
10/20/2016	A	36.00214	76.23837	Atlantic	alive	n/a	1,219	n/a
10/20/2016	A	36.00292	76.23818	Atlantic	alive	n/a	914	n/a
11/1/2016	A	35.98326	76.65352	Atlantic	alive	982.000362199115	589	509
11/2/2016	A	35.98329	76.65231	Atlantic	alive	982.000362199115	589	506
11/3/2016	A	36.09223	76.27110	Atlantic	alive	982.000362191076	576	481
11/3/2016	A	36.09223	76.27110	Atlantic	alive	982.000362056370	827	730
11/3/2016	A	36.09223	76.27110	Atlantic	alive	982.000362056329	624	521
11/3/2016	A	36.09223	76.27110	Atlantic	alive	982.000362058462	618	521
11/3/2016	A	36.09223	76.27110	Atlantic	alive	982.000362049181	571	490
11/3/2016	A	35.98676	76.26745	Atlantic	alive	n/a	508	n/a
11/3/2016	A	36.00460	76.23548	Atlantic	alive	n/a	406	n/a
11/9/2016	A	35.98683	76.26207	Atlantic	alive	n/a	508	n/a
11/9/2016	A	35.98683	76.26207	Atlantic	alive	n/a	584	n/a
12/3/2016	A	36.06278	76.30528	Atlantic	alive	982.000362048651	620	525
12/3/2016	A	36.06278	76.30528	Atlantic	alive	982.000362055613	599	515
12/13/2016	A	35.99166	76.68108	Atlantic [1]	alive	982.000362055869	459	403
12/13/2016	A	36.02978	76.06973	Atlantic	alive	982.000362197191	472	413
12/13/2016	A	36.06193	76.17842	Atlantic	alive	982.000364358833	570	530
12/13/2016	A	36.06031	76.17773	Atlantic	alive	982.000364297501	705	630
12/13/2016	A	36.05937	76.17694	Atlantic	alive	982.000364298501	650	560
12/13/2016	A	36.05937	76.17694	Atlantic	alive	982.000364197049	700	620
12/13/2016	A	36.09528	76.12910	Atlantic	alive	982.000364301096	640	560
12/13/2016	A	35.99252	76.23865	Atlantic	alive	n/a	457	n/a
2/21/2017	C	35.00206	76.96243	Atlantic	alive	982.000364297051	530	n/a
3/6/2017	A	36.03043	76.42896	Atlantic	alive	n/a	623	530
3/6/2017	A	36.03043	76.42896	Atlantic	alive	n/a	453	431
3/6/2017	A	36.02819	76.42939	Atlantic	alive	n/a	654	573
3/7/2017	A	35.99262	76.50180	Atlantic	alive	982.000362196348	703	605
3/7/2017	A	35.99607	76.50367	Atlantic	alive	982.000362056085	704	604
3/7/2017	A	35.99667	76.50459	Atlantic	alive	982.000362319707	609	600
3/7/2017	A	35.99780	76.50442	Atlantic	alive	989.001000716254	605	506
3/7/2017	A	36.00143	76.50641	Atlantic	alive	982.000362191902	503	501
3/7/2017	A	36.00148	76.50633	Atlantic	alive	982.000362319737	607	599
3/7/2017	C	35.09871	77.01007	Atlantic	alive	n/a	n/a	n/a
3/11/2017	A	35.99684	76.50465	Atlantic	alive	982.000362320105	485	469

Table 7. (cont.).

Date	Management Unit	Latitude	Longitude	Species	Disposition	Tag	Length	
						PIT	Total	Fork
3/13/2017	A	36.08794	76.70763	Atlantic	alive	982.000362055657	624	526
3/17/2017	A	36.06431	76.38897	Atlantic	alive	982.000364297455	705	609
3/17/2017	A	36.03877	76.43262	Atlantic	alive	989.001001951888	560	480
3/17/2017	A	36.05758	76.40439	Atlantic	alive	982.000364296885	721	660
3/17/2017	A	36.05844	76.41477	Atlantic	alive	982.000362198352	546	471
3/17/2017	A	35.99195	76.50192	Atlantic	alive	982.000364298224	660	565
3/17/2017	A	35.99359	76.50179	Atlantic	alive	989.001003731500	610	530
3/17/2017	A	35.99652	76.50444	Atlantic	alive	982.000364216095	790	680
3/17/2017	A	35.99652	76.50444	Atlantic	alive	982.000364297516	690	590
3/17/2017	A	35.99773	76.50467	Atlantic	alive	982.000364300940	644	570
3/17/2017	A	35.99956	76.50495	Atlantic	alive	982.000364301817	676	562
3/20/2017	A	36.07744	76.72431	Atlantic	alive	982.000364295757	510	420
3/20/2017	A	36.05984	76.69924	Atlantic	alive	989.001001952757	640	560
3/21/2017	A	36.03965	76.43526	Atlantic	alive	982.000362055546	607	491
3/21/2017	A	36.03967	76.43527	Atlantic	alive	982.000362048379	608	501
3/21/2017	A	36.03968	76.43536	Atlantic	alive	982.000362320322	609	508
3/21/2017	A	35.91083	75.75950	Atlantic	alive	982.000364358515	665	578
3/21/2017	A	35.94988	75.75931	Atlantic	alive	982.000364297487	636	545
3/21/2017	A	35.91362	75.75830	Atlantic	alive	982.000364296912	649	562
3/22/2017	A	36.03951	76.43639	Atlantic	alive	982.000362055546	607	491
3/23/2017	C	35.00940	76.97876	Atlantic	alive	982.000364298492	895	785
3/24/2017	C	35.42296	76.84188	Atlantic	alive	982.000364296308	681	590
3/28/2017	A	35.97484	76.63765	Atlantic	alive	982.000362191535	608	509
3/29/2017	A	35.96500	76.56702	Atlantic [2]	alive	989.001006519318	674	582
3/29/2017	A	35.96684	76.56679	Atlantic	alive	982.000362048010	740	661
4/3/2017	E	33.99874	77.92047	Atlantic [1]	alive	982.000362191717	625	535
4/5/2017	B	35.16601	75.89088	Atlantic [1]	alive	n/a	n/a	n/a
4/21/2017	A	36.02403	75.72512	Atlantic	alive	982.000364297026	740	667
8/31/2017	A	36.00890	76.24223	Atlantic	alive	n/a	647	n/a

[1] Indicates small mesh gear

[2] Recaptured Atlantic sturgeon

Table 8. Summary of reported Atlantic sturgeon interactions in anchored large mesh gill nets through the NCDMF Observer Program for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Date	Management Unit	Latitude	Longitude	Species	Disposition	Length	
						Total	Fork
9/7/2016	A	n/a	n/a	Atlantic	alive	n/a	n/a
9/7/2016	A	n/a	n/a	Atlantic	alive	n/a	n/a
1/26/2017	A	36.03523	76.69909	Atlantic [1]	alive	635	438
4/18/2017	A	n/a	n/a	Atlantic	alive	n/a	n/a

[1] Sturgeon was encountered while Marine Patrol officers were retrieving illegally set gill net

Table 9. Number of gill-net checks made and citations issued by Marine Patrol for large and small mesh gill nets by season during ITP Year 2017 (September 1, 2016 - August 31, 2017).

Season	# Gill Net Checks	# Citations
Fall 2016	366	44
Winter 2016-17	274	144
Spring 2017	395	10
Summer 2017	960	0
Total	1,995	198

Table 10. Citations written by Marine Patrol for large and small mesh gill nets by season and violation code during ITP Year 2017 (September 1, 2015 - August 31, 2016).

	Violation		
Season [1]	Date	Code	Description
Fall 2016	9/1/2016	NETG04	Leave gill net in waters when could not be legally fished
	9/8/2016	NETG03	Using gill net with improper buoys or identification
	9/13/2016	NETG01	Leave gill net in coastal waters unattended
	9/14/2016	NETG03	Using gill net with improper buoys or identification
	9/15/2016	NETG03	Using gill net with improper buoys or identification
	9/15/2016	NETG03	Using gill net with improper buoys or identification
	9/17/2016	NETG04	Leave gill net in waters when could not be legally fished
	9/20/2016	NETG03	Using gill net with improper buoys or identification
	9/20/2016	NETG53	Use large mesh gill net with corks or floats on top line
	9/22/2016	NETG03	Using gill net with improper buoys or identification
	9/22/2016	NETG08	Gill net within 200 yards of pound net
	9/25/2016	NETG03	Using gill net with improper buoys or identification
	9/29/2016	NETG03	Using gill net with improper buoys or identification
	10/2/2016	NETG04	Leave gill net in waters when could not be legally fished
	10/3/2016	NETG04	Leave gill net in waters when could not be legally fished
	10/17/2016	NETG01	Leave gill net in coastal waters unattended
	10/17/2016	NETG03	Using gill net with improper buoys or identification
	10/18/2016	NETG03	Using gill net with improper buoys or identification
	10/20/2016	NETG03	Using gill net with improper buoys or identification
	10/20/2016	NETG33	Violate provisions of Proc M-19-09 setting gill net more than 15 meshes deep in Core Sound
	10/20/2016	NETG53	Use large mesh gill net with corks or floats on top line
	10/22/2016	NETG03	Using gill net with improper buoys or identification
	10/23/2016	NETG03	Using gill net with improper buoys or identification
	10/29/2016	NETG17	Sink net in Neuse River during closed season
	10/30/2016	NETG34	Use unattended gill net w/mesh less than 5" in commercial operation from May 1 through Nov 30

[1] There were no citations written during the Summer 2017 season

Table 10. (cont.).

Season [1]	Violation		
	Date	Code	Description
Fall 2016	10/31/2016	NETG04	Leave gill net in waters when could not be legally fished
	11/3/2016	NETG03	Using gill net with improper buoys or identification
	11/3/2016	NETG03	Using gill net with improper buoys or identification
	11/3/2016	NETG30	Leave RCGL gill net unattended
	11/5/2016	NETG03	Using gill net with improper buoys or identification
	11/5/2016	NETG16	Use an unattended gill net in a restricted area
	11/5/2016	NETG30	Leave RCGL gill net unattended
	11/6/2016	NETG01	Leave gill net in coastal waters unattended
	11/6/2016	NETG04	Leave gill net in waters when could not be legally fished
	11/17/2016	NETG37	Leave small mesh gill nets unattended
	11/17/2016	NETG37	Leave small mesh gill nets unattended
	11/17/2016	NETG37	Leave small mesh gill nets unattended
	11/19/2016	NETG02	Using gill net without buoys or identification
	11/19/2016	NETG03	Using gill net with improper buoys or identification
	11/22/2016	NETG01	Leave gill net in coastal waters unattended
	11/22/2016	NETG02	Using gill net without buoys or identification
	11/22/2016	NETG03	Using gill net with improper buoys or identification
	11/22/2016	NETG37	Leave small mesh gill nets unattended
	11/22/2016	NETG37	Leave small mesh gill nets unattended
Winter 2016-2017	12/2/2016	NETG02	Using gill net without buoys or identification
	12/2/2016	NETG02	Using gill net without buoys or identification
	1/1/2017	NETG01	Leave gill net in coastal waters unattended
	1/13/2017	NETG03	Using gill net with improper buoys or identification
	1/13/2017	NETG01	Leave gill net in coastal waters unattended
	1/20/2017	NETG10	Gill net with illegal mesh size

[1] There were no citations written during the Summer 2017 season

Table 10. (cont.).

Season [1]	Violation		
	Date	Code	Description
Winter 2016-2017	1/20/2017	NETG10	Gill net with illegal mesh size
	1/20/2017	NETG10	Gill net with illegal mesh size
	1/20/2017	NETG10	Gill net with illegal mesh size
	1/20/2017	NETG10	Gill net with illegal mesh size
	1/20/2017	NETG10	Gill net with illegal mesh size
	1/20/2017	NETG61	Gill net tie down violation
	1/20/2017	NETG10	Gill net with illegal mesh size
	1/24/2017	NETG10	Gill net with illegal mesh size
	1/25/2017	NETG10	Gill net with illegal mesh size
	1/25/2017	NETG10	Gill net with illegal mesh size
	2/3/2017	NETG02	Using gill net without buoys or identification
	2/15/2017	NETG04	Leave gill net in waters when could not be legally fished
	2/21/2017	NETG29	RCGL gear without proper buoys
Spring 2017	3/28/2017	NETG46	Set or retrieve large mesh gill nets later than one hour after sunrise on Tuesday through Friday
	3/28/2017	NETG53	Use large mesh gill net with corks or floats on top line
	4/10/2017	NETG22	Improperly set gill net
	4/15/2017	NETG03	Using gill net with improper buoys or identification
	4/15/2017	NETG60	Use gill nets with a mesh size of more than 6.5 inches (stretched mesh) in violation of proclamation
	4/20/2017	NETG03	Using gill net with improper buoys or identification
	4/20/2017	NETG29	RCGL gear without proper buoys
	4/21/2017	NETG22	Improperly set gill net
	5/7/2017	NETG29	RCGL gear without proper buoys
	5/17/2017	NETG45	Set or retrieve large mesh gill nets no sooner than one hour before sunset on Monday through Friday

[1] There were no citations written during the Summer 2017 season

Table 11. Contacts attempted (n = 9,132) by the observers trying to set up trips by season categorized by contact type (0-14) and by total number, percent for each season, and percent for the entire ITP Year 2017 for ITP Year 2017 (September 1, 2016 - August 31, 2017).

	Categories (%) [1]														
Season	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Fall 2016	63	514	181	66	47	34	160	5	284	61	53	11	296	885	2,660
	2.4%	19.3%	6.8%	2.5%	1.8%	1.3%	6.0%	0.2%	10.7%	2.3%	2.0%	0.4%	11.1%	33.3%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Winter 2016-2017	34	356	52	24	7	22	54	12	114	13	35	10	159	464	1,356
	2.5%	26.3%	3.8%	1.8%	0.5%	1.6%	4.0%	0.9%	8.4%	1.0%	2.6%	0.7%	11.7%	34.2%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Spring 2017	61	440	171	30	18	28	98	9	130	20	93	16	320	991	2,425
	2.5%	18.1%	7.1%	1.2%	0.7%	1.2%	4.0%	0.4%	5.4%	0.8%	3.8%	0.7%	13.2%	40.9%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Summer 2017	64	482	161	24	26	37	104	4	177	53	107	17	385	1,050	2,691
	2.4%	17.9%	6.0%	0.9%	1.0%	1.4%	3.9%	0.1%	6.6%	2.0%	4.0%	0.6%	14.3%	39.0%	100.0%
	Categories (%) [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
Total	222	1,792	565	144	98	121	416	30	705	147	288	54	1,160	3,390	9,132
	2.4%	19.6%	6.2%	1.6%	1.1%	1.3%	4.6%	0.3%	7.7%	1.6%	3.2%	0.6%	12.7%	37.1%	100.0%

[1] Contact type categories: 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

Table 12. Notice of Violations issued by season, date and violation code for the Estuarine Gill Net Permit for ITP Year 2017 (September 1, 2016 - August 31, 2017).

Season	Date	Code	Description
Fall 2016	11/3/2016	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	11/3/2016	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	11/3/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	11/3/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	11/29/2016	EGNP11	Failure to attend nets
	11/29/2016	EGNP11	Failure to attend nets
	11/29/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	11/29/2016	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
Winter 2016-2017	1/12/2017	EGNP11	Failure to attend nets
	1/12/2017	EGNP11	Failure to attend nets
	1/12/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	1/12/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	1/12/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	1/13/2017	EGNP11	Failure to attend nets
	1/26/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	1/26/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	1/26/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP14	Mislead observers to avoid fishing trip
	2/1/2017	EGNP25	Refuse to allow fisheries observers onboard or collect data
	2/1/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	2/1/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
Spring 2017	3/6/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	4/24/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	4/24/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation
	4/24/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	4/28/2017	EGNP10	Set more than the legal length of gill net
	4/28/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
Summer 2017	6/28/2017	EGNP10	Set more than the legal length of gill net
	6/28/2017	EGNP99	Failure to comply with statutes(s), rules(s), and/or proclamation(s)
	8/24/2017	EGNP30	Failure to comply with gill net configurations outlined in proclamation

FIGURES

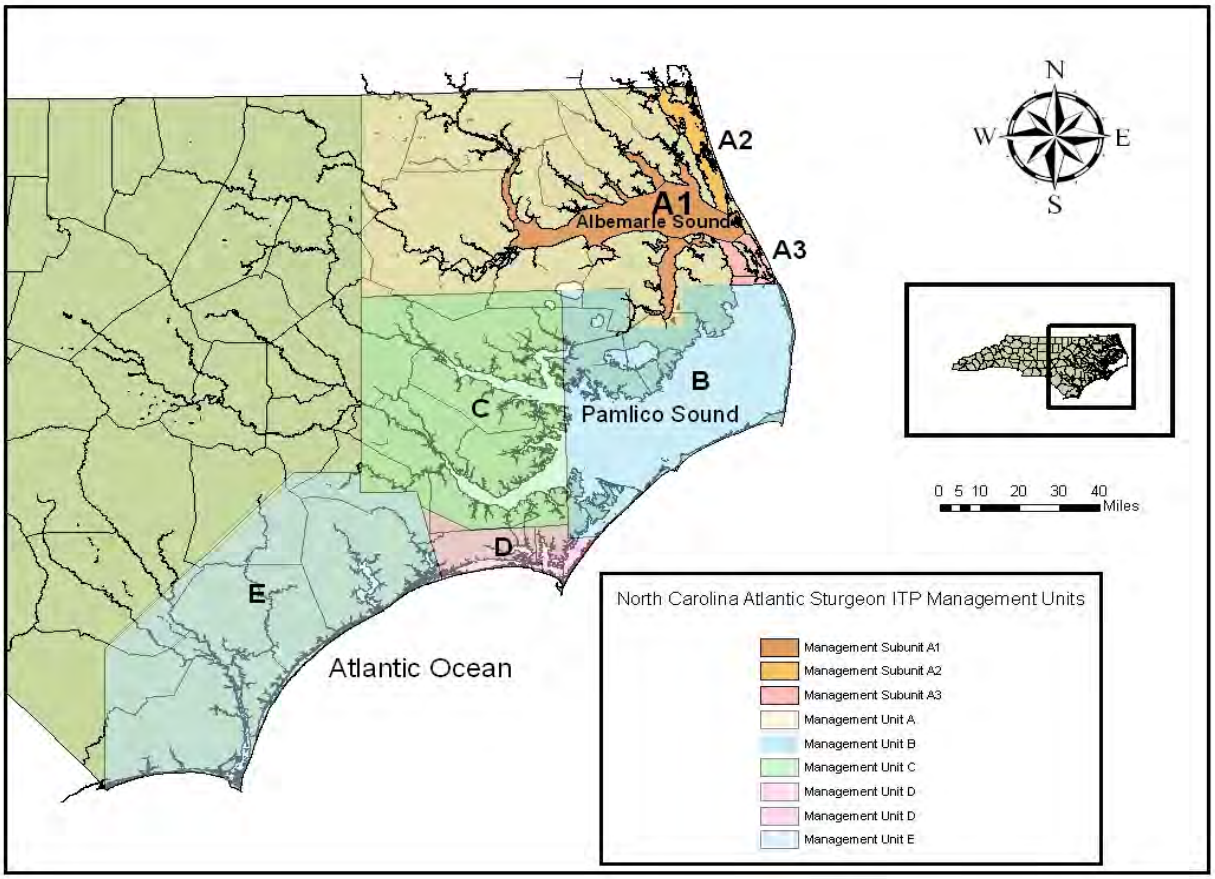


Figure 1. Management units (A1, A2, A3, B, C, D, and E) as outlined in the Conservation Plan and utilized by the Observer Program for ITP Year 2017 (September 1, 2016 – August 31, 2017).

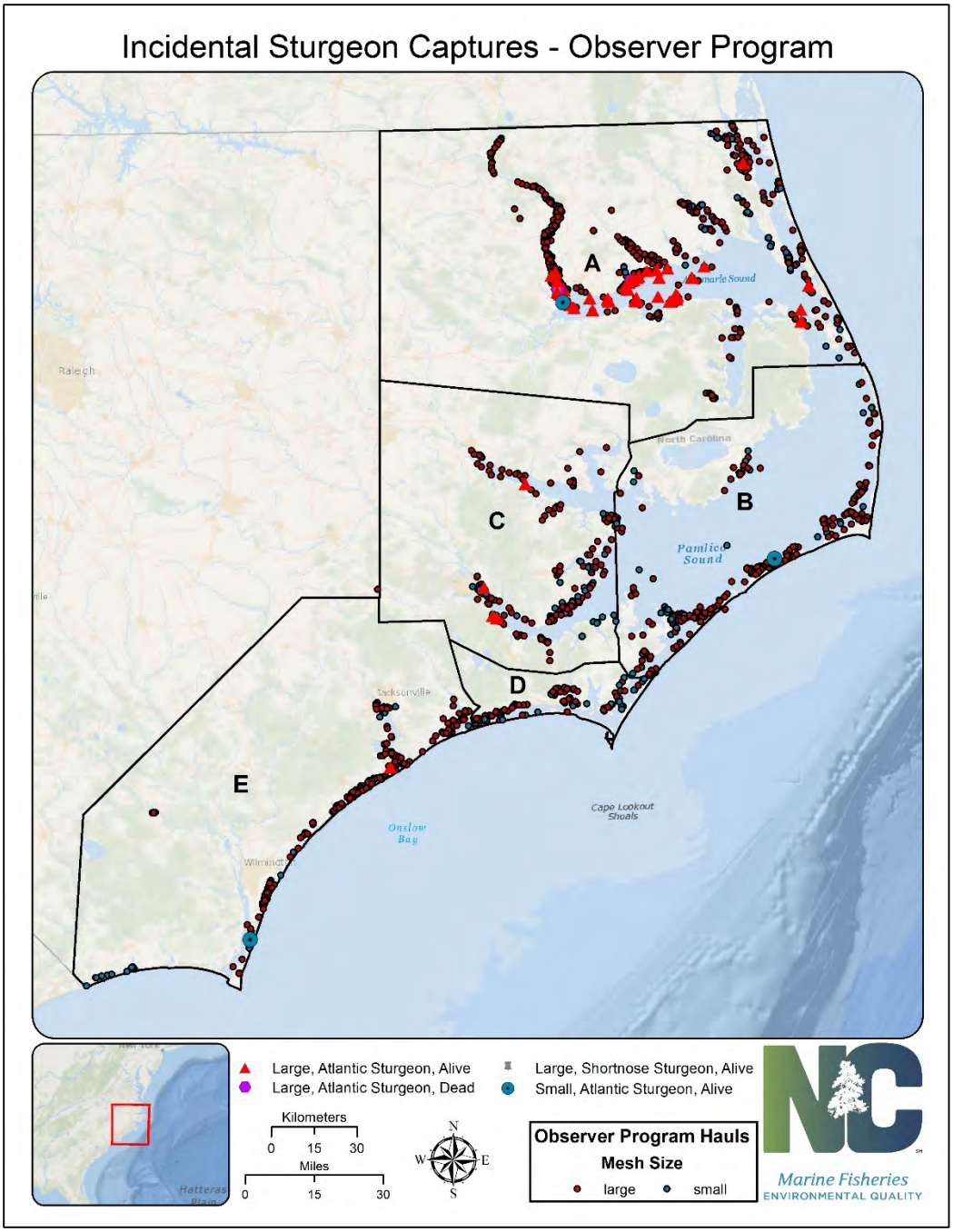


Figure 2. Atlantic sturgeon interaction locations by species, disposition, and gear and observer trips (hauls) by gear throughout all management units for ITP Year 2017 (September 1, 2016 – August 31, 2017).

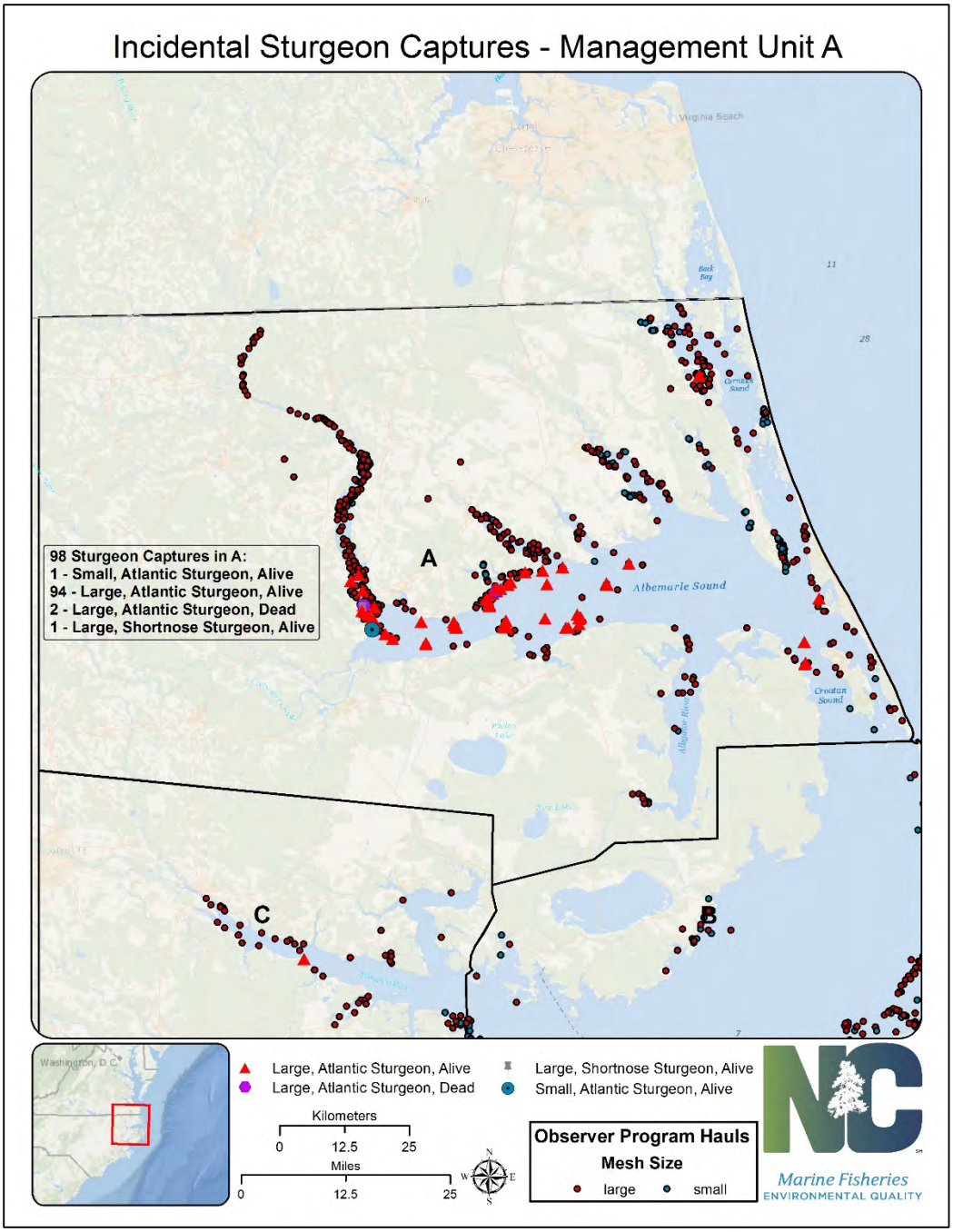


Figure 3. Atlantic sturgeon interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit A for ITP Year 2017 (September 1, 2016 – August 31, 2017).

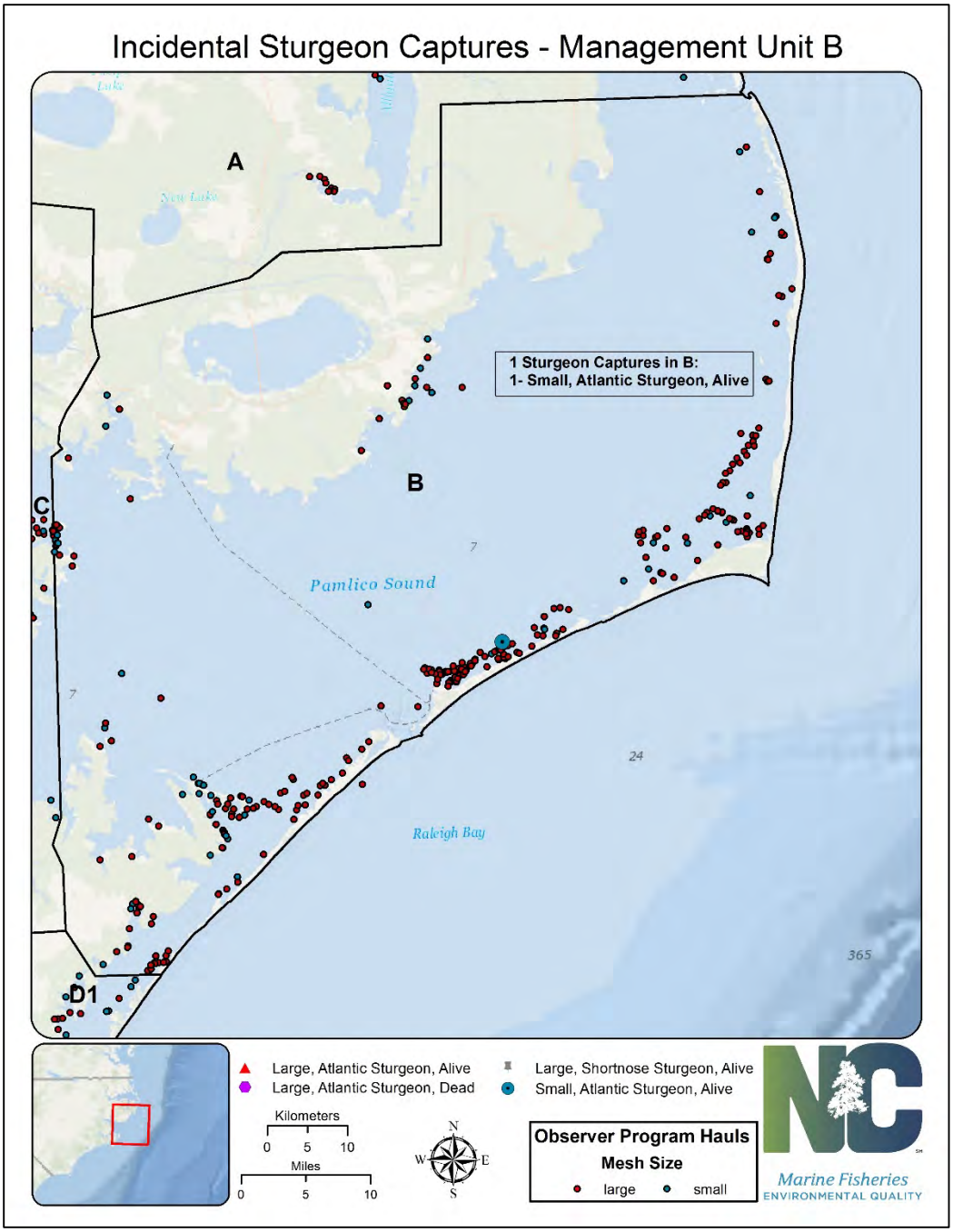


Figure 4. Atlantic sturgeon interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit B for ITP Year 2017 (September 1, 2016 – August 31, 2017).

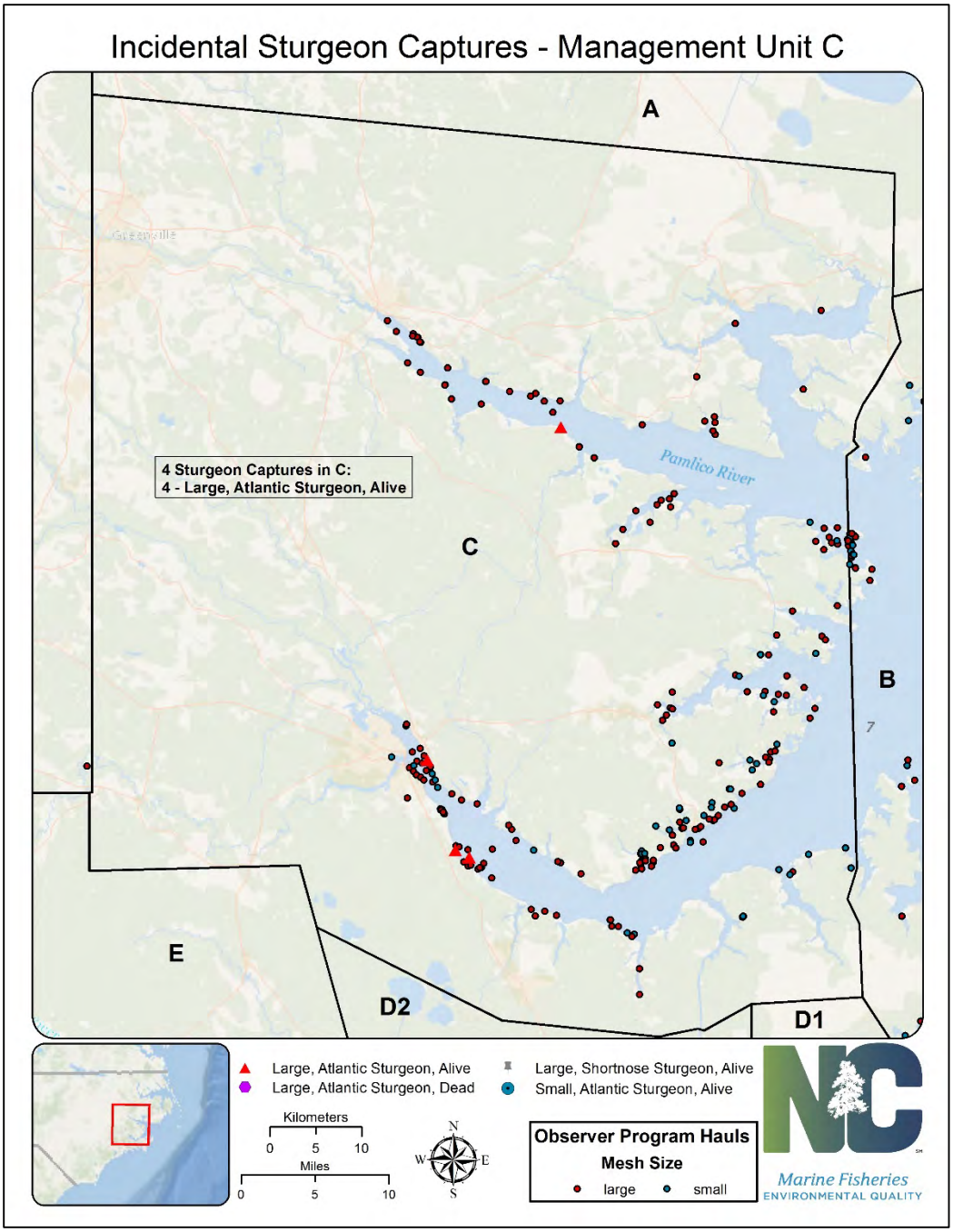


Figure 5. Atlantic sturgeon interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit C for ITP Year 2017 (September 1, 2016 – August 31, 2017).

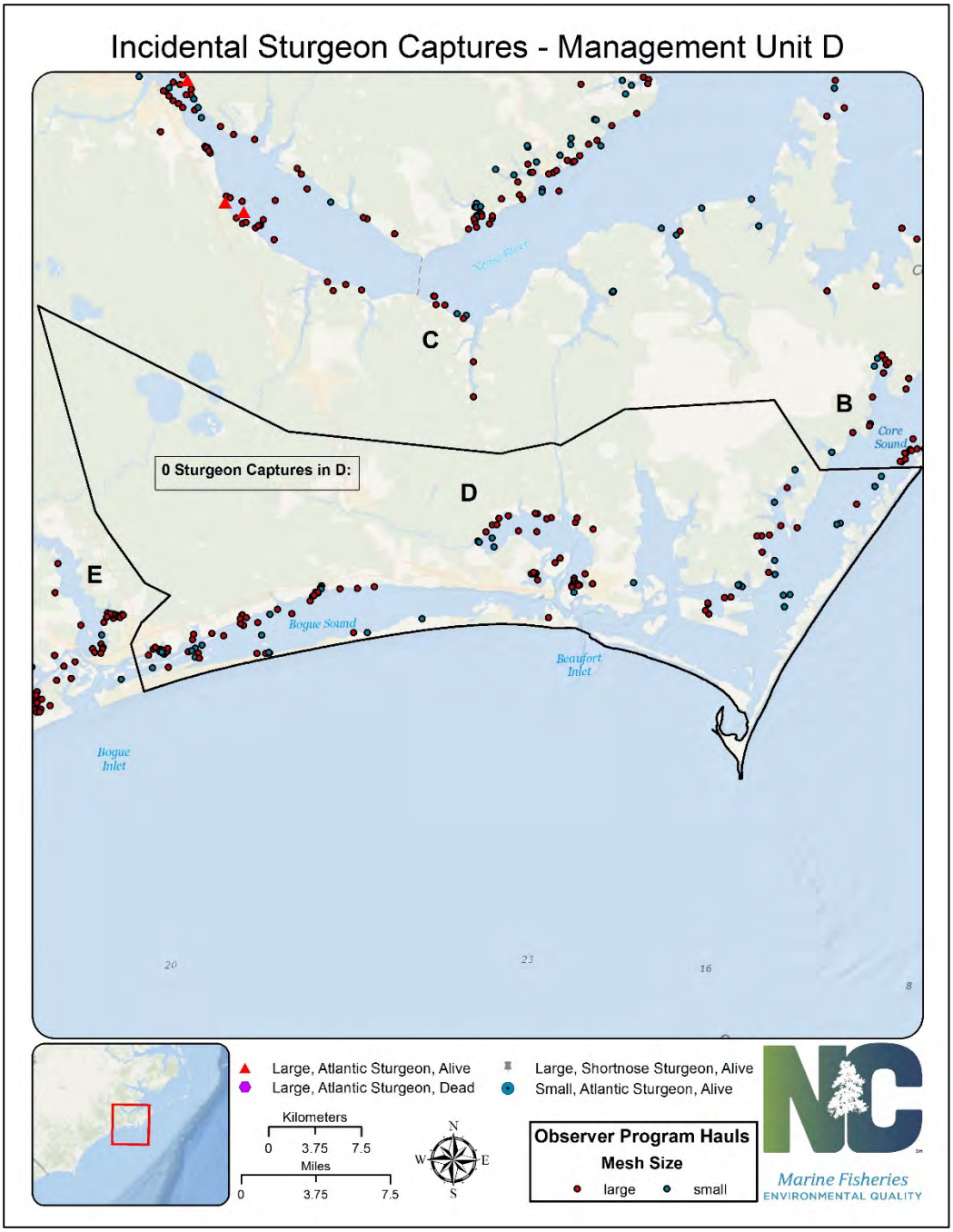


Figure 6. Atlantic sturgeon interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit D for ITP Year 2017 (September 1, 2016 – August 31, 2017).

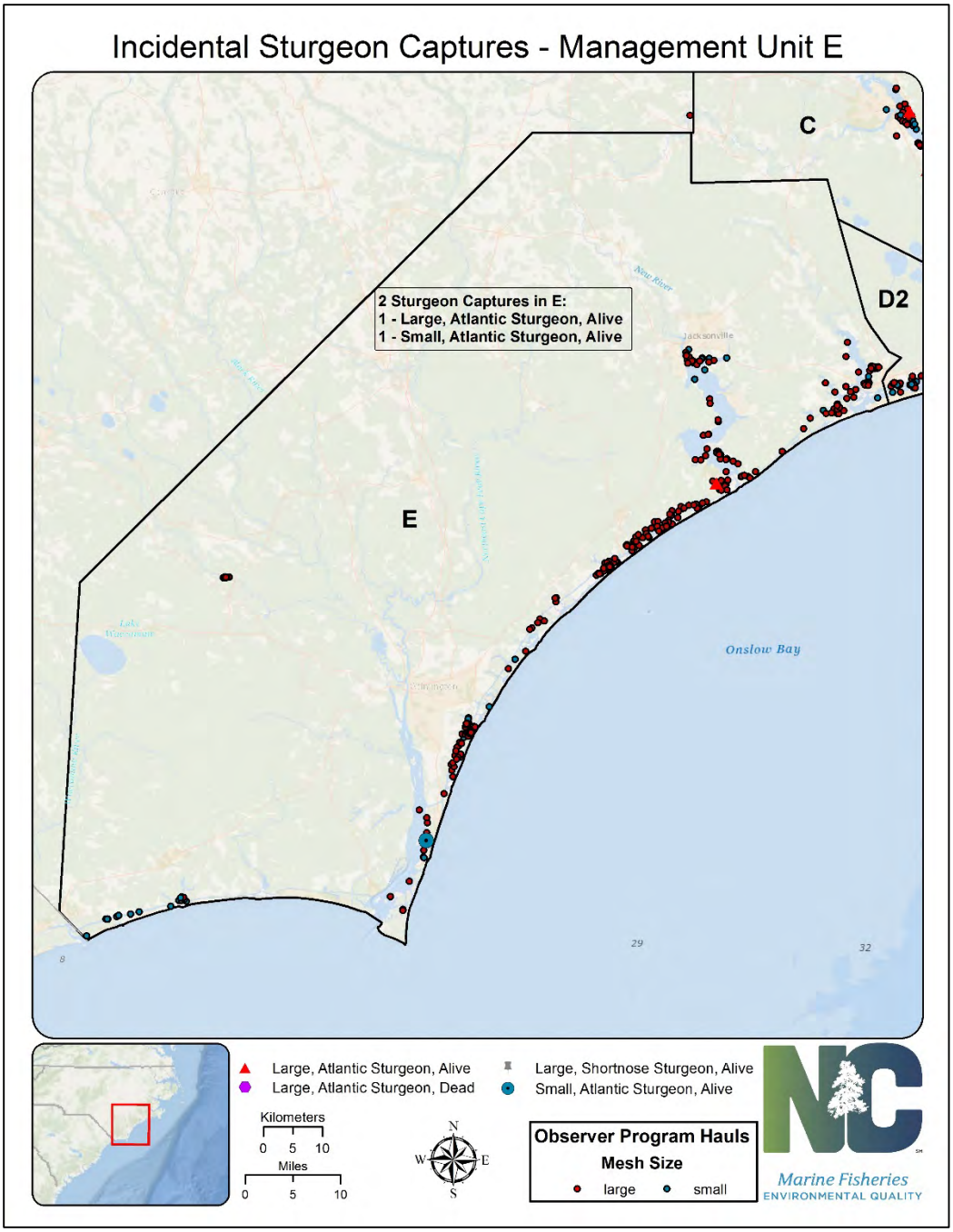


Figure 7. Atlantic sturgeon interaction locations by species, disposition, and gear and observer trips (hauls) by gear in management unit E for ITP Year 2017 (September 1, 2016 – August 31, 2017).

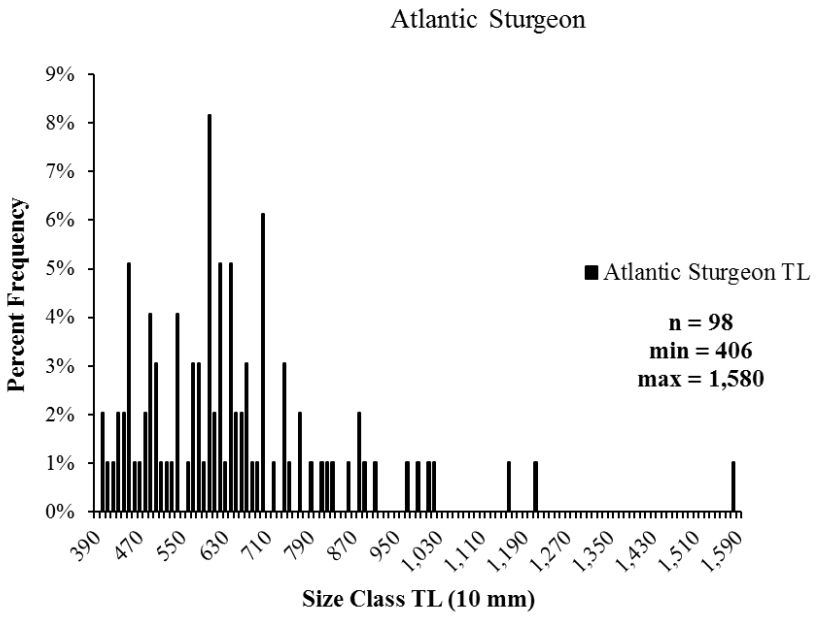


Figure 8. Length-frequency (total length) of observed incidental captures of Atlantic sturgeon where measurements were obtained (n = 98) by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017).

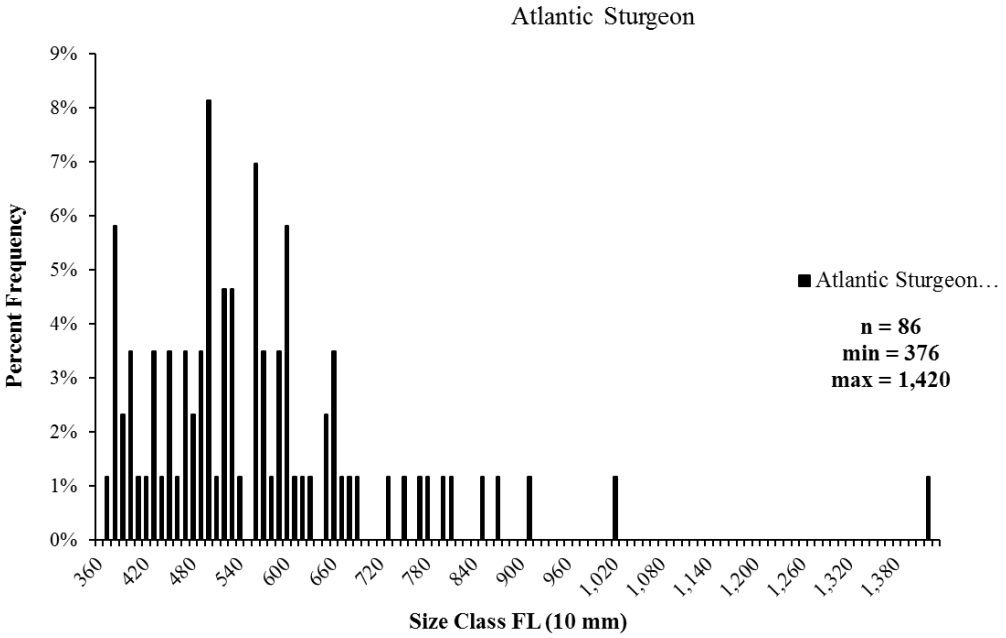


Figure 9. Length-frequency (fork length) of observed incidental captures of Atlantic sturgeon where measurements were obtained (n = 86) by the Observer Program from onboard and alternative platform observations for ITP Year 2017 (September 1, 2016 – August 31, 2017).

APPENDIX A

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JAN 4 2017

Braxton C. Davis
Director, North Carolina Division of Marine Fisheries
3441 Arendell Street
P.O. Box 769
Morehead City, North Carolina 28557

Dear Mr. Davis:

On November 21, 2016, the North Carolina Division of Marine Fisheries (NCDMF) requested a minor modification to extend the future annual report deadlines for the Sea Turtle (No. 16230) and Atlantic Sturgeon (No. 18102) Incidental Take Permits from January 31 to the last day in February. You note that this extension would benefit your staff due to a lag time in data being uploaded and verified, the time of year, the deadline for the fall seasonal report, and staff availability.

We appreciate the challenges associated with staff availability and the data accessibility at this time of year, and this delay will not significantly impact our ability to review the annual report. National Marine Fisheries Service (NMFS) therefore concurs with your request for this minor modification. Please sign below to acknowledge that you will comply with the minor modifications specified in this letter and send a copy of the signed letter to Kristy Long on my staff at your earliest convenience.

We note that NCDMF has requested several modifications since the permit began and understand that you are in the process of developing an updated Incidental Take Permit application. We encourage you to incorporate any further anticipated minor modifications into that application process so we can more efficiently analyze these requests.

Please feel free to contact Ron Dean (ron.dean@noaa.gov) or Kristy Long (kristy.long@noaa.gov) with any questions about this minor modification request approval or your pending updated application.

We look forward to continuing to work with you on sea turtle conservation in North Carolina.

Sincerely,

Donna S. Wieting

Donna S. Wieting
Director, Office of Protected Resources

Printed on Recycled Paper

I acknowledge the minor modification specified above to Permit No. 16230 issued under Section 10 (a)(l)(B) of the Endangered Species Act to incidentally take threatened and endangered sea turtles in gillnet fisheries operating in inshore waters of North Carolina.

Braxton C. Davis
Director
N.C. Division of Marine Fisheries

1-5-17
Date

APPENDIX B

Marine Fisheries
ENVIRONMENTAL QUALITY

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
BRAXTON C. DAVIS
Director

Angela Somma
Office of Protected Resources (F/PR)
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

Dear Angela:

The North Carolina Division of Marine Fisheries (NCDMF) Observer Program data have been updated using the finalized 2016 Trip Ticket Program (TTP) data. The Annual Completion Report for the Atlantic Sturgeon Incidental Take Permit (ITP) No. 18102 was completed for ITP Year 2016 and submitted in February 2017. Using the finalized 2016 data, Tables 1, 2, 5, and 6 from the Completion Report were updated to reflect the final estimates of observer coverage and Atlantic sturgeon takes (Tables 1 - 4). The fall 2015 season was based on finalized 2015 TTP data and did not deviate from the previous report for both anchored large and small mesh gill nets (Tables 1 and 2).

Anchored Large Mesh

The winter 2015 – 2016 season had an increase in fishing trips for anchored large mesh gill nets than previously estimated in management unit A, a decrease in fishing trips in management units B, C, and E, and fishing trips remaining constant in management unit D (Table 1). Observer coverage goals for anchored large mesh gill nets were met in management units C and E for the winter 2015 – 2016 season. Fishing activity was sparse in management unit B (n = 35 fishing trips) and management unit D (n = 1 fishing trip) during the winter 2015 – 2016 season. Observer coverage for management unit A during the same period totaled 3.0% with 52 observed anchored large mesh gill-net trips completed (Table 1).

The spring 2016 season had an increase in fishing trips for anchored large mesh gill nets than previously estimated in management units A, C, and D with all other management units having a decrease in fishing trips (Table 1). Observer coverage goals for anchored large mesh gill nets were met in all management units except management unit D for the spring 2016 season. Minimal trips (n = 4) were obtained in management unit D during the spring 2016 season due to portions (management unit D1) of the management unit being closed for the latter portion of the spring 2016 season and minimal fishing effort (n = 97 fishing trips) while open. While observer coverage goals were not met in management unit D, they were far exceeded in management units B (15.8%) and E (30.2%) for anchored large mesh gill nets (Table 1).

The summer 2016 season had an increase in fishing trips for anchored large mesh gill nets than previously estimated in all management unit except C (Table 1). Observer coverage goals for anchored large mesh gill nets were met in all management units except management units A and B for the summer 2016 season. Portions of management unit D (management unit D1) are closed annually from May 8 through October 14 as described in the ITP. Management unit A was open for only seven days before being closed to anchored large and small mesh gill nets for the remainder of the summer 2016 season allowing for only five trips to be obtained before the closure was implemented. Management unit B was open for only three days before being closed to anchored large mesh gill nets for the remainder of the summer 2016 season allowing for only three trips to be obtained before the closure was implemented. While observer coverage goals were not met in management units A and B, they were exceeded in management units C (11.0%), D (13.5%), and E (19.8%) for anchored large mesh gill nets (Table 1).

Anchored Small Mesh

The winter 2015 – 2016 season had an increase in fishing trips for anchored small mesh gill nets than previously estimated in management units A and E (Table 2). Observer coverage goals for anchored small mesh gill nets were met in all management units except management unit B for the winter 2015 – 2016 season. Observer coverage for management unit B during this period totaled 0.6% with three observed anchored small mesh gill-net trips completed (Table 2).

The spring 2016 season had an increase in fishing trips for anchored small mesh gill nets than previously estimated in management unit B (Table 2). Management unit E closed to anchored small mesh gill nets on May 4, 2016 for the remainder of ITP Year 2016 due to reaching allowable sea turtle takes. Observer coverage goals for anchored small mesh gill nets were met in all management units for the spring 2016 season. Furthermore, observer coverage goals were far exceeded in management units A (4.1%), C (7.4%), D (14.8%), and E (8.3%) for anchored small mesh gill nets (Table 2).

The summer 2016 season had an increase in fishing trips for anchored small mesh gill nets than previously estimated in management units A and B (Table 2). Management unit E remained closed to anchored small mesh gill nets for the duration of the summer 2016 season. Observer coverage goals for anchored small mesh gill nets were met in all management units except management units A and B. Management unit A was open for only seven days before being closed to anchored large and small mesh gill nets for the duration of the summer 2016 season. Therefore, no anchored small mesh gill-net trips were obtained during this short time frame. Attendance requirements for anchored small mesh gill nets during the summer season made it difficult to obtain trips in management unit B. While observer coverage goals were not met in management units A and B, they were far exceeded in management units C (4.5%) and D (20.0%) for anchored small mesh gill nets (Table 2).

Atlantic Sturgeon Takes

Annual estimated allowable Atlantic sturgeon takes were recalculated for anchored large and small mesh gill nets using the finalized 2016 TTP data (Tables 3 and 4). The estimates of Atlantic sturgeon takes in anchored large mesh gill nets differed slightly from previous estimates for all seasons in management unit A (Table 3). For management unit A, estimates increased in anchored large mesh gill nets for the winter and fall seasons while decreasing in the spring and summer seasons. For each season and management unit for anchored large mesh gill nets, except for the winter 2015 – 2016 season in management unit A, the fishery remained below the annual estimated allowable Atlantic sturgeon takes for all dispositions for ITP Year 2016 (Table 3).

The estimates of Atlantic sturgeon takes in anchored small mesh gill nets increased slightly or remained constant from previous estimates for all seasons in management unit A (Table 4). For management unit A, estimates increased in anchored small mesh gill nets for the winter season. The anchored small mesh gill-net fishery remained below the annual estimated allowable Atlantic sturgeon takes for all dispositions for ITP Year 2016 for each season and management unit (Table 4).

A memo was sent in May 2016 explaining the overage of allowed Atlantic sturgeon takes (n = 77) in the anchored large mesh gill-net fishery from the winter 2015 – 2016 season based on finalized December 2015 data and preliminary January/February 2016 data. Using the finalized 2015 and 2016 data, the anchored large mesh gill-net fishery for the winter 2015 – 2016 season in management unit A went over (n = 111) the allowed takes for Atlantic sturgeon (Table 3).

Table 1. Observer coverage calculated from finalized 2016 Trip Ticket data and observer data for anchored large mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2016 (September 1, 2015 - August 31, 2016).

		Anchored Large Mesh		
Season	Management Unit	Fishing Trips	Observed Trips	Coverage
Fall 2015	A	2,258	205	9.1
	B	424	63	14.9
	C	366	58	15.8
	D	327	34	10.4
	E	518	36	6.9
Winter 2015-2016	A	1,724	52	3.0
	B	35	0	0.0
	C	30	13	43.3
	D	1	0	0.0
	E	41	12	29.3
Spring 2016	A	1,510	138	9.1
	B	273	43	15.8
	C	996	73	7.3
	D	97	4	4.1
	E	179	54	30.2
Summer 2016	A	148	5	3.4
	B	159	3	1.9
	C	528	58	11.0
	D	163	22	13.5
	E	500	99	19.8
Total		10,277	972	9.5

Table 2. Observer coverage calculated from finalized 2016 Trip Ticket data and observer data for anchored small mesh gill nets by season and management unit through the NCDMF Observer Program for ITP Year 2016 (September 1, 2015 - August 31, 2016).

		Anchored Small Mesh		
Season	Management Unit	Fishing Trips	Observed Trips	Coverage
Fall 2015	A	358	10	2.8
	B	706	9	1.3
	C	95	7	7.4
	D	221	23	10.4
	E	547	29	5.3
Winter 2015-2016	A	1,392	50	3.6
	B	470	3	0.6
	C	119	9	7.6
	D	24	1	4.2
	E	147	9	6.1
Spring 2016	A	675	28	4.1
	B	1,478	29	2.0
	C	95	7	7.4
	D	54	8	14.8
	E	133	11	8.3
Summer 2016	A	51	0	0.0
	B	1,084	7	0.6
	C	157	7	4.5
	D	20	4	20.0
	E [1]	n/a	n/a	n/a
Total		7,826	251	3.2

[1] Management unit E closed to anchored small mesh gill nets for the duration of the summer 2016 season

Table 3. Authorized and actual annual estimated incidental takes per fishing year (for a total of 10 years; the life of the permit) with confidence intervals (95%) using a bootstrap method based on observer data for coverage and Atlantic sturgeon interaction levels in North Carolina's anchored large mesh (≥5.0 ISM) inshore gill-net fishery for ITP Year 2016 (September 1, 2015 - August 31, 2016).

		Total Interactions			
		Authorized (Mortality)		Actual All DPS [2]	
Management Unit	Season	Carolina DPS	Other DPS	Alive	Dead
A	Winter	149 (6)	50 (2)	310 [115,566]	0
	Spring	460 (19)	154 (6)	37 [10,96]	19 [0,109]
	Summer	157 (6)	52 (2)	5 [0,34]	0
	Fall	838 (34)	279 (11)	285 [151,415]	13 [0,54]
B	Winter	2 (1)[1]	n/a	0	0
	Spring	1 (1)[1]	1 (0)	0	0
	Summer	4 (2)[1]	2 (0)	0	0
	Fall	17 (2)[1]	6 (0)	0	0
C	Winter	2 (1)[1]	n/a	0	0
	Spring	3 (1)[1]	1 (0)	0	0
	Summer	2 (1)[1]	1 (0)	0	0
	Fall	4 (2)[1]	2 (0)	4	1
D	Annual	8 (2)[1]	n/a	1	0
E	Annual	8 (2)[1]	n/a	2	1
Total		1,655 (80)	548 (21)	644	34

[1] Total interaction number represents actual observed and not estimated based on observer coverage. Mortality estimates could not be completed for management units B-E due to low take; thus, if observed interactions were ≤ 5 mortality was one; if observed interactions were >5 mortality was two.

[2] Fin clip samples have been sent to the lab for genetic analysis

Table 4. Authorized and actual annual estimated incidental takes per fishing year (for a total of 10 years; the life of the permit) with confidence intervals (95%) using a bootstrap method based on observer data for coverage and Atlantic sturgeon interaction levels in North Carolina's anchored small mesh (<5.0 ISM) inshore gill-net fishery for ITP Year 2016 (September 1, 2015 - August 31, 2016).

		Total Interactions			
		Authorized (Mortality)		Actual All DPS [2]	
Management Unit	Season	Carolina DPS	Other DPS	Alive	Dead
A	Winter	175 (14)	35 (3)	119 [29,283]	0
	Spring	219 (17)	44 (4)	0	0
	Summer	72 (6)	14 (1)	0	0
	Fall	103 (8)	21 (2)	0	0
B	Winter	2 (1)[1]	n/a	0	0
	Spring	6 (2)[1]	1 (0)	1	0
	Summer	3 (1)[1]	1 (0)	0	0
	Fall	3 (1)[1]	1 (0)	0	0
C	Winter	2 (1)[1]	n/a	0	0
	Spring	2 (1)[1]	n/a	0	0
	Summer	2 (1)[1]	n/a	0	0
	Fall	2 (1)[1]	n/a	0	0
D	Annual	8 (2)[1]	n/a	0	0
E	Annual	8 (2)[1]	n/a	0	0
Total		607 (58)	117 (10)	120	0

[1] Total interaction number represents actual observed and not estimated based on observer coverage. Mortality estimates could not be completed for management units B-E due to low take; thus, if observed interactions were ≤ 5 mortality was one; if observed interactions were >5 mortality was two.

[2] Fin clip samples have been sent to the lab for genetic analysis

Sincerely,

Jacob Boyd, Protected Species Biologist
Division of Marine Fisheries, NCDEQ

cc: Chris Batsavage
Braxton Davis
Dee Lupton
John McConnaughey

APPENDIX C

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUL 19 2017

Braxton C. Davis
Director, North Carolina Division of Marine Fisheries
3441 Arendell Street
P.O. Box 769
Morehead City, NC 28557

Dear Mr. Davis:

On July 13, 2017, the N.C. Division of Marine Fisheries (NCDMF) requested a minor modification to the Atlantic Sturgeon Incidental Take Permit (ITP) no. 18102 to allocate the takes in management units A – C as annual takes rather than seasonal takes. You note in your request that the number of allowed seasonal takes is very low in some cases, and the seasonal takes have been reached on a few occasions and have resulted in seasonal closures.

In your request, you also address the concern of takes occurring in warmer waters (20°C – 30°C) being correlated with more mortalities by noting that lower fishing effort in the summer season due to increasing water temperatures and fish availability should prevent sturgeon mortalities from exceeding the take limit. In our discussions, your staff also noted that the flexibility gained from this minor modification will allow you to adaptively manage fishing effort for times when the fishery is most productive from the fall through the spring, and that fishing effort in the summer decreases as productivity wanes. You also note that you actively monitor the fisheries and take levels daily to ensure take levels, including mortality levels, are not exceeded.

We have considered this minor modification request and determined it to be reasonable. NMFS therefore concurs with your request for this minor modification.

I appreciate you proactively requesting minor modifications to maximize permit implementation as you identify them. Also, as we have discussed with you previously, we understand that you are in the process of developing an updated ITP application and we look forward to analyzing all aspects of that updated application. I encourage you to incorporate any further anticipated minor modifications into that application process so my staff can more efficiently analyze these requests. Please sign below to acknowledge that you will comply with the minor modifications specified in this letter and send a copy of the signed letter to Ron Dean on my staff at your earliest convenience.

We look forward to continuing to work with you on Endangered Species conservation in North Carolina.

Sincerely,

for

Donna S. Wieting
Director, Office of Protected Resources

I acknowledge the minor modification specified above to Permit No. 18102 issued under Section 10 (a)(1)(B) of the Endangered Species Act to incidentally take endangered Atlantic Sturgeon in gillnet fisheries operating in inshore waters of North Carolina.

Braxton C. Davis
Director
N.C. Division of Marine Fisheries

7/21/17
Date

APPENDIX D

September 2, 2016

David,

The North Carolina Watermen United (NCWU) would like to thank you setting up the meeting with gill- and pound- netters. We appreciate your efforts to help re-open closed areas and keep others from being closed.

However, as many of the attendees at the meeting in Wanchese on Tuesday, August 30, 2016 mentioned, every possible action has been in effect for years to reduce interactions with endangered sea turtles under the regulations of the Sea Turtle ITPs since 2002. We already have many gear modifications, closures in high turtle interaction areas, a reduction in fishing times and a reduction in fishing efforts that include -

- 1. The state is divided into 6 Unit Areas and 4 of those 6 units have 4 days a week fishing only; night-time soaks only; 15-mesh deep nets and no floats. These are year-round restrictions in the 4 areas.

- 2. The southern portion of Unit A is also under these same restrictions. The entire deep-water area of Pamlico Sound is closed to the use of large mesh gillnet from September 1 until January of the next year.

- 3. All inlet corridors are closed to large mesh gillnets after September 1 each year.

- 4. Unit E is closed to the use of large mesh gillnets every May until October.

- 5. In all internal waters, the only areas that do not have gear modifications and further restrictions under the ITP are the northern parts of Unit A and Unit C – both of which have minimal interactions with sea turtles, and still only 4 interactions per unit per year are authorized.

At this time, NCWU would like to ask again that a meeting be set up with NCWU and NCFA fishermen, especially gill- and pound- netters, with representatives from the NC Division of Marine Fisheries and with Jean Beasley from the Karen Beasley Sea Turtle Foundation. Jean Beasley and NCWU asked the previous DMF Director for this meeting many times, but he never acted on our request. It is the perfect time to listen to her ideas and experiment with the devices that she has been advocating for years that she believes would help lessen the number of turtle interactions. I am a gillnetter and very willing to help test and monitor these devices.

We are hopeful that the cooperation between NCWU, NCFA and the NCDMF with Jean Beasley may help us all to solve some of the problems that our state's gillnet fishermen are experiencing.

Thank you.

Yours truly,

Andrew Berry

Andrew Berry
NCWU Board Member
252-722-4293
bowhunterab14@gmail.com

AB: mm
cc: NCDMF Director Braxton Davis, Chris Batsavage; Jacob Berg
NCDEQ Secretary van der Vaart
NCFA Director Jerry Schill, Chairman Brent Fulcher

APPENDIX E

Chris,

I am following up on the Protected Species Workgroup meetings. As was discussed at both meetings, there have been more than substantial measures directly, and indirectly, reducing mitigation of turtle interactions, but those measures need quantified.

I am requesting per the direction of the fishermen, that NCDFM quantify the total sea turtle mitigation reduction that has taken place from prior to the sea turtle lawsuit to present. It should also include impacts by other regulations such as fishery effort/harvest reductions. For the information to be useful, it may be necessary to separate reductions based on ITP closures from other reductions, so that we can determine how effective all of the other measures have been without closures. You may even include one total with, and one without closures.

It is also requested that a biological opinion be completed relating to those measures, once quantified, addressing the successful mitigation of sea turtles. It should include any potential measures that might be necessary, and only if necessary, to reduce interactions sufficiently, without relying on a set number to base closures on. This opinion should address both large and small mesh fisheries that have substantial interaction with turtles.

These items are being requested to work towards an ITP that sufficiently protects the species, while preventing unnecessary closures to the fishery.

I was just directed to make this request and wanted to get it to you as soon as possible. If in my haste I was unclear and need to clarify anything, please contact me anytime.

Take care,

David Bush
Fisheries Biologist,
NC Fisheries Association
(910)777-1605

APPENDIX F

November 23, 2016

Laura Runyan, Director
Foundation, Government and Faculty Grants Gettysburg College
300 North Washington Street
Gettysburg, PA 17325

Subj: Saltonstall-Kennedy Competitive Research Program Grant Proposal

Title: Development of sensory-based bycatch reduction technologies to reduce sea turtle bycatch in North Carolina coastal gillnet and pound net fisheries.

North Carolina Fisheries Association (NCFA) is excited at the opportunity to collaborate with Gettysburg College on the above referenced project. As a primary goal of our organization, we attempt to support all possible efforts to solidify the future of one of the oldest and proudest of professions, the commercial fishing industry. NCFA understands that to accomplish this, sustainable fishing efforts to harvest public trust resources is an absolute requirement.

The goal of this research, sea turtle bycatch reduction, is an important yet very complicated issue. It is one that NC fishermen understand, supporting substantial research efforts and enduring the subsequent changes to their fisheries to accomplish. The Turtle Excluder Device, or TED, is a prime example of successful collaboration between fishermen, academia, government scientists and management. The positive results of these efforts compound the issue within our internal water fisheries where the ever-increasing numbers of these animals are now encountered. This research is vital in finding ways to coexist with these endangered species, and it is hopeful that technology derived from this research will also be applicable to other industries and projects that affect them.

NCFA is experienced and knowledgeable in supporting research to develop bycatch reduction methods for finfish and sea turtles, and is eager to contribute to this project's successful implementation. We are currently in our second of three years of research concerning finfish bycatch reduction in the shrimp trawl industry. In collaboration with our state management agency, our preliminary results surpass all state and federal requirements. We support this proposed research methodology, and will also support the project to completion if awarded the requested grant.

We (NCFA) agree to act as subcontractor with Gettysburg College to complete the work plan as outlined in the proposal. It is understood that general concept of this work will involve coordination of the appropriate industry and state management personnel, facilitate workshops

as required, train and supervise independent observer efforts, directly contribute to this research utilizing accepted scientific methodology, and travel as required in performance of these duties.

NCFA Fisheries Biologist David Bush will perform that work. He will coordinate with his Co-PI Wendy Piniak of Gettysburg College and report to his board of directors with work results and updates as outlined in the scope of work enclosed within the application.

It is our understanding that, in the event this proposal is awarded, a subcontract will be issued in the estimated amount of $12,505 for the period covering 9/1/2017 through 8/31/2019. While this amount and dates appear in the application, the actual amount and project dates awarded to NCFA will be determined based on Gettysburg College's executed award.

The appropriate programmatic and administrative personnel of each institution involved in this grant application are aware of the sponsor's guidelines and pertinent regulations and policies and are prepared to establish the necessary inter-institutional agreement(s) consistent with all such policies. NCFA hereby certifies that neither it nor its principles nor those performing services under this application are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency from participation in this transaction.

Thank you for the opportunity to contribute to this project and we look forward to working with Dr. Piniak and Gettysburg College.

Respectfully,

Jerry Schill,
President,
NC Fisheries Association
2807 Neuse Blvd Suite 11
New Bern, NC 28562
252-633-6232 Ext. 100

cc: NCDMF - Director Braxton Davis, Biologists: Chris Batsavage, Jacob Boyd
NCFA - Board and Director

APPENDIX G

NORTH CAROLINA MARINE FISHERIES COMMISSION
DEPARTMENT OF ENVIRONMENTAL QUALITY

Aug. 25, 2016

Mr. Bob Lorenz
P.O. Box 10512
Wilmington, NC 28404

Dear Bob:

I wanted to let you know at last week's Marine Fisheries Commission meeting I announced the Sea Turtle Advisory Committee was being disbanded. I wanted to contact you directly and let you know I had taken this action and the reason why.

The commission has a multitude of committees, many of which are statutorily mandated, such as the Northern and Southern regional advisory committees and the Finfish, Shellfish/Crustacean and Habitat and Water Quality advisory committees. These committees require a great deal of attention, both in staff time and in resources. In looking for efficiencies in our committee system, I felt our regional and pertinent standing advisory committees could serve as venues to review and provide the needed input on sea turtle issues. So, after much consideration, I decided to disband the Sea Turtle Advisory Committee, because it is not statutorily required. This was a difficult decision, especially since I served on the Sea Turtle Advisory Committee prior to being appointed to the Marine Fisheries Commission.

Later this fall we will be doing our annual solicitation for advisers. If any of you are interested in serving on other committees, please let me know and I will make every effort to place you on one of these committees as openings become available.

In closing, please know how much I appreciate your dedication and service to the state. I encourage you to please stay involved in fisheries issues and I hope to see you or hear from you in the future.

Sincerely,

Sammy Corbett, Chairman
N.C. Marine Fisheries Commission

cc: Chris Batsavage, Division of Marine Fisheries

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

March 7, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Chris Batsavage, Protected Resources Section Chief/Special Assistant for Councils

SUBJECT: Mid-Atlantic Fishery Management Council Meeting Summary— Feb. 13-15, 201

The Mid-Atlantic Fishery Management Council met on Feb. 13-15 in Raleigh, NC. Highlights of the management actions taken by the council are discussed below:

2018 Recreational Black Sea Bass Management Measures
The council took action on 2018 recreational black sea bass regulations in federal waters after deferring action at their December meeting to wait until the Atlantic States Marine Fisheries Commission's Summer Flounder, Scup and Black Sea Bass Board (board) approved new management approaches for state water measures in 2018. The state waters measures were approved by the board at its February meeting through the adoption of Addendum XXX to the Atlantic States Marine Fisheries Commission's Summer Flounder, Scup and Black Sea Bass Fishery Management Plan. The council recommended an open season from May 15-Dec. 31 with a 12.5-inch minimum size limit and a 15-fish possession limit. The recommended measures eliminate the closure from late September to late October, which has been in place for several years. The combination of both state and federal water recreational management measures is meant to achieve, but not exceed, the 2018 recreational harvest limit of 3.66 million pounds.

Recreational Black Sea Bass Wave 1 Fishery and Letter of Authorization Framework
The council discussed the current and future implementation of a recreational black sea bass fishery during Wave 1 (January-February). The fishery was open from Feb. 1-28, 2018 with a 12.5-inch minimum size limit and a 15-fish possession limit, but only Virginia and North Carolina chose to participate. The council considered a Letter of Authorization program for the Wave 1 fishery in 2019, but ultimately decided to implement a Wave 1 fishery through the normal specifications process, if the council thinks it is prudent to open the fishery during Wave 1 next year. The council thought it was a better use of staff time to focus on other recreational black sea bass priorities in 2018 instead of developing a Letter of Authorization program in 2019. However, the development of a Letter of Authorization program will continue for potential implementation in 2020.

Summer Flounder, Scup, and Black Sea Bass Commercial Accountability Measures Framework
The council took final action on a framework to modify the commercial accountability measures for summer flounder, scup, and black sea bass. The current accountability measures require a pound-for-

pound payback if the annual catch limit is exceeded due to dead discards. This framework provides flexibility for commercial accountability measures based on the stock status of these species. A payback is not required if the current biomass is above the biomass target. Paybacks are required when the current biomass is either between the biomass target and threshold or if the current biomass is below the threshold; the degree of payback depends on the stock status (higher paybacks are required when the current biomass is lower).

North Atlantic Right Whales Status Review

The council received information on the latest 5-Year Review for North Atlantic Right Whales, which showed a low rate of reproduction, longer calving intervals, declining population abundance, continued mortality from vessel strikes and fishing gear interactions, changes in prey availability, and increased transboundary movement and risk. This substantial change in the right whale's status resulted in the re-initiation of the Endangered Species Act Section 7 Fishery Biological Opinion for five of the council's seven fishery management plans. The council also received information on a range of gear modifications and technology developments that could potentially reduce whale entanglements.

Upcoming Meeting

The next regularly scheduled meeting of the Mid-Atlantic Fishery Management Council will be April 10-12, 2018 at the Montauk Yacht Club in Montauk, NY.

February 2018 Council Meeting Report

February 13-15, 2018
Raleigh, NC

The following summary highlights actions taken and issues considered at the Mid-Atlantic Fishery Management Council's February 2018 meeting in Raleigh, NC. Presentations, briefing materials, and webinar recordings are available on the Council website at www.mafmc.org/briefing/february-2018.

Black Sea Bass Recreational Management Measures

2018 Recreational Management Measures

The Council took final action on 2018 recreational black sea bass federal water measures. The Council initially considered these measures at the December 2017 meeting but delayed action to wait until the Atlantic States Marine Fisheries Commission's Summer Flounder, Scup and Black Sea Bass Board (Board) approved new management approaches for state water measures in 2018. At their February meeting, the Board approved regionally allocating the coastwide Recreational Harvest Limit (RHL) based on a combination of exploitable biomass information from the latest stock assessment and historical harvest. Three regions were established (MA-NY; NJ; DE-NC), and each region will develop recreational management measures to achieve their respective regional allocations. The combination of both state and federal water recreational management measures is meant to achieve, but not exceed, the 2018 RHL of 3.66 million pounds. The Council recommended the removal of the current fall closure which would result in the following 2018 federal water measures: a season from May 15 – December 31, a 15-fish possession limit and 12.5-inch TL minimum size.

Wave 1 Fishery and LOA Framework

The Council discussed the direction and future implementation of a recreational black sea bass Wave 1 (January-February) fishery. For 2018, the Council had previously approved a February 1-28 fishery through the recreational specification-setting process. Only the states of Virginia and North Carolina ultimately participated in the 2018 fishery. For future years, the Council is considering opening the Wave 1 fishery under a Letter of Authorization (LOA) program which would allow any vessel owner to participate in the Wave 1 fishery provided they obtain and abide by all requirements contained within an LOA. After a lengthy discussion regarding recreational black sea bass management priorities the Council agreed to consider a Wave 1 fishery in 2019 through the recreational specification process, as occurred in 2018. Staff resources will prioritize other recreational management initiatives while the development of an LOA program will continue for potential implementation in 2020.

Summer Flounder, Scup, and Black Sea Bass Commercial Accountability Measures Framework

The Council took final action on a framework to modify the commercial accountability measures (AMs) for summer flounder, scup, and black sea bass. The AMs currently in place require a pound-for-pound payback if the ACL is exceeded due to higher-than-projected discards. This framework is intended to add flexibility in the commercial AMs for these species based on stock status. The framework considered alternatives to the existing AMs, with a focus on evaluating and accounting for commercial discards with options for both (1) evaluation of Annual Catch Limit (ACL) overages and (2) responses to non-landing overages to account for the latest information and current stock status.

After considering a range of options, the Council selected a preferred alternative which would not require a payback if current stock biomass is above the target biomass and would implement more aggressive paybacks when stock conditions warrant additional protection and management response. The Council also decided to

retain the existing ACL evaluation process which utilizes a single year of commercial catch (both landings and discards) to evaluate the commercial sector ACL instead of the alternative that would have used a 3-year average discard calculation. If this action is approved by NOAA Fisheries, it is anticipated that these changes will be implemented later in 2018.

Risk Policy Framework and Management Strategy Evaluation (MSE)

In December 2017 the Council discussed possible changes to its Acceptable Biological Catch (ABC) control rule and risk policy. The Council considered seven alternatives that were evaluated via management strategy evaluation (MSE) by Dr. John Wiedenmann (Rutgers University) and agreed to postpone final action until after the completion of additional MSE analyses which would more comprehensively account for social and economic impacts of alternative ABC control rules and risk tolerance levels.

During this meeting, the Council received presentations from Dr. Wiedenmann and Dr. Doug Lipton (NOAA Fisheries) on current model development and research that would integrate more comprehensive social and economic analyses into an MSE model. The Council provided feedback on the ongoing work and agreed to continue MSE model development with a focus on incorporating social and economic factors in a more comprehensive manner, with an initial focus on summer flounder. Based on some of the initial MSE results, the Council may also explore different risk policy approaches depending on species life history.

Council Habitat Update

Council staff provided an update on the development of a Northeast regional habitat assessment, including a summary of recommendations from the first meeting of the regional habitat steering committee. The Northeast regional habitat assessment is a collaborative effort to describe the quantity and quality of key marine fish habitats in the Northeast region. This project will involve compiling new and existing habitat information and identifying habitat information gaps. Three key areas have been identified to support the integrated habitat assessment: (1) an inshore assessment, (2) an offshore assessment, and (3) an evaluation of the "fish habitat footprint" for key fish species and species groups. Project teams will be formed to develop work plans for each component of the assessment, and work is expected to begin in July 2018.

Staff provided an update on offshore wind development in the region and discussed options for Council engagement in offshore wind issues. The Council voted to support the collaborative approach described in the staff memo, that will involve working with both the New England Council and the NOAA Fisheries "Wind Team" to examine the social, economic, and ecological impacts of wind energy facilities in the region, commenting on specific upcoming BOEM projects, and developing a web-based "living report" with analyses, maps, and products to enable more effective engagement on offshore wind issues. The Council also passed a motion to submit a letter to the Secretaries of Interior and Commerce requesting that: (1) no new wind energy areas be sited, nor project designs finalized, until the study (collaborative work) is complete and fisheries impacts can be properly evaluated, and (2) request that NOAA adopt a more active role in working with BOEM to effectively site future wind energy projects.

The Council also received an overview of fish habitat projects of interest occurring in the region that were highlighted by the NOAA Fisheries Habitat Conservation Division in a written update.

North Atlantic Right Whales

Dr. Michael Asaro, from NOAA Fisheries Greater Atlantic Regional Office, presented on the North Atlantic Right Whale Five-Year Review, the re-initiation of Endangered Species Act Section 7 Fishery Biological Opinion, and the formal consultation process. In October 2017 NOAA Fisheries released the results of a five-year review of North Atlantic right whales, conducted as a requirement of the Endangered Species Act. The review indicated that the population has been in decline since 2010 and that the status of North Atlantic right whale recovery has not improved since the last 5-Year Review was conducted in 2012. Specifically, the report found that North Atlantic right whales are experiencing a low rate of reproduction, longer calving intervals, declining population

abundance, continued mortality from vessel and fishing gear interactions, changes in prey availability, and increased transboundary movement and risk. Because of the significant change in the status of the species, NOAA Fisheries has reinitiated formal consultation on a number of federal fishery management plans (FMPs), including 5 of the Council's 7 FMPs. Dr. Asaro provided an overview of the formal consultation process and discussed a range of gear modifications and technology developments that could potentially reduce whale entanglements.

Climate Change and Fisheries

Bradford Dubik, a PhD candidate at Duke University, presented on his research examining long-term trends in average commercial fishing location for summer flounder since 1996. Vessel Trip Report data indicate that many states have seen a Northward shift in their permitted vessels' average fishing location, likely due in part to changes in the range and center of biomass of summer flounder.

Dr. Jim Morley presented the results of his research with colleagues at Rutgers University to predict geographic range shifts for hundreds of marine species in the Atlantic and Pacific. Using long-term ecological data, the researchers developed thermal habitat models which were coupled with various future greenhouse gas emission scenarios to produce a range of possible future outcomes for each species. Dr. Morley provided an overview of the projected shifts in distribution for Mid-Atlantic species. These projections offer fishery managers a tool for identifying species, fisheries, and management efforts that are particularly vulnerable to climate change impacts.

Other Business

Ricks E Savage Award

Former Council member Howard King was named this year's 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. In 2017, Mr. King completed a 9-year term on the Council. Mr. King retired in 2007 as Director of Fisheries Service for the Maryland Department of Natural Resources following a 41-year career in fisheries science and management. "Howard King has served this Council with tremendous leadership both on the Council and as our liaison at the New England Council," said Council Chairman Mike Luisi.

From Left: Council Executive Director Chris Moore, Vice-Chairman Warren Elliott, Howard King, and Chairman Mike Luisi

Next Meeting

April 10-12, 2018
Montauk Yacht Club
32 Star Island Road Montauk, NY 11954
Telephone: 631-668-3100

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

April 20, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Chris Batsavage, Protected Resources Section Chief/Special Assistant for Councils

SUBJECT: Mid-Atlantic Fishery Management Council Meeting Summary— April 10-12, 2018

The Mid-Atlantic Fishery Management Council met on April 10-12 in Montauk, NY. Highlights of the management actions taken by the council are discussed below:

Atlantic Mackerel Benchmark Stock Assessment and Stock Rebuilding
The council received a report on the benchmark stock assessment for Atlantic mackerel, which determined that the stock is overfished and overfishing is occurring. Fishing mortality in 2016 was estimated at 0.47, which is above the overfishing threshold of 0.26 and the 2016 spawning stock biomass was estimated at 43,419 metric tons, which is below the overfished threshold of 98,447 metric tons. The Magnuson-Stevens Conservation Act requires rebuilding plans for overfished stocks, so the council reviewed potential options for rebuilding the stock. Current projections suggest that due to a strong incoming year class, Atlantic mackerel can rebuild as soon as 2021, though recruitment at the end of a time series is typically one of the most uncertain outputs of assessments. The council will take final action on a rebuilding plan later this year.

River Herring and Shad Bycatch in the Atlantic Mackerel Fishery
The 82-metric ton river herring and shad catch cap for the directed Atlantic mackerel fishery was surpassed in February, which prohibited vessels from possessing more than 20,000 pounds of Atlantic mackerel per trip for the remainder of the year. This is the first time the cap has been exceeded since the catch cap was implemented in 2015. The cap is designed to create an incentive for Atlantic mackerel fishermen to avoid river herring and shad because the entire mackerel quota cannot be landed if the catch cap is reached. However, the river herring and shad catch cap is not based on stock abundance for these species, so there is overall concern that the impact of river and herring catch from this fishery is unknown. The council will develop river herring and catch caps for the Atlantic mackerel fishery in 2019-2021 later this year.

Blueline Tilefish Specifications
The council recommended an annual recreational blueline tilefish quota of 71,912 pounds and an annual commercial quota of 27,140 pounds for the commercial fishery for 2019, 2020, and 2021. The recreational management measures remain the same: May 1 – Oct. 31 season with bag limits set at 7 fish for U.S. Coast Guard inspected vessels (head boats), 5 fish for uninspected vessels (charter boats), and 3 fish for private vessels. The commercial trip limit increased to 500 pounds

per trip until 70 percent of the quota is reached; the trip limit decreases to 300 pounds per trip for the remaining 30 percent of the quota. The quota and management measures account for the management unit north of the North Carolina/Virginia border. The South Atlantic Fishery Management Council manages blueline tilefish from North Carolina through the east coast of Florida.

Upcoming Meeting

The council will meet jointly with the Atlantic States Marine Fisheries Commission's Summer Flounder, Scup, and Black Sea Bass Management Board on April 30 in Arlington, VA. The next regularly scheduled meeting of the Mid-Atlantic Fishery Management Council will be June 5-7, 2018 at The Doubletree by Hilton in Philadelphia, PA.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

April 6, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Michelle Duval

SUBJECT: South Atlantic Fishery Management Council Meeting Summary (March 5-9, 2018)

The South Atlantic Fishery Management Council (council) met March 5-9, 2018 in Jekyll Island, Georgia. The attached meeting report compiled by council staff contains a summary of the major issues addressed and actions taken. The report includes links to the post-meeting news release, briefing materials, and the graphical and more detailed summary of the meeting via the March 2018 Council Meeting Round-up Story Map (https://arcg.is/0H55O1). Links to summary motions, public comments, the meeting report, as well as the above items for any council meeting can be found on the main Council Meetings webpage (http://safmc.net/safmc-meetings/council-meetings/). Items that may be of interest to the commission are highlighted below:

- Cobia: The council reviewed public comment on Coastal Migratory Pelagics Amendment 31, which considers either transferring management authority to the Atlantic States Marine Fisheries Commission, or continuing complementary management of cobia. The council's preferred alternative is to remove Atlantic cobia from the federal fishery management plan, and the clear majority of public comment supported this option. The council was scheduled to take final action on this amendment in March; however, most members voted to postpone final action until the June council meeting. This was done so that concerns from NOAA Fisheries General Counsel regarding timing of regulatory requests from the Atlantic States Marine Fisheries Commission to complement the state-specific plans could be addressed.

- For-Hire Electronic Reporting Amendment: The proposed rule for this amendment published on April 3, 2018; comments on both the proposed rule and amendment will be accepted through May 13, 2018. The amendment would require weekly electronic reporting by federally-permitted charter vessels, and would modify the existing electronic reporting timeframe for headboats. Please see the following NOAA Fishery Bulletin for more information: http://sero.nmfs.noaa.gov/fishery_bulletins/2018/024/index.html).

- For-Hire Permit Moratorium Amendment: The council reviewed a simplified scoping document and requested several modifications to the questions and issues presented. The revised document will be reviewed in June and considered for approval for August scoping hearings.

- Commercial and Recreational Vision Blueprint Amendments: The council approved both draft amendments for public comment, which will be solicited both online and in person via webinar listening stations. The amendments contain actions to address input received during development of the Snapper Grouper Vision Blueprint and pertain to geographic access, retention and minimizing discards. Actions contained in the commercial amendment address split seasons and/or trip limits for a number of foundational species in the fishery, while actions in the recreational amendment address reorganization of the existing bag limit aggregates to better reflect how anglers fish and the characteristics of a recreational trip. Listening stations will be held in North Carolina at 6pm on the following dates: May 8 (Wilmington Regional Office), May 9 (Central District Office), May 10 (Hatteras Community Building).

- Commercial Snapper Grouper Fishery Social and Economic Profile: The council received a presentation on the draft social and economic profile of the commercial snapper grouper fishery. This report was requested by the council as a result of input received during the development of the Snapper Grouper Vision Blueprint. Information contained in the report highlights the regional and seasonal differences in trip types, commercial permit porfolios, and community differences. The current draft of the report can be found here: http://safmc.net/download/Briefing%20Book%20March%202018/06%20-%20Snapper%20Grouper%20Committee/TAB06_A05b_SGProfileReport_021318_ForSAFMCMarch2018.pdf. The presentation on the report can be found here: http://safmc.net/download/Briefing%20Book%20March%202018/06%20-%20Snapper%20Grouper%20Committee/TAB06_A05a_SGProfilePresentation_March2018.pdf.

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

4055 Faber Place Drive, Suite 201, North Charleston SC 29405
Call: (843) 571-4366 | Toll-Free: (866) SAFMC-10 | Fax: (843) 769-4520 | Connect: www.safmc.net

Charlie Phillips, Chair | Captain Mark Brown, Vice Chair
Gregg T. Waugh, Executive Director

REVISED*
MARCH 5-9, 2017 COUNCIL MEETING REPORT
JEKYLL ISLAND, GEORGIA

The following summary highlights the major issues discussed and actions taken at the South Atlantic Fishery Management Council's March 2018 meeting in Jekyll Island, Georgia.

Briefing materials, presentations, and public comments are available on the Council's website at: http://safmc.net/safmc-meetings/council-meetings/

Final Committee Reports contain more details of what was accomplished for each committee and are located on the March 2018 briefing book page. In addition, the Summary of Motions on the Council's website includes all motions from the meeting. Read further details and see images and other links at the March 2018 Council Meeting Round-up Story Map: https://arcg.is/0H55O1. The Meeting News Release is available at: http://safmc.net/news-releases/03-09-18-safmc-news-release-council-delays-changes-to-atlantic-cobia-management-at-march-council-meeting/

*Revised to correct timing on visioning amendments to show final approval in September not December.

Issue:	Action Taken:	Schedule:
Red Snapper	Amendment 43 is currently under review by NMFS. The amendment was sent to NMFS on November 20, 2017.	If approved, the recreational season would begin on July 13, 2018 (2nd Friday) and the commercial season on July 9, 2018. Recreational bag = 1 with no size limit. Commercial trip limit = 75 pounds gutted weight with no size limit.
	The Council provided guidance on actions to include in Amendment 46: • Private Recreational Permit • Private Recreational Electronic Reporting	Review actions in Amendment 46 at the June 2018 meeting.
	The following items were split into a framework amendment to move faster: • Require use of Best Fishing Practices (e.g., descending devices, venting, hook type) • Adjust Powerhead Prohibitions in the South Atlantic (allow in the EEZ off SC or prohibit use of powerheads in entire EEZ)	Review actions at the June 2018 meeting. The Framework Amendment would move faster than Amendment 46 during 2018.

Issue:	Action Taken:	Schedule:
Recreational Visioning Amendment	Regulatory Amendment 26: Provided guidance and revised Actions & Alternatives. Alternatives include options for modifications to bag limits, seasons for deep-water species and shallow-water groupers, and size limits for deep-water species and triggerfish that would help streamline the regulations for anglers, law enforcement, and managers. Approved for public hearings.	Public hearings in Spring. Review public comments, modify document, and approve all actions in June 2018. Review and approve for formal review in September 2018.
Commercial Visioning Amendment	Regulatory Amendment 27: Provided guidance and revised Actions & Alternatives for trip limits, size limits, split seasons, seasons, and other measures. Approved for public hearings.	Public hearings in Spring. Review public comments, modify document, and approve all actions in June 2018. Review and approve for formal review in September 2018.
For-Hire Moratorium Amendment	The Council provided guidance on what to include in the scoping document.	Review draft scoping document and consider approving for scoping at the June 2018 meeting.
Golden Tilefish	The Council provided guidance on alternatives to include in the amendment. The Council requested the SSC to revisit the ABC recommendation indicating the Council is willing to accept the risk of overfishing associated with an ABC of 362,000 pounds whole weight for 2019 and 2020. The Council's rationale is included in the Snapper Grouper Committee Report.	Conduct a public hearing at the June 2018 meeting. The Council will then review and approve the amendment for formal review with the intent to have regulations in place prior to January 1, 2019 when the season opens.
Red Grouper	The Council directed staff to begin an amendment to revise the rebuilding plan for red grouper.	Review the draft amendment in June 2018.
Yellowtail Snapper	The Council directed staff to work on an amendment to revise the accountability measures to remove in-season closures for either sector until the total ACL is met.	Review the draft amendment and provide guidance to staff in June 2018. The intent is to have changes in place for the 2019 season.
Modifications to Sea Turtle Release Gear	The Council directed staff to continue working on the framework amendment and conduct scoping.	Review scoping comments, provide guidance, and approve actions/alternatives in June 2018.

Issue:	Action Taken:	Schedule:
Mackerel Cobia	State implementation plans, under the approved ASMFC Cobia Plan, are scheduled to become effective April 1, 2018. The Council revised the Actions and Alternatives in CMP Amendment 31 (Atlantic Cobia) and retained Alternative 2 as preferred: Remove Atlantic cobia from the CMP Fishery Management Plan. The Council directed staff to make the requested revisions, address the NOAA GC concerns, and bring the document back to the Council in June 2018 for final action. The Council selected Preferred Alternative 3 in the framework amendment to change the Atlantic king mackerel commercial trip limit.	State regulations effective April 1, 2018. The Council will help get the word out to the public. The Council will review the revised amendment and take final action at the June 2018 meeting. Council staff will work on this framework and bring it back at a future meeting.
Spiny Lobster	The Council reviewed scoping comments and provided guidance on Actions & Alternatives to be analyzed in Spiny Lobster Amendment 13 (Modifications to Gear Requirements & Cooperative Management Procedure).	This is a joint Amendment with the Gulf Council. Review the amendment and approve for public hearings at the June 2018 meeting. Public hearings are expected in July with final approval by the Gulf in August and the South Atlantic in September.
Habitat and Ecosystem Based Management	The Council approved the Fishery Ecosystem Plan II, the FEP II Dashboard, the Implementation Plan, and the 2-Year Roadmap.	Prepare materials for posting to the Council's website and begin work on the items identified.
Citizen Science Program	The Council received recommendations from the five Action Teams busy developing the program.	The Council agreed that the recommendations were on track and that they would now be put into motion by the Action Teams for the scamp pilot project during 2018.
For-Hire Recreational Reporting	The Council received an update on the amendment: the Notice of Availability of the Amendment and the Proposed Rule are under review in headquarters and are expected to publish soon. Council staff briefed the Council on the For-Hire Outreach efforts.	The proposed rule and notice of availability of the amendment are expected to publish in the federal register soon. The goal is to have regulations effective this summer. For-Hire reporting training and outreach will continue in 2018.

Issue:	Action Taken:	Schedule:
SEDAR	Dr. Cisco Werner, acting SEFSC Director, outlined approaches to get more assessments sooner. This includes a Research/Operational Assessment framework and providing interim analyses of assessed stocks. The Council provided the following guidance for the SEDAR Steering Committee: 1. Requested red grouper as the first MRIP revision assessment. 2. Recommend the next king mackerel assessment be a standard assessment. 3. Requested the SEFSC provide guidance on stocks to consider for a 1st benchmark assessment in 2023 and 2024, considering the prioritization tool and the need for a wreckfish assessment.	The Council supported the efforts to get more stock assessments. The South Atlantic Council representatives will raise these issues at the next SEDAR Steering Committee meeting.
ABC Control Rule	Directed staff to work on an amendment to the Snapper Grouper, Dolphin Wahoo, Golden Crab, Sargassum, and Coral FMPs to make changes to the ABC control rule. Directed staff to work on an amendment to change the in-season closure for the recreational sector.	Review a revised options paper at the June 2018 meeting. Review an options paper at the June 2018 meeting.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Randy Gregory, Fishery Management Section

SUBJECT: Highly Migratory Species Update

The Highly Migratory Species Advisory Panel met March 7-9, 2018 in Silver Spring, Maryland. The advisory panel discussed the results of the 2017 International Commission for the Conservation of Atlantic Tunas annual meeting, shortfin mako shark emergency interim final rule, draft Amendment 11 scoping review for shortfin mako shark, Amendment 7 bluefin tuna management three-year review, January/December General Category bluefin tuna fishery, and modifications to shark commercial fishery closure criteria.

Bluefin Tuna

The National Marine Fisheries Service closed the January sub-quota (January through March) for the Atlantic bluefin tuna General category fishery for large medium and giant bluefin tuna on March 2, 2018. Prior to the closing, a transfer of 10 metric ton from the 24.8 metric ton Reserve category quota to the General category quota for the January sub-quota resulted in an adjusted sub-quota of 49 metric tons. Fish were landed mainly in Dare County from mid-February until the closing and landings totaled 59.2 metric tons (121 percent of the adjusted January sub-quota). An International Commission for the Conservation of Atlantic Tunas recommendation adopted at the annual meeting in November 2017 for western Atlantic bluefin tuna management will result in an increase to the baseline U.S. bluefin tuna quota from 1,058.79 metric tons to 1,247.86 metric tons. National Marine Fisheries Service also anticipates that some under harvest of the 2017 adjusted U.S. bluefin tuna quota will be carried forward to 2018 and placed in the Reserve category in mid-2018 (when complete 2017 catch information is available and finalized). The General category fishery will reopen on June 1, 2018, with a quota of 233.3 metric tons available for the June through August sub-quota.

The National Marine Fisheries Service closed the Atlantic bluefin tuna (BFT) Angling (recreational) category fishery for large medium and giant "trophy" BFT (measuring 73" or greater) in the southern area effective on March 17, 2018 and the fishery will remain closed through December 31, 2018. The southern area is the area south of 39°18'N (off Great Egg Inlet, NJ), outside the Gulf of Mexico. Just before the fishery closed, retired Army General Scott Chambers of Townsend, Delaware, caught a new state record 877-pound bluefin tuna off Oregon Inlet. It measured 113 inches fork length (curved lower jaw fork length, tip of the nose to the fork

in the tail) and had a girth of 79 inches. Chambers' fish broke the former state record bluefin tuna by 72 pounds. That fish was caught off Oregon Inlet, as well, in 2011.

Sharks

On March 1, 2018, the National Marine Fisheries Service announced an emergency rule to implement management measures to address overfishing of North Atlantic shortfin mako sharks. The measures are based on the International Commission for the Conservation of Atlantic Tuna's Standing Committee for Research and Statistics 2017 benchmark stock assessment for North Atlantic shortfin mako sharks, which found the stock to be overfished* with overfishing* occurring. Commercial measures require the live release of shortfin mako sharks in the commercial pelagic longline fishery (retention is only allowed if a shortfin mako shark is dead at haul back) and no landings of shortfin mako sharks by commercial fishermen using other commercial gear types. Recreational measures require a minimum size limit of 83 inches fork length for shortfin mako sharks.

***Definitions**

Overfished: 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.

Overfishing: Fishing that causes a level of mortality that prevents a fishery from producing a sustainable harvest.

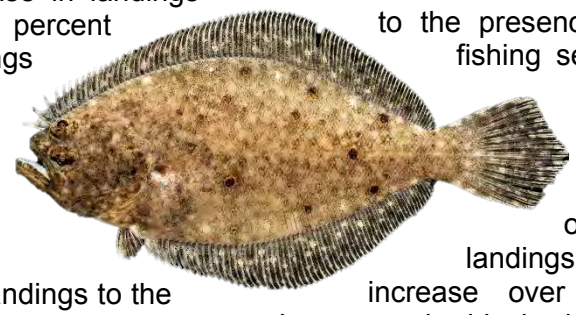
NORTH CAROLINA DIVISION OF MARINE FISHERIES

Fish Dealer Report

License & Statistics Section, PO Box 769, Morehead City, NC 28557 May 2018

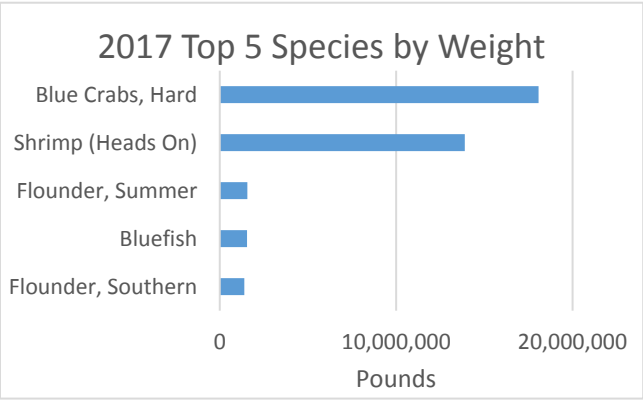
2017 COMMERCIAL LANDINGS REVIEW

Commercial fishermen landed 54.3 million pounds of finfish and shellfish in 2017, with an estimated dockside value of $96.5 million dollars, based on data collected through the North Carolina Division of Marine Fisheries Trip Ticket Program. This represents a 9.3 percent decrease in landings compared to 2016, and a 2.6 percent increase in value. The 2017 landings were lower than the five-year average of 58 million pounds, and higher than the five-year average value of $92 million dollars.



Dealers in 33 counties reported landings to the Trip Ticket Program in 2017. Dare county had the highest landings (13.8 million pounds), followed by Carteret (8.4 million pounds), Hyde (6.1 million pounds) Pamlico (3.9 million pounds), and Tyrrell (3.4 million pounds). These five counties accounted for 68.6 percent of the statewide landings.

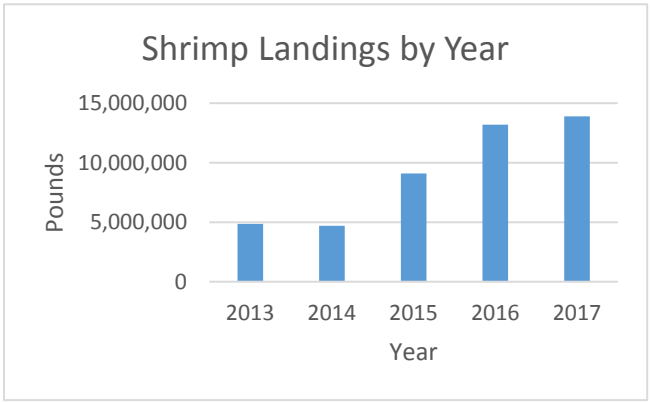
The top five species landed were hard blue crabs (18.1 million pounds), followed by shrimp (13.9 million pounds), summer flounder (1.6 million pounds), bluefish (1.5 million pounds), and southern flounder (1.4 million pounds).



The top five species with landings increases from 2016 to 2017 were red drum (142 percent), bluefin tuna (107 percent), black drum (103 percent), Atlantic menhaden (89 percent), and skates (78 percent).

The increase in bluefin tuna was, in part, due to the presence of the fish during the fishing season, favorable weather, and the availability of quota. Although menhaden experienced an 89 percent increase over the previous year's landings, it was only a 10 percent increase over the five-year average. Increases in black drum and red drum were attributed to strong year classes in previous years.

Shrimp landings were also notable in 2017. Although the landings were only up 5 percent from 2016, they remained at an all-time high and are 34 percent higher than the five-year average.



The top five species landed by value were shrimp ($29.6 million), hard blue crabs ($17.8 million), summer flounder ($6.3 million), southern flounder ($5.7 million), and oysters ($5.6 million).

Other landings increases included spot (76 percent), yellowfin tuna (61 percent), soft blue crabs (50 percent), and king mackerel (50 percent).

Blue peeler crab landings, interestingly, experienced a 74 percent increase from 2016, with an increase in value of 25 percent, even with a 30 percent drop in peeler pot trips over the same period.

Noteworthy decreases in landings included spiny dogfish (83 percent), cobia (57 percent), Atlantic croaker (52 percent), American eel (49 percent), and harvestfish (49 percent).

The number of trips by major gear experienced some notable changes from 2016 to 2017. These changes included increases in beach seine (182 percent), drift gill nets (111 percent), trotline (98 percent) and decreases in crab dredges (83 percent), skimmer trawl (47 percent), oyster dredge (43 percent), and peeler pots (30 percent).

BLUE CATFISH LANDINGS

Catfish have seen an overall increase in landings in the past few years, based on data collected through the North Carolina Trip Ticket Program. The 2015 (917,965 pounds), and 2016 (992,439 pounds) landings were nearly double those of previous years. Landings in 2017 (1,165,136 pounds), were the highest in the state since 1994 (1,276,359). The estimated five-year average dockside value since 2013 is $230,391.

Major gears used to land catfish were gill nets, pound nets and fyke nets. The areas with the highest landings were in the western Albemarle Sound and Chowan River.

At fish houses across coastal North Carolina, it is important to identify catfish to the exact species whenever possible. While the Trip Ticket Program has the ability to record white, channel, blue, and bullhead catfishes, most landings are reported as unclassified catfish. Fish house sampling from division Fisheries Management staff indicates that most of these unclassified catfish are blue catfish. Blue catfish are native to the Mississippi River Basin, and considered an invasive species in river basins that drain into the Atlantic Ocean.

Blue catfish were introduced into North Carolina and Virginia coastal rivers in the 1960s and 1970s. Although they have been in North Carolina coastal waters for many years, in recent years the population has increased significantly, and blue catfish are now the dominant catfish in the Albemarle Sound and its tributaries, especially the Chowan and Roanoke rivers.

Blue catfish have a long-life span, can exceed 120 pounds, and have an expansive diet that includes many native species that play an important role in North Carolina's ecosystem and economy, such as blue crab, striped bass, Atlantic menhaden, river herring, and American shad. Once an invasive species like blue catfish has established a population it can be impossible to eradicate. Instead, managers must focus on keeping their overall numbers as low as possible and containing their expansion to minimize adverse impacts on native species. For this reason, the division encourages dealers to report landings to the area as close as possible, and not just the general "Albemarle Sound".

The trip ticket codes for blue catfish are as follows:

182 Catfish, Blue - whole	183 Catfish, Blue - dressed
1820 Mixed	1830 Mixed
1822 Small	1832 Small
1823 Medium	1833 Medium
1824 Large	1834 Large
1825 Jumbo	1835 Jumbo

VESSEL UPDATE

The North Carolina Trip Ticket Program is working with Bluefin Data, the developer of the current trip ticket software, on a web-based application that will allow trip ticket reporting via your web browser.

Entering tickets through your web browser will allow dealers to use smart phones, computers, or tablets. With the help of North Carolina fish dealers, the Trip Ticket Program has undergone preliminary user testing, and forwarded participants' comments to the developer. The program continues to work with the developer to ensure state requirements are met and the application functions in a user-friendly manner.

DISPOSITION CODE UPDATES

The North Carolina Marine Fisheries Commission has instructed the North Carolina Division of Marine Fisheries to add a place to record catch disposition on commercial trip tickets. The intent is to capture commercial harvest that is not being sold to the dealer. This could include situations where a fisherman has kept some of the landed species for personal consumption, or if part of the harvest was kept for bait. The Trip Ticket Program has begun phasing in these new tickets. Examples of them, and how to fill them out, are attached to this report. The electronic reporting software can also record this data, and the division strongly encourages all dealers to use it.

NEW DIRECTOR

Steve Murphey assumed the role of director of the Division of Marine Fisheries in January. Murphey began his career in the division in 1987 as a biologist. He worked for the Shellfish Sanitation and Recreational Water Quality Section of the Division of Environmental Health from 1999 to 2010 when the section moved under the Division of Marine Fisheries. He became section chief for Habitat and Enhancement in the summer of 2015, where he was responsible for coordinating large-scale marine and estuarine habitat restoration and other programs including shellfish leasing and the Coastal Habitat Protection Plan.

LICENSE SALES

Below are sales as of April 11, by license type for the 2018 (July 1, 2017-June 30, 2018) license year. The values below include active licenses only. Totals do not include transfers, replacements, or voids.

Standard Commercial Fishing License	4,968
Retired Standard Commercial Fishing License	1,328
Commercial Fishing Vessel Registration	7,270
Land or Sell License	109
NC Resident Shellfish License Without SCFL	988
Fish Dealer License	694
Ocean Pier License	20
Recreational Fishing Tournament License	20
Recreational Commercial Gear License	1,733
Total Licenses for All License Types	17,130

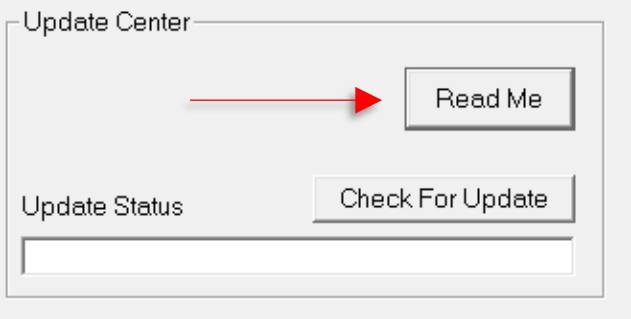
TRIP TICKET CODE ADDITIONS

The Trip Ticket Program recently added new species codes. These codes were developed in response to dealer requests and new fishing practices. They are: Caribbean Red Snapper (6420), Frigate Mackerel (7260), Bullet Mackerel (7280), and Chub Mackerel (4110). New gear codes were also implemented to reflect changes in gear use and to help align with federal logbook reporting. These codes include: buoy gear (614), trolling with bandit gear (661), bottom fishing with bandit gear (613), and bottom fishing with rod and electromate reel (616). Dealers should update their software to the latest version (7.0.2) to begin using these codes.

TECH TIPS

The following are tips designed to help electronic dealers enter data on their trip tickets faster and with less hassle.

Did you know that the electronic trip ticket software gets regular updates? The software is updated to fix bugs, add new and updated species codes, and to update the user manual. You can find a list of changes by clicking on the "Read Me" button on the bottom right of the main screen, under the "Update Center" section.



From this screen, you can also find the user manual, by clicking on the menu option on the top right labeled "User's Manual". The latest update is version 7.0.2, which incorporated the following changes:

```
7.0.2

1. Added Mackerel.  Frigate, Bullet, and Chub.
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If you have any questions regarding use of the Trip Ticket software, please contact Grace Kemp at Grace.Kemp@ncdenr.gov or call (252) 808-8101.

PORT AGENT CONTACTS

The Trip Ticket Program's commercial port agents act as liaisons between the division and the fishing public. If you have any questions regarding rules, procedures, or requirements, please contact your nearest agent. If they are unable to answer your questions directly, they will put you in contact with someone who can.

Wilmington Tyler McGuire (910) 796-7216 Tyler.mcguire@ncdenr.gov	**Morehead City** Chuck Davis (252) 808-8029 Chuck.davis@ncdenr.gov
Washington Jon Anglemyer (252) 948-3881 Jon.anglemyer@ncdenr.gov	**Manteo** Marty Brill (252) 473-2158 Martin.brill@ncdenr.gov
Elizabeth City Chris Kelly (252) 264-3911 Chris.kelly@ncdenr.gov	

STRIPED BASS DEALER TAGS

The division is reminding fish dealers that they must pick up striped bass tags from a Division of Marine Fisheries office. Tags will no longer be delivered to dealers. Fish dealers with a Striped Bass Dealer Permit for quota monitoring must contact Kim Hewitt at the Division of Marine Fisheries' Elizabeth City office (252-264-3911 or 1-800-338-7805) to obtain or return harvest tags. Tags will be signed for and given out in numerical sequences for tracking purposes. Tags are marked with the harvest season year, harvest area, minimum size limit for that area, and a unique tag number. The Atlantic States Marine Fisheries Commission requires each state to keep detailed records of how many striped bass tags each dealer receives, uses, and returns to the division annually. It is critical that each dealer save all unused, broken, or defective tags and return them to the division at the end of each calendar year or harvest season. Dealers in the Albemarle Sound Management Area can pick up their tags at the Elizabeth City or Manteo offices while dealers in the Central Southern Management Area can pick up their tags from the Washington office.

1 -

NORTH CAROLINA TRIP TICKET (FINFISH)

FISHERMAN NAME:	John Smith	FISH DEALER #	123456
FISHERMAN LICENSE #	1158995	CHECK BOX IF **NO** VESSEL USED → →	
TRIP START DATE:	02 | 23 | 2018	CFVR #	P 698516
UNLOADING DATE:	02 | 23 | 2018	NO. OF CREW:	2

TRANSACTION #

EXAMPLE

CIRCLE ALL GEARS USED

020	Beach Seine	345	Fish Pot	610	Rod-n-Reel
030	Haul Seine	426	Sm Msh Set Gill Net (<5 in.)	660	Trolling
025	Swipe Net	427	Lg Msh Set Gill Net (>=5 in.)	735	Cast Net
275	Pound Net	470	Drift Gill Net	760	Gigs
340	Eel Pot	475	Runaround Net		

CIRCLE ONE WATERBODY WHERE MOST OF CATCH WAS MADE

01	Albemarle Sound	10	Currituck Sound	33	Pamlico River
02	Alligator River	11	Lockwood Folly	34	Pamlico Sound
03	Bay River	12	Masonboro Sd.	45	Roanoke Sound
05	Bogue Sound	29	Neuse River	38	Shallotte River
06	Cape Fea			39	Stump Sound
08	Core Sou			41	Topsail Sound
09	Croatan S			42	White Oak River
53	Inland Wa			aterway - Onslow	
20	Ocean 0- (North of			3 miles Cape Hatteras)	
22	Ocean greater than 3 miles (North of Cape Hatteras)	23	Ocean greater than 3 miles (South of Cape Hatteras)		

If the catch has a disposition other than Food or Bait, fill out the 'DSP' column with the appropriate disposition code.

KIND	CODE	POUNDS	DSP	UNIT PRICE	TOTAL PRICE
Black Drum	2100	52	2		
Bluefish Small	1352				
Med.	1353				
Lg.	1354				
Mixed	1350				
Butterfish	1550				
Catfish Mixed	1700				
Croaker Small	1952				
Med	1953				
Lg.					
Dogfish-Smooth C					
Dogfish-Smooth F					
Dogfish-Spiny Wh					
Eels, American	2200				
Flounder Mixed	2300				
Med.	2303				
Lg.	2304				
Jumbo	2305				
TripleTail / Strawberry Bass	7250				

Use a blank line to write in any catch with a disposition not available from the list.

KIND	CODE	POUNDS	DSP	UNIT PRICE	TOTAL PRICE
Gars/Skippers	6100				
Gra Trout Pan	5352				
Med.	5353				
Lg.	5354				
Hogfish/Pigfish	4500				
Jumping Mullet	4350				
Mullet Red Roe	4357				
White Roe	4358				
Little Tunny Whole (False Alb.)	7300				
Pompano Small	4652				
Lg.	4654				
Puffers Whole (Sea Chickens)	6850				
Puppy/ Red Drum/ Redfish	2150				
Sea Mullet / Kingfish / Whiting	4000	28			
Roe Shad (Am. Shad)	5356				
Buck Shad (Am. Shad)	5359				
Jacks (Hickory Shad)	3800				
Sheepshead	6000				
Spadefish	6650				
Spanish Mackerel Small	6702				
Med.	6703				
Lg.	6704				
Speckled Trout Pan	5302				
S					
S					
S					
White Perch	7650				
Menhaden Bait (lb)	4200				
Mixed Bait	7900				
Ladyfish	7000	10	1		
Ladyfish		22	9		

Leaving 'DSP' blank will default it to 'food'.

If the catch is split between two separate dispositions, please write in the second portion in the blank lines provided at the bottom.

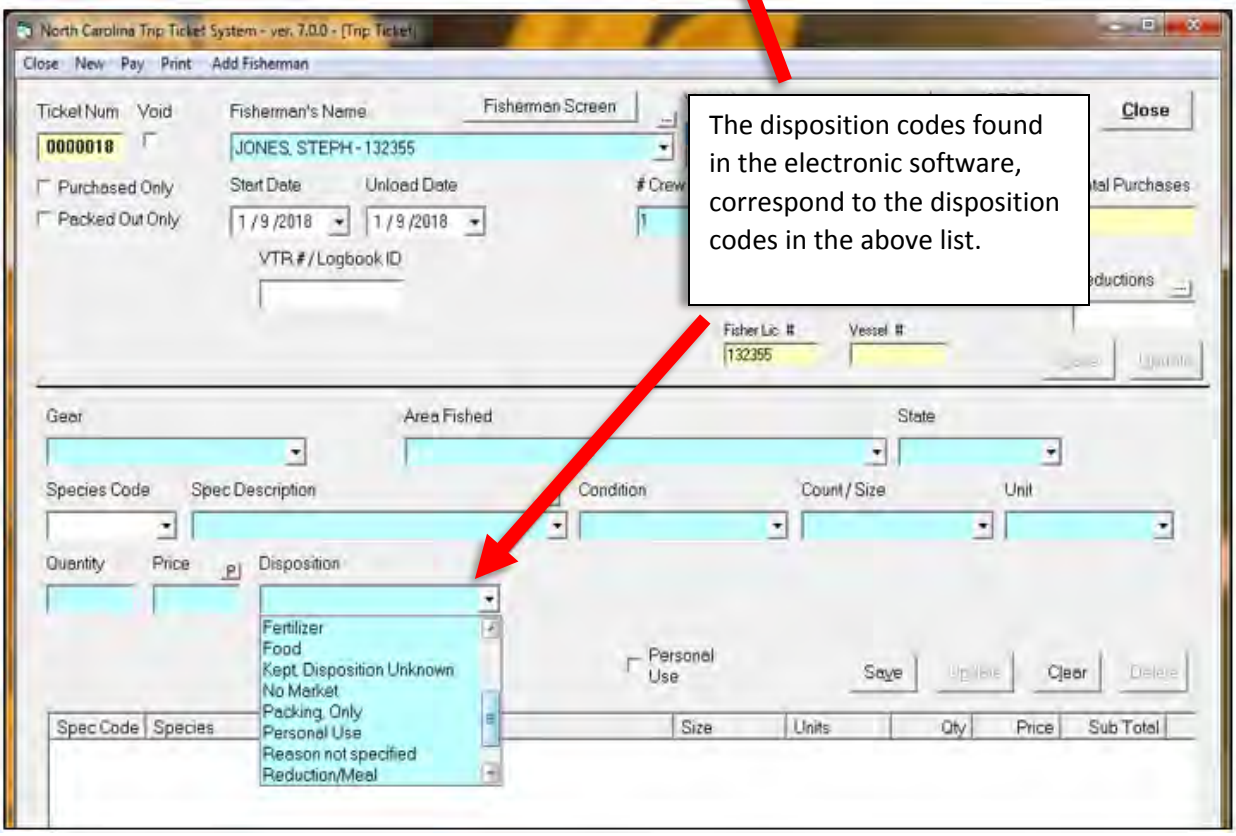
Flounder - 10lbs - Kept for grow out

Dealer/Fisherman Use

Table 1. North Carolina Trip Ticket Program disposition codes.

Disposition Code	Description
0	No Disposition
1	Food
2	Personal Use
5	Aquaculture
6	Canned Pet Food
7	Animal Food
8	Bait
9	Reduction/Meal
10	Aquarium
11	Kept, Disposition Unknown
12	Biomedical Use
13	Packing, Only
14	Fertilizer
15	Research
100	Reason not specified
101	No Market
602	Seized by Law Enforcement

Disposition Codes for use on paper trip tickets.



The disposition codes found in the electronic software, correspond to the disposition codes in the above list.

NORTH CAROLINA DIVISION OF MARINE FISHERIES

Annual Fisheries Bulletin

2017 Commercial and Recreational Statistics

License and Statistics Section, PO Box 769, Morehead City, NC 28557 May 2018

Included in this bulletin are the finalized 2017 landings and harvest information from the commercial and recreational fisheries programs, along with the 2013 to 2016 landings for comparison. The bulletin also contains a summary of commercial fishing trips by major gear.

The North Carolina Trip Ticket Program collects commercial fishery landings and effort statistics. This program collects trip level fish dealer reports for all finfish and shellfish landed in the state. Recreational fishery harvest and effort statistics are derived from the Marine Recreational Information Program (MRIP) that conducts recreational angler interviews at public access points and telephone/mail surveys.

Total Pounds Harvested in 2017

Commercial	Recreational
54,364,185 pounds	11,024,294 pounds

Top Five Species Caught in Each Fishery

Commercial	
Species	**Pounds**
Blue Crabs, Hard	18,069,170
Shrimp (Heads On)	13,892,730
Flounder, Summer	1,563,045
Bluefish	1,544,014
Flounder, Southern	1,394,552

Recreational	
Species	**Pounds**
Tuna, Yellowfin	2,980,821
Dolphin	1,486,909
Bluefish	690,018
Seatrout, Spotted	580,849
Wahoo	497,341

Issued by the North Carolina Division of Marine Fisheries, Department of Environmental Quality

For additional information regarding Commercial and Recreational Statistics, please contact:

Alan Bianchi, Commercial Statistics
(252) 726-7021 or (800) 682-2632
alan.bianchi@ncdenr.gov

Chris Wilson, Recreational Statistics
(252) 948-3876 or (800) 338-7804
chris.wilson@ncdenr.gov

2017 North Carolina Commercial Landings 2017

Issued: May 2018

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Amberjacks[1]	127,574	$162,196
Anglerfish (Monkfish Including Monklivers)	66,225	$60,045
Bluefish	1,544,014	$999,629
Bonito, Atlantic	11,342	$20,256
Butterfish	76,097	$38,791
Carp	18,346	$2,101
Catfishes	1,165,136	$399,413
Cobia	20,842	$50,003
Croaker,Atlantic	1,007,963	$1,133,533
Cutlassfish, Atlantic	49,975	$86,733
Dogfish, Smooth	154,440	$72,966
Dogfish, Spiny	393,085	$39,346
Dolphinfish	197,999	$719,321
Drum, Black	182,876	$185,198
Drum, Red	186,463	$496,725
Eel, American	20,211	$11,839
Flounder, Southern	1,394,552	$5,655,489
Flounder, Summer	1,563,045	$6,315,997
Flounders, Other	*	*
Garfish	22,719	$3,924
Grouper, Gag	97,702	$456,023
Grouper, Red	18,250	$78,146
Grouper, Scamp	34,106	$164,006
Grouper, Snowy	65,044	$280,161
Groupers, Other	8,373	$35,093
Grunts	42,192	$45,428
Hakes	2,946	$1,987
Harvestfish (Starbutters)	62,528	$96,177
Herring, River (Alewife and Blueback)	0	$0
Hogfish (Hog Snapper)	15,776	$70,760
Jacks (Crevalle, Bluerunner, Rainbowrunner)	5,293	$3,715
Mackerel, Atlantic (Boston)	992	$470
Mackerel, King	629,374	$1,266,308
Mackerel, Spanish	815,972	$1,384,479
Menhaden,Atlantic	752,277	$157,180
Mullet, Sea (Kingfishes)	942,291	$1,095,851
Mullet, Striped	1,362,073	$1,033,450
Perch, White	171,756	$125,448
Perch, Yellow	16,131	$21,621
Pigfish	9,203	$4,530
Pinfish	520	$145
Pompano	21,545	$49,419
Porgies	64,964	$108,395
Pufferfish	4,481	$1,782
Scup	188,852	$107,355
Sea Basses	631,879	$1,860,934
Seatrout, Spotted	299,874	$779,758

2017 North Carolina Commercial Landings

(continued)

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Shad, American	92,525	$111,819
Shad, Gizzard	165,553	$8,278
Shad, Hickory	73,675	$20,201
Sharks[2]	862,171	$424,465
Sheepshead	128,275	$154,923
Skates	45,467	$9,007
Skippers	10,505	$3,483
Snapper, Red[3]	9,542	$47,810
Snapper, Vermilion (Beeliner)	263,877	$924,225
Snappers, Other	7,422	$26,840
Spadefish	18,833	$13,414
Spot	413,995	$521,975
Striped Bass	99,009	$288,888
Swordfish	458,361	$1,138,260
Tilefish, Blueline	46,431	$154,761
Tilefishes, Other	42,258	$181,179
Triggerfishes	148,166	$403,689
Tuna, Bigeye	380,039	$1,350,709
Tuna, Bluefin	323,251	$1,212,083
Tuna, Yellowfin	1,079,709	$2,325,468
Tunas, Other	72,220	$70,813
Tunny, Little (False Albacore)	216,424	$112,405
Unclassified Fish for Food	94,659	$130,869
Unclassified Fish for Industrial/Bait	95,161	$41,114
Wahoo	28,929	$110,448
Weakfish (Grey Trout)	85,440	$129,131
TOTAL FINFISH	19,729,195	$35,598,383
SHELLFISH		
Blue Crabs, Hard	18,069,170	$17,776,188
Blue Crabs, Peeler	776,234	$1,649,626
Blue Crabs, Soft	427,753	$2,792,000
Clams, Hard (Meats)	273,280 *(14,417,980 Numbers)*	$2,174,491
Oysters (Meats)	836,791 *(158,184 Bushels)*	$5,571,391
Octopus	330	$692
Scallop, Sea (Meats)	104,181	$913,116
Shrimp (Heads On)[4]	13,892,730	$29,597,826
Squid	41,071	$35,418
Stone Crabs	7,181	$20,762
Unclassified Shellfish	150,329	$217,696
Whelks/Conchs (Meats)	55,939	$161,199
TOTAL SHELLFISH	34,634,989	$60,910,405
GRAND TOTAL	54,364,185	$96,508,788

[1] Includes species from the genus *Seriola* (amberjacks, almaco jacks, and banded rudderfish)
[2] Includes shark fins and the following sharks: blacknose, blacktip, bonnethead, bull, finetooth, hammerhead, shortfin mako, spinner, thresher, tiger, and Atlantic sharpnose
[3] The red snapper fishery closed on January 4, 2010 with restricted openings occurring in some years.
[4] Includes brown, pink, and white shrimp
* Units and value not shown to avoid disclosure of private enterprise

2016 North Carolina Commercial Landings 2016

Updated: April 2018

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Amberjacks[1]	132,496	$147,331
Anglerfish (Monkfish Including Monklivers)	50,883	$47,173
Bluefish	1,148,126	$599,918
Bonito, Atlantic	14,838	$26,780
Butterfish	63,542	$31,387
Carp	27,688	$3,453
Catfishes	992,439	$238,725
Cobia	48,244	$107,952
Croaker, Atlantic	2,092,135	$2,216,106
Cutlassfish, Atlantic	56,723	$103,316
Dogfish, Smooth	178,694	$73,243
Dogfish, Spiny	2,271,201	$235,069
Dolphinfish	356,053	$1,271,271
Drum, Black	90,012	$82,200
Drum, Red	77,017	$202,785
Eel, American	39,911	$88,195
Flounder, Southern	897,765	$3,610,533
Flounder, Summer	2,071,089	$8,238,703
Flounders, Other	1,209	$3,478
Garfish	16,424	$4,982
Grouper, Gag	114,902	$511,245
Grouper, Red	21,011	$84,600
Grouper, Scamp	41,056	$190,160
Grouper, Snowy	70,403	$282,182
Groupers, Other	10,357	$41,102
Grunts	39,843	$42,17
Hakes	42,967	$44,411
Harvestfish (Starbutters)	123,266	$211,512
Herring, River (Alewife and Blueback)	0	$0
Hogfish (Hog Snapper)	9,195	$39,452
Jacks (Crevalle, Bluerunner, Rainbowrunner)	9,455	$5,924
Mackerel, Atlantic (Boston)	663	$305
Mackerel, King	420,088	$868,542
Mackerel, Spanish	601,615	$1,068,237
Menhaden, Atlantic	397,725	$75,167
Mullet, Sea (Kingfishes)	831,974	$1,004,314
Mullet, Striped	965,198	$669,760
Perch, White	242,106	$166,889
Perch, Yellow	29,404	$41,609
Pigfish	15,331	$7,556
Pinfish	404	$138
Pompano	18,601	$44,092
Porgies	45,918	$80,872
Pufferfish	4,567	$2,109
Scup	111,908	$72,871
Sea Basses	422,720	$1,342,582
Seatrout, Spotted	253,991	$661,107

2016 North Carolina Commercial Landings

(continued)

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Shad, American	63,286	$89,335
Shad, Gizzard	173,155	$30,302
Shad, Hickory	96,543	$29,418
Sharks[2]	951,814	$403,736
Sheepshead	93,506	$116,501
Skates	25,488	$4,905
Skippers	12,861	$4,030
Snapper, Red[3]	0	$0
Snapper, Vermilion (Beeliner)	266,150	$909,274
Snappers, Other	9,278	$32,681
Spadefish	15,231	$9,189
Spot	235,670	$295,019
Striped Bass	146,189	$432,127
Swordfish	445,415	$1,202,276
Tilefish, Blueline	75,536	$242,806
Tilefish, Other	36,252	$153,007
Triggerfishes	131,626	$345,575
Tuna, Bigeye	287,442	$1,037,207
Tuna, Bluefin	156,198	$517,114
Tuna, Yellowfin	668,360	$1,410,177
Tunas, Other	102,854	$119,272
Tunny, Little (False Albacore)	233,501	$110,271
Unclassified Fish for Industrial/Bait	43,142	$30,344
Unclassified Fish for Food	97,325	$108,618
Wahoo	25,307	$93,707
Weakfish (Grey Trout)	79,640	$120,548
TOTAL FINFISH	19,903,083	$32,696,777
SHELLFISH		
Blue Crabs, Hard	24,732,127	$20,738,465
Blue Crabs, Peeler	445,844	$1,314,879
Blue Crabs, Soft	284,769	$2,063,004
Clams, Hard (Meats)	331,215	$2,578,120
	(17,384,413 Numbers)	
Oysters (Meats)	653,889	$4,045,574
	(123,609 Bushels)	
Octopus	230	$477
Scallop, Sea (Meats)	171,159	$1,995,270
Shrimp (Heads On)[4]	13,191,267	$28,241,463
Squid	45,841	$40,683
Stone Crabs	7,908	$21,594
Unclassified Shellfish	83,923	$89,390
Whelks/Conchs (Meats)	76,249	$191,124
TOTAL SHELLFISH	40,037,421	$61,350,268
GRAND TOTAL	59,940,504	$94,047,045

[1] Includes species from the genus *Seriola* (amberjacks, almaco jacks, and banded rudderfish)
[2] Includes shark fins and the following sharks: blacknose, blacktip, bonnethead, bull, finetooth, hammerhead, shortfin mako, spinner, thresher, tiger, and Atlantic sharpnose
[3] The red snapper fishery closed on January 4, 2010 with restricted openings occurring in some years.
[4] Includes brown, pink, and white shrimp
* Units and value not shown to avoid disclosure of private enterprise

2015 North Carolina Commercial Landings 2015

Updated: April 2018

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Amberjacks[1]	146,498	$161,768
Anglerfish (Monkfish Including Monklivers)	112,863	$106,081
Bluefish	804,336	$445,293
Bonito, Atlantic	20,989	$32,905
Butterfish	62,658	$28,237
Carp	37,791	$3,071
Catfishes	917,965	$262,840
Cobia	52,684	$113,176
Croaker, Atlantic	1,819,070	$1,646,377
Cutlassfish, Atlantic	178,077	$309,752
Dogfish, Smooth	268,429	$98,113
Dogfish, Spiny	4,247,213	$532,180
Dolphinfish	320,961	$973,324
Drum, Black	51,103	$43,158
Drum, Red	80,393	$196,144
Eel, American	57,791	$142,826
Flounder, Southern	1,202,930	$3,823,707
Flounder, Summer	2,878,753	$9,092,527
Flounders, Other	7,638	$26,179
Garfish	37,651	$5,648
Grouper, Gag	127,194	$580,929
Grouper, Red	35,258	$138,669
Grouper, Scamp	36,390	$161,478
Grouper, Snowy	47,121	$184,206
Groupers, Other	15,234	$57,065
Grunts	32,684	$33,221
Hakes	1,407	$685
Harvestfish (Starbutters)	164,046	$221,595
Herring, River (Alewife and Blueback)	0	$0
Hogfish (Hog Snapper)	8,238	$33,500
Jacks (Crevalle, Bluerunner, Rainbowrunner)	7,607	$4,692
Mackerel, Atlantic (Boston)	1,861	$796
Mackerel, King	391,315	$800,688
Mackerel, Spanish	561,409	$1,034,231
Menhaden, Atlantic	896,918	$152,241
Mullet, Sea (Kingfishes)	786,515	$860,461
Mullet, Striped	1,247,044	$804,675
Perch, White	161,596	$124,499
Perch, Yellow	41,654	$54,013
Pigfish	20,763	$7,507
Pinfish	845	$304
Pompano	22,085	$39,973
Porgies	54,464	$92,779
Pufferfish	9,578	$5,861
Scup	229,696	$130,029
Sea Basses	467,953	$1,366,822
Seatrout, Spotted	128,762	$318,307

2015 North Carolina Commercial Landings

(continued)

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Shad, American	98,118	$93,657
Shad, Gizzard	97,970	$4,898
Shad, Hickory	148,714	$42,916
Sharks[2]	795,831	$338,283
Sheepshead	124,836	$139,237
Skates	44,848	$8,349
Skippers	16,736	$4,636
Snapper, Red[3]	0	$0
Snapper, Vermilion (Beeliner)	225,481	$781,211
Snappers, Other	6,549	$22,776
Spadefish	15,996	$8,177
Spot	377,358	$322,198
Striped Bass	141,824	$450,208
Swordfish	593,258	$1,277,355
Tilefish, Blueline	27,181	$69,502
Tilefishes, Other	18,173	$65,726
Triggerfishes	131,536	$331,805
Tuna, Bigeye	369,347	$1,277,767
Tuna, Bluefin	118,159	$200,380
Tuna, Yellowfin	515,014	$1,191,039
Tunas, Other	152,716	$128,529
Tunny, Little (False Albacore)	164,852	$85,437
Unclassified Fish for Industrial/Bait	67,995	$8,066
Unclassified Fish for Food	138,824	$108,871
Wahoo	18,380	$65,475
Weakfish (Grey Trout)	80,235	$115,834
TOTAL FINFISH	23,293,361	$32,394,864
SHELLFISH		
Blue Crabs, Hard	31,040,008	$29,626,984
Blue Crabs, Peeler	706,660	$2,106,108
Blue Crabs, Soft	380,375	$2,247,306
Clams, Hard (Meats)	415,027 *(21,126,582 Numbers)*	$5,038,973
Oysters (Meats)	631,050 *(*119,291 *Bushels)*	$3,898,079
Octopus	209	$388
Scallop, Sea (Meats)	198,393	$2,213,074
Shrimp (Heads On)[4]	9,090,560	$16,824,594
Squid	25,516	$22,212
Stone Crabs	8,158	$22,925
Unclassified Shellfish	91,124	$177,869
Whelks/Conchs (Meats)	65,221	$137,526
TOTAL SHELLFISH	42,652,301	$62,316,038
GRAND TOTAL	65,945,662	$94,710,902

[1] Includes species from the genus *Seriola* (amberjacks, almaco jacks, and banded rudderfish)
[2] Includes shark fins and the following sharks: blacknose, blacktip, bonnethead, bull, finetooth, hammerhead, shortfin mako, spinner, thresher, tiger, and Atlantic sharpnose
[3] The red snapper fishery closed on January 4, 2010 with restricted openings occurring in some years.
[4] Includes brown, pink, and white shrimp
* Units and value not shown to avoid disclosure of private enterprise

2014 North Carolina Commercial Landings 2014

Updated: April 2018

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Amberjacks[1]	193,001	$198,899
Anglerfish (Monkfish Including Monklivers)	76,392	$85,364
Bluefish	2,019,279	$889,710
Bonito, Atlantic	9,081	$14,386
Butterfish	53,606	$27,287
Carp	16,456	$1,557
Catfishes	521,540	$158,480
Cobia	41,798	$87,931
Croaker, Atlantic	2,629,908	$1,865,595
Cutlassfish, Atlantic	165,375	$221,870
Dogfish, Smooth	498,904	$213,763
Dogfish, Spiny	5,650,285	$566,615
Dolphinfish	422,496	$1,237,458
Drum, Black	51,217	$32,298
Drum, Red	90,647	$208,288
Eel, American	60,754	$164,797
Flounder, Southern	1,673,511	$4,839,672
Flounder, Summer	2,911,750	$8,225,282
Flounders, Other	4,412	$8,926
Garfish	10,803	$3,673
Grouper, Gag	168,036	$739,793
Grouper, Red	53,096	$202,112
Grouper, Scamp	42,206	$187,776
Grouper, Snowy	27,553	$102,830
Groupers, Other	9,125	$33,799
Grunts	39,312	$40,117
Hakes	652	$293
Harvestfish (Starbutters)	155,356	$187,901
Herring, River (Alewife and Blueback)	1,139	$1,519
Hogfish (Hog Snapper)	9,767	$37,920
Jacks (Crevalle, Bluerunner, Rainbowrunner)	9,151	$6,220
Mackerel, Atlantic (Boston)	1,761	$658
Mackerel, King	549,981	$1,203,503
Mackerel, Spanish	673,974	$1,230,410
Menhaden, Atlantic	917,375	$145,587
Mullet, Sea (Kingfishes)	955,071	$1,007,496
Mullet, Striped	1,828,351	$1,112,465
Perch, White	172,486	$148,698
Perch, Yellow	67,454	$82,336
Pigfish	38,572	$15,334
Pinfish	1,431	$561
Pompano	12,923	$31,176
Porgies	82,809	$145,061
Pufferfish	1,611	$886
Scup	160,508	$110,203
Sea Basses	529,075	$1,413,708
Seatrout, Spotted	242,245	$579,343

2014 North Carolina Commercial Landings

(continued)

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Shad, American	193,117	$160,969
Shad, Gizzard	114,594	$5,730
Shad, Hickory	109,420	$27,397
Sharks[2]	1,005,858	$473,375
Sheepshead	173,376	$159,274
Skates	18,907	$6,137
Skippers	19,884	$5,207
Snapper, Red[3]	4,826	$23,007
Snapper, Vermilion (Beeliner)	242,259	$829,916
Snappers, Other	4,002	$11,695
Spadefish	22,761	$10,652
Spot	766,224	$619,643
Striped Bass	96,233	$283,241
Swordfish	694,911	$2,109,549
Tilefish, Blueline	71,768	$176,807
Tilefishes, Other	19,306	$62,001
Triggerfishes	116,782	$262,199
Tuna, Bigeye	337,269	$1,222,610
Tuna, Bluefin	114,037	$375,975
Tuna, Yellowfin	821,520	$1,811,675
Tunas, Other	155,033	$115,186
Tunny, Little (False Albacore)	225,797	$107,605
Unclassified Fish for Industrial/Bait	24,635	$4,196
Unclassified Fish for Food	123,386	$138,185
Wahoo	22,783	$71,829
Weakfish (Grey Trout)	105,246	$140,573
TOTAL FINFISH	29,456,169	$37,034,189
SHELLFISH		
Blue Crabs, Hard	25,242,795	$29,954,723
Blue Crabs, Peeler	621,040	$1,935,462
Blue Crabs, Soft	367,277	$2,137,335
Clams, Hard (Meats)	430,816	$2,866,096
	(22,440,617 Numbers)	
Oysters (Meats)	727,775	$4,544,236
	(137,576 Bushels)	
Octopus	217	$276
Scallop, Sea (Meats)	92,976	$1,011,221
Shrimp (Heads On)[4]	4,690,933	$14,145,407
Squid	16,156	$13,493
Stone Crabs	7,451	$19,882
Unclassified Shellfish	84,167	$152,710
Whelks/Conchs (Meats)	53,627	$112,275
TOTAL SHELLFISH	32,519,243	$57,077,129
GRAND TOTAL	61,975,412	$94,111,318

[1] Includes species from the genus *Seriola* (amberjacks, almaco jacks, and banded rudderfish)
[2] Includes shark fins and the following sharks: blacknose, blacktip, bonnethead, bull, finetooth, hammerhead, shortfin mako, spinner, thresher, tiger, and Atlantic sharpnose
[3] The red snapper fishery closed on January 4, 2010 with restricted openings occurring in some years.
[4] Includes brown, pink, and white shrimp
* Units and value not shown to avoid disclosure of private enterprise

2013 North Carolina Commercial Landings 2013

Updated April 2018

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Amberjacks[1]	90,180	$90,035
Anglerfish (Monkfish Including Monklivers)	10,566	$9,053
Bluefish	1,159,580	$564,377
Bonito, Atlantic	10,506	$15,460
Butterfish	93,146	$53,369
Carp	14,132	$1,360
Catfishes	548,913	$92,497
Cobia	35,456	$73,142
Croaker, Atlantic	1,927,938	$1,723,578
Cutlassfish, Atlantic	145,362	$204,869
Dogfish, Smooth	783,053	$344,182
Dogfish, Spiny	3,010,958	$302,248
Dolphinfish	178,035	$529,916
Drum, Black	127,170	$79,480
Drum, Red	371,949	$715,685
Eel, American	33,980	$88,649
Flounder, Southern	2,186,391	$5,673,190
Flounder, Summer	541,542	$1,386,338
Flounders, Other	*	*
Garfish	5,893	$1,208
Grouper, Gag	167,334	$704,382
Grouper, Red	72,034	$259,053
Grouper, Scamp	42,711	$180,679
Grouper, Snowy	20,274	$72,067
Groupers, Other	8,856	$31,637
Grunts	44,702	$47,062
Hakes	614	$231
Harvestfish (Starbutters)	221,168	$253,604
Herring, River (Alewife and Blueback)	743	$743
Hogfish (Hog Snapper)	7,847	$30,640
Jacks (Crevalle, Bluerunner, Rainbowrunner)	14,492	$10,639
Mackerel, Atlantic (Boston)	154	$61
Mackerel, King	345,177	$877,497
Mackerel, Spanish	620,752	$1,015,965
Menhaden, Atlantic	454,206	$73,494
Mullet, Sea (Kingfishes)	603,186	$668,480
Mullet, Striped	1,549,157	$1,402,914
Perch, White	275,652	$255,633
Perch, Yellow	31,480	$40,546
Pigfish	62,099	$28,093
Pinfish	1,536	$463
Pompano	15,423	$41,351
Porgies	72,669	$116,776
Pufferfish	5,846	$2,858
Scup	28,691	$13,323
Sea Basses	329,691	$868,811
Seatrout, Spotted	367,648	$818,159

2013 North Carolina Commercial Landings

(continued)

	POUNDS (Whole/Round Weight)	VALUE
FINFISH		
Shad, American	257,348	$306,885
Shad, Gizzard	112,295	$4,492
Shad, Hickory	71,772	$29,324
Sharks[2]	553,665	$282,318
Sheepshead	180,225	$145,794
Skates	2,286	$429
Skippers	15,780	$4,652
Snapper, Red[3]	2,686	$11,942
Snapper, Vermilion (Beeliner)	267,260	$886,596
Snappers, Other	6,587	$19,449
Spadefish	20,368	$9,246
Spot	768,592	$690,035
Striped Bass	96,935	$303,486
Swordfish	1,058,089	$2,935,940
Tilefish, Blueline	214,153	$517,882
Tilefishes, Other	2,926	$4,770
Triggerfishes	160,861	$342,228
Tuna, Bigeye	243,637	$939,909
Tuna, Bluefin	106,197	$608,952
Tuna, Yellowfin	648,039	$1,434,318
Tunas, Other	96,937	$113,429
Tunny, Little (False Albacore)	189,746	$114,416
Unclassified Fish for Industrial/Bait	24,389	$2,565
Unclassified Fish for Food	119,914	$120,455
Wahoo	23,380	$75,577
Weakfish (Grey Trout)	120,191	$150,730
TOTAL FINFISH	22,003,150	$29,819,911
SHELLFISH		
Blue Crabs, Hard	21,438,077	$26,465,523
Blue Crabs, Peeler	447,120	$1,449,542
Blue Crabs, Soft	317,426	$2,091,382
Clams, Hard (Meats)	347,073	$2,295,366
	(17,855,759 Numbers)	
Oysters (Meats)	586,625	$3,353,126
	(110,893 Bushels)	
Octopus	1,205	$2,069
Scallop, Sea (Meats)	36,445	$402,717
Shrimp (Heads On)[4]	4,858,885	$12,944,880
Squid	12,090	$10,703
Stone Crabs	6,839	$18,479
Unclassified Shellfish	90,886	$117,361
Whelks/Conchs (Meats)	50,079	$123,236
TOTAL SHELLFISH	28,194,087	$49,283,890
GRAND TOTAL	50,197,237	$79,103,801

[1] Includes species from the genus *Seriola* (amberjacks, almaco jacks, and banded rudderfish)
[2] Includes shark fins and the following sharks: blacknose, blacktip, bonnethead, bull, finetooth, hammerhead, shortfin mako, spinner, thresher, tiger, and Atlantic sharpnose
[3] The red snapper fishery closed on January 4, 2010 with restricted openings occurring in some years.
[4] Includes brown, pink, and white shrimp
* Units and value not shown to avoid disclosure of private enterprise

North Carolina Commercial Fishing Trips by Major Gears

(2013 – 2017)

	Trips				
Gear	**2013**	**2014**	**2015**	**2016**	**2017**
Beach Seine	57	21	23	11	31
By Hand	16,446	18,019	17,170	18,778	20,892
Cast Net	703	627	690	666	663
Channel Net	1,626	1,078	968	761	776
Clam Dredges	344	388	251	213	189
Clam Trawl Kicking	180	155	77	39	31
Crab Dredge	1	3	14	6	1
Crab Pot	48,122	50,527	51,758	46,281	37,210
Crab Trawl	85	197	470	461	356
Eel Pot	70	143	97	63	78
Fish Pot	623	678	583	471	577
Flounder Trawl	71	257	276	266	199
Flynet	4	40	11	19	16
Fyke Net	428	404	639	628	546
Gigs	2,585	2,804	2,739	2,795	2,892
Gill Net – Anchored	36,712	27,862	23,437	22,758	25,338
Gill Net – Drift	236	296	401	278	586
Gill Net – Runaround	3,780	3,377	3,252	3,294	4,112
Haul Seines[1]	273	204	45	93	68
Longlines	719	634	519	598	433
Oyster Dredge	3,763	5,705	4,031	2,684	1,540
Peeler Pot	3,334	4,006	4,743	4,957	3,462
Peeler Trawl[2]	29	26	21	14	15
Pound Nets	2,859	2,444	2,856	2,557	2,918
Rakes	9,988	11,779	12,489	11,220	9,293
Rod-n-Reel	2,068	2,272	1,991	2,278	2,274
Shrimp Trawl	5,650	4,598	6,052	7,468	7,766
Skimmer Trawl	1,194	711	1,035	1,273	676
Spears (Diving)	159	195	168	186	168
Tongs	4,092	3,896	3,688	3,152	3,578
Trolling	2,195	2,247	1,950	1,874	2,521
Trotline	38	49	39	86	170
Other Gears[3]	231	168	117	106	112
Total trips [4]	148,665	145,810	142,600	136,334	129,487

A **trip** is defined as the time period beginning when a vessel or fisherman leaves port to conduct fishing activities and ending when that vessel or fisherman returns to land the catch. The duration of a trip can vary from a few hours, as in hand clamming, to several days, as in ocean flounder trawling. An assessment of the number of trips gives an indication of the amount of effort conducted by commercial fishermen within that fishery.

[1] Includes long hauls, common seines, and swipe nets
[2] A new code to distinguish peeler trawl gear was put into effect in 2010.
[3] Includes greenstick trolling, butterfly nets, conch pots, dip nets, purse seines, bay scallop dredges, scallop scoops and trawls, shrimp pots and turtle pots
[4] Total trips are not equal to the sum of trips by gear due to multi-gear trips.

Source: North Carolina Division of Marine Fisheries Trip Ticket Program (April 2018).

North Carolina Marine Recreational Finfish Harvest

(2016 – 2017)

SPECIES	NUMBER 2016	NUMBER 2017	POUNDS 2016	POUNDS 2017
Amberjacks	10,051	5,313	168,563	124,382
Barracudas	961	2,281	7,283	28,245
Bluefish	1,178,529	524,072	855,631	690,018
Bonito	1,599	1,368	9,115	5,801
Cobia	9,293	7,308	298,090	259,737
Croaker, Atlantic	368,203	243,199	141,571	85,473
Dolphin	261,553	184,928	2,706,002	1,486,909
Drum, Black	71,708	65,455	238,012	164,295
Drum, Red	62,105	101,473	230,473	402,390
Flounders, Southern	118,267	99,399	267,811	211,241
Flounders, Summer	17,887	26,136	30,355	41,996
Groupers	2,573	1,034	36,248	13,262
Grunts	20,753	14,588	30,861	13,807
Jacks	46,206	12,217	24,718	23,398
Kingfishes	869,958	551,861	270,380	140,599
Mackerel, King	54,891	39,140	465,195	325,846
Mackerel, Spanish	424,341	439,654	411,353	459,982
Perch, Silver	10,991	23,386	1,991	4,308
Pigfish	463,160	150,540	153,036	53,584
Pinfish	336,380	214,635	69,513	62,352
Pompano	60,015	67,241	24,603	26,845
Porgies	4,067	8,873	7,120	17,376
Puffers	218,549	103,535	90,778	40,510
Sea basses	57,822	71,281	87,596	113,641
Seatrout, Spotted	388,544	339,523	691,277	580,849
Sharks	1,669	3,878	3,921	39,887
Dogfish Sharks	3,167	227	14,373	1,739
Sheepshead	42,137	128,083	116,683	371,503
Snappers	37,092	11,117	49,828	17,362
Spot	513,320	469,462	151,352	174,224
Striped Bass[1]	379	0	1,449	0
Tuna, Bluefin[2]	74	39	13,576	9,130
Tuna, Yellowfin	59,777	85,064	2,254,234	2,980,821
Wahoo	23,771	16,730	635,244	497,341
Weakfish	33,585	16,320	34,860	18,708

[1] Striped bass landings reflect Atlantic Ocean catches only.
[2] Landings for Atlantic Bluefin Tuna shown by Highly Migratory Species fishing year January 1 through December 31.

NOTE: The number and pounds of finfish listed represent estimated harvest; finfish released alive are not included. Headboat landings are not included but are available upon request from the NOAA Beaufort Lab's Southeast Region Headboat Survey.

North Carolina Marine Recreational Finfish Harvest

(2013 – 2015)

SPECIES	NUMBER 2013	NUMBER 2014	NUMBER 2015	POUNDS 2013	POUNDS 2014	POUNDS 2015
Amberjacks	10,078	3,098	9,934	172,647	60,260	244,797
Barracudas	224	852	2,065	1,276	10,737	17,394
Bluefish	1,183,627	1,084,292	977,599	988,664	966,003	868,867
Bonito	9,219	6,700	5,619	133,163	30,988	37,263
Cobia	19,224	9,804	16,166	506,067	247,386	695,842
Croaker, Atlantic	411,882	541,657	471,869	141,880	227,949	190,808
Dolphin	212,388	185,077	434,454	1,562,755	1,329,353	3,170,590
Drum, Black	363,466	24,058	35,529	713,047	60,406	115,609
Drum, Red	164,218	116,601	36,704	676,050	596,447	154,496
Flounder, Southern	178,178	69,956	108,369	409,086	149,723	254,132
Flounder, Summer	44,941	45,708	40,561	70,874	67,791	64,065
Groupers	5,390	1,729	1,776	54,418	18,973	21,125
Grunts	16,374	26,257	24,278	26,769	39,265	32,120
Jacks	25,164	8,871	20,635	24,835	28,167	27,254
Kingfishes	1,377,835	1,143,212	1,556,068	343,454	451,073	493,506
Mackerel, King	22,613	23,374	34,330	235,436	366,128	320,388
Mackerel, Spanish	497,329	398,398	388,157	625,035	449,709	431,082
Perch, Silver	13,345	11,519	4,849	2,366	2,519	1,161
Pigfish	299,065	293,523	508,767	101,014	83,741	177,093
Pinfish	355,871	332,185	333,330	61,148	74,085	115,132
Pompano	471,156	166,888	142,927	171,860	83,190	64,763
Porgies	8,460	7,812	7,020	16,720	15,657	9,421
Puffers	209,770	49,269	860,154	126,039	25,416	397,472
Sea basses	49,258	74,648	69,270	68,225	132,351	100,146
Seatrout, Spotted	369,265	234,045	87,396	649,158	433,978	148,926
Sharks	13,426	3,340	5,599	20,386	23,102	78,482
Sharks, Dogfish	4,986	853	9,101	10,143	4,296	45,596
Sheepshead	273,211	61,379	76,496	500,096	143,782	217,148
Snappers	9,852	9,110	12,965	14,013	15,017	15,147
Spot	1,464,592	2,111,880	1,081,083	460,928	704,445	395,268
Striped Bass[1]	0	0	0	0	0	0
Tuna, Bluefin[2]	201	69	44	40,979	14,492	7,747
Tuna, Yellowfin	44,688	27,248	24,459	1,441,122	873,536	723,874
Wahoo	9,370	11,639	19,561	255,306	322,468	584,670
Weakfish	33,851	26,308	39,842	34,731	25,957	50,903

[1] Striped bass landings reflect Atlantic Ocean catches only.
[2] Landings for Atlantic Bluefin Tuna shown by Highly Migratory Species fishing year January 1 through December 31.

NOTE: The number and pounds of finfish listed represent estimated harvest; finfish released alive are not included. Headboat landings are not included but are available upon request from NOAA Beaufort Lab's Southeast Region Headboat Survey.

North Carolina Coastal Angling Program

North Carolina Marine Recreational Finfish Harvest and Release Catch Estimates, 2013 – 2017.

Year	Number Harvested	Pounds Harvested	Number Released
2013	11,479,525	11,968,710	20,963,650
2014	9,572,612	8,788,702	19,765,129
2015	10,363,367	11,917,061	21,137,129
2016	8,618,071	11,993,540	21,784,450
2017	5,541,629	11,024,294	15,392,295

North Carolina Marine Recreational Fishing Trip Estimates (number), 2013 – 2017.

Year	Beach/Bank	Charter Boat	Manmade	Private Boat	Total
2013	1,212,558	111,366	1,543,314	2,100,515	4,967,753
2014	1,665,273	96,620	1,484,850	1,707,330	4,954,073
2015	1,205,413	114,061	1,285,166	2,041,020	4,645,659
2016	2,042,417	141,374	1,435,463	1,792,075	5,411,329
2017	1,243,564	149,468	1,381,398	1,764,427	4,538,858

Coastal Recreational Fishing License (CRFL) Sales by Residency, 2013 – 2017.

Year	In-State	Out-of-State	Total
2013	317,649	162,351	480,000
2014	320,663	165,624	486,287
2015	316,376	164,470	480,846
2016	308,879	158,827	467,706
2017	308,220	161,354	469,574

Survey Methods

The survey consists of telephone/mail and on-site angler interviews. Telephone/mail interviews are used to collect data on number of trips, fishing location, and when these trips were made. Information on actual catch (species, number, weight, and length) is collected through on-site angler interviews. Information from both types of interviews is combined to produce estimates of total number and pounds of finfish caught.

Precision of Estimates

Numbers and pounds presented are estimates, not actual counts; therefore have varying levels of precision.

Coastal recreational fishery statistics are provided through participation in the Marine Recreational Information Program. In North Carolina, this project is supported in part by the U.S. Fish and Wildlife Service through the Sport Fish Restoration Program, Grant F-31.

Issues/Reports

INFORMATION WILL BE PROVIDED AT THE MEETING.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 17, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Catherine Blum, Fishery Management Plan and Rulemaking Coordinator
Fisheries Management Section

SUBJECT: Fishery Management Plan Update

This memo provides an overview on the status of the North Carolina fishery management plans for the May 2018 commission meeting. No action is required by the commission.

The review process for the **Blue Crab Fishery Management Plan** is underway. The next advisory committee meeting will be held in early May. Agenda items include a general overview of the division's efforts to streamline fishery management plan documents. There will also be a presentation reviewing the results of the blue crab stock assessment. This follows the stock assessment peer review workshop that was held March 27-29 in New Bern, NC. A memo summarizing the stock assessment process and the results is included in your briefing book, along with the full stock assessment report. The commission will receive a presentation at its May meeting.

The commission gave its final approval of the **Shrimp Fishery Management Plan** Amendment 1 and associated rules Feb. 19, 2015. One of several strategies approved in Amendment 1 was the convening of an industry stakeholder group to initiate a three-year study to test bycatch reduction devices to reduce bycatch to the extent practicable, with a 40-percent target reduction. The Shrimp Bycatch Reduction Industry Work Group was formed and gear testing was conducted from 2015 through 2017. An information paper summarizing the final results of the gear testing and the work group's recommendation is included in your briefing book. The commission will receive a presentation at its May meeting. Recommendations from the industry workgroup on bycatch reduction in shrimp trawls that may be adopted by the commission can be implemented by existing proclamation authority.

After completing the annual update in July 2017 for the **Striped Mullet Fishery Management Plan**, the stock status was moved from "viable" to "concern" because 2016 commercial landings fell below the minimum landings trigger established in Amendment 1 to the plan. In accordance with the plan, the division reviewed striped mullet data in more detail to determine what factors are responsible for this decline and presented preliminary data analysis and recommendations at the November 2017 commission meeting. At the February 2018 meeting, the commission received a presentation on the completed data analysis, including preliminary 2017 striped mullet

commercial landings and fishery independent data, as well as recommendations for steps to move forward.

Based on results of the completed data analysis, the striped mullet stock has likely declined since completion of the 2013 stock assessment (terminal year 2011) and management action is likely warranted. The division is updating the 2013 stock assessment model to include data through 2017 prior to taking any management action. The target for model completion is May 2018. As an assessment update, there will be no changes to model parameters and peer review will not be required, as the configuration of the model that previously passed peer review will be maintained. If results of the update indicate overfishing is occurring in the striped mullet fishery, management options will be developed to maintain harvest at sustainable levels.

After management options are developed, the division will select a preferred option. Per the fishery management plan, management options will then be brought to an advisory committee, specifically the Finfish and regional advisory committees, to receive input. Recommendations will be presented to the commission at its August 2018 business meeting. At that meeting, the commission will be asked to decide on management options to be implemented by existing proclamation authority. Implementing management measures in August 2018 provides adequate time for management measures to be in place prior to the peak of the 2018 fishing season, which occurs in the fall.

The review process for the **Southern Flounder Fishery Management Plan** is underway. The second advisory committee meeting was held March 21 when the committee received a presentation reviewing the data sources considered for the southern flounder stock assessment. The next advisory committee meeting will be held in early May. Agenda items include a general overview of the division's efforts to streamline fishery management plan documents. There will also be a presentation to provide the results of the coastwide stock assessment. The assessment was conducted by a group of representatives from North Carolina, South Carolina, Georgia and Florida.

At the February 2018 commission meeting, the division gave a presentation summarizing the results of the coastwide stock assessment, peer review evaluation and recommendations for steps to move forward. The review panel accepted the stock assessment for management contingent on updating the model with data through 2017 (not just 2015 as it was reviewed) to provide the best, most up-to-date estimate of stock status for management. Next steps include updating the approved model with the additional two years of data. The division also plans to include updated Marine Recreational Information Program estimates, as requested by the review panel, if they are available as scheduled in July 2018. This update can move forward while continuing with the review and amendment of the plan.

For the review of the **Estuarine Striped Bass Fishery Management Plan**, stock assessments for the Central Southern Management Area stocks and the Albemarle Sound Management Area and Roanoke River Management Area stock that began in 2017 are continuing. This is a joint plan with the Wildlife Resources Commission, so all updates and reviews are joint efforts by both agencies. Preparations are underway for holding the stock assessment methods workshop with the plan development team. Multiple assessment techniques will be considered given the number of systems to assess and the variety of data sources for each system.

ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Yan Li, Stock Assessment Scientist
Jason Rock, Blue Crab Species Lead
Fisheries Management Section

SUBJECT: North Carolina Blue Crab Stock Assessment

Since late 2016, the Division of Marine Fisheries has been working to develop a quantitative stock assessment for the North Carolina blue crab stock. The effort was prompted by a motion from the Marine Fisheries Commission at its August 2016 business meeting to move up the review of the Blue Crab Fishery Management Plan to begin in 2016. The division's Blue Crab Plan Development Team (PDT)* held their first meeting in November 2016 to begin the stock assessment process. This process concluded with an in-person peer review workshop, that was open to the public and held in New Bern in March 2018.

During the development of the stock assessment, the PDT followed the division's stock assessment standard operating procedures. The PDT thoroughly reviewed datasets including:

- Commercial landings and discards,
- Recreational landings and discards,
- Survey indices of abundance, and
- Biological data (e.g., carapace width, weight, sex, maturity).

Selected data were incorporated into a sex-specific two-stage model (based on the catch-survey analysis) that was appropriate for the available data. The time series selected for the assessment was 1995 through 2016 and was based on available data. Data from four fishery-independent surveys, as well as commercial landings, were included in the model.

In March 2018, the division held a three-day stock assessment peer review workshop where members of the PDT reviewed the model inputs and results with a panel of four experts on blue crab biology and/or stock assessment modeling. This in-person review workshop allowed discussion between the PDT and reviewers, enabling the reviewers to ask for and receive timely updates to the model as they evaluated sensitivity of the results to different model assumptions. The workshop also allowed the public the opportunity to observe the peer review process and better understand the development of stock assessments.

The results of the peer review workshop include:

- The reviewers accepted the sex-specific two-stage model as appropriate for management use. Results of the model indicate the stock is overfished* and overfishing* is occurring (Figure 1).
- The reviewers strongly recommended the model be updated at least once within the management time period of five years.
- The reviewers had concerns about possible over-parameterization, inconsistencies between survey and fishing time steps, and model assumptions about life history characteristics (e.g., natural mortality, growth), but additional model runs testing these concerns indicate the model is not influenced by these uncertainties.

A detailed report was produced by the peer review panel and is provided in the commission's briefing book.

***Definitions**

Plan Development Team(PDT): A group of staff, selected by the Division of Marine Fisheries Director for their expertise, that help develop and write a fishery management plan. Staff from other agencies, like the Wildlife Resources Commission, can also serve on a PDT for multi-jurisdictional plans, such as estuarine striped bass.

Overfished: 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.

Overfishing: Fishing that causes a level of mortality that prevents a fishery from producing a sustainable harvest.

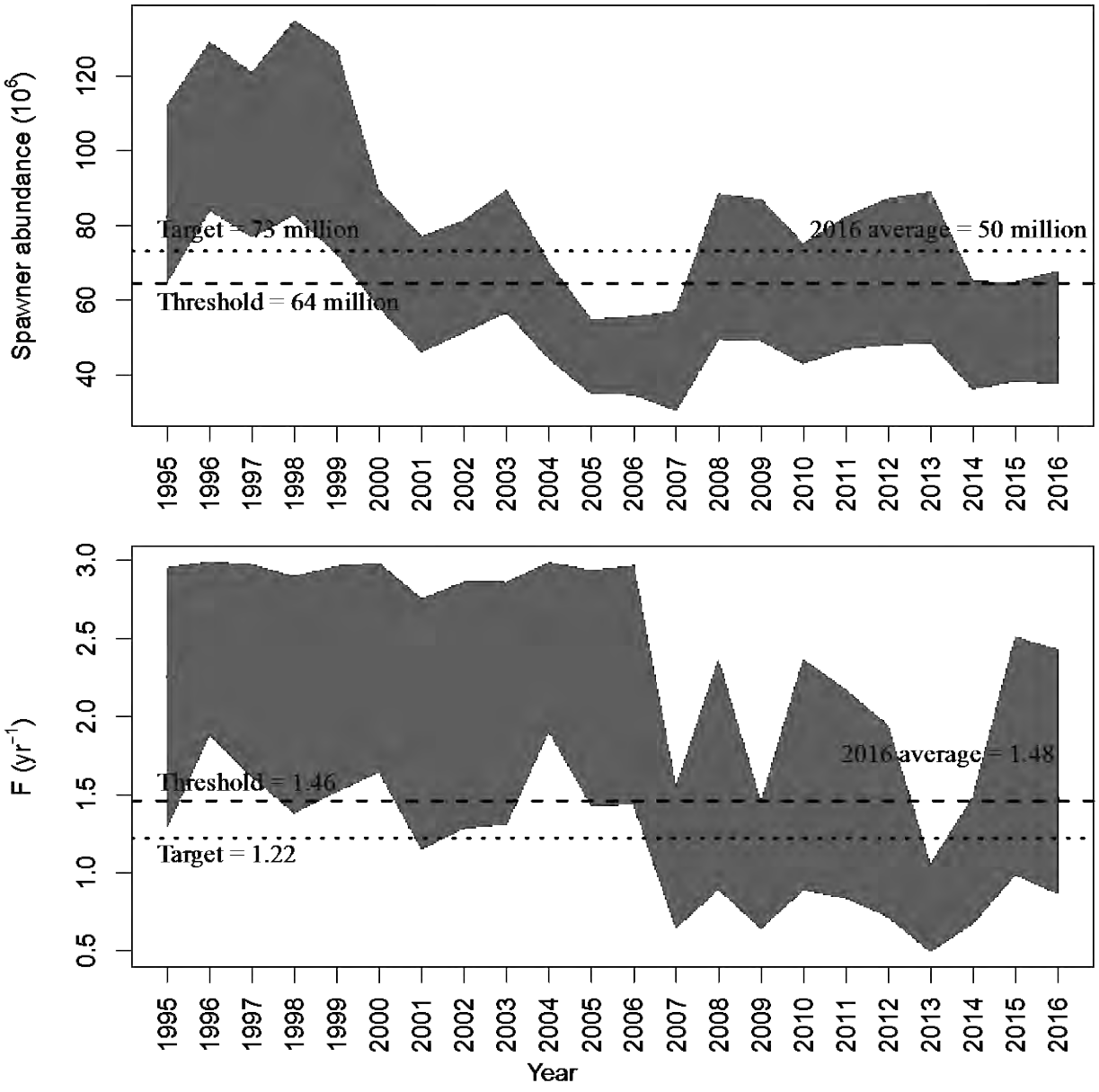


Figure 1. Estimated spawner abundance and fishing mortality (*F*) of North Carolina blue crab from the baseline model (Model 1), with lines representing posterior mean and shaded area representing 95% credible interval from the baseline model, Model 1. The threshold and target values are the posterior means.

Stock Assessment of the North Carolina Blue Crab (*Callinectes sapidus*), 1995–2016

Prepared by

North Carolina Division of Marine Fisheries
Blue Crab Plan Development Team

March 2018

NCDMF SAP-SAR-2018-02

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We would like to thank the members of the NCDMF Management Review Team for their review and comments.

We are especially grateful to the external peer reviewers for offering their time and effort to review the blue crab stock assessment: Jeffrey Brust at the New Jersey Marine Fisheries Administration, Dr. Robert Leaf at The University of Southern Mississippi, Genine McClair at the Maryland Department of Natural Resources, and Dr. Ed Hale at the Delaware Division of Fish and Wildlife.

EXECUTIVE SUMMARY

The North Carolina Fisheries Reform Act requires that fishery management plans be developed for all commercially and recreationally significant species or fisheries that comprise State marine or estuarine resources. The goal of these plans shall be to ensure the long-term viability of the State's commercially and recreationally significant species or fisheries. Stock assessments are the primary tools used by managers to assist in determining the status of stocks and developing appropriate management measures to ensure the long-term viability of stocks.

In December 1998, the North Carolina Division of Marine Fisheries (NCDMF) adopted a Fishery Management Plan for the blue crab resource. The 2004 amendment (Amendment 1) adopted a spawning stock trigger and associated measures to protect the blue crab spawning stock. Amendment 2 (2013) repealed the spawning stock trigger and associated measures and adopted the traffic light approach in conjunction with an adaptive management plan to manage the blue crab stock. The 2016 revision to Amendment 2 implemented additional management measures (no harvest of immature females, no harvest of dark sponge crabs from April 1 to April 30, no targeted crab dredging, and adding a third cull ring to crab pots) because a management threshold identified in Amendment 2 was reached. Amendment 3 to the Fishery Management Plan is currently in development and this stock assessment was performed in support of the amendment.

A comprehensive stock assessment approach, the sex-specific two-stage model, was applied to available data to assess the status of North Carolina's blue crab stock during 1995–2016. Data were available from commercial fishery monitoring programs and several fishery-independent surveys. The two-stage model was developed based on the catch-survey analysis designed for species lacking information on the age structure of the population. The model synthesized information from multiple sources, tracked population dynamics of male and female recruits and fully recruited animals, estimated critical demographic and fishery parameters such as natural and fishing mortality, and thus, provided a comprehensive assessment of blue crab status in North Carolina. The hierarchical Bayesian approach was used to estimate model parameters, which can incorporate uncertainty associated with the data and model assumptions.

The model estimated an overall declining trend in catch, relative abundance indices, population size of both male and female recruits and fully recruited crabs, with a rebound starting in 2007. Females had higher natural mortality estimates than males. The estimated fishing mortality remained high before 2007, and decreased by approximately 50% afterwards.

The stock status of North Carolina blue crab in the current assessment (2016) was determined based maximum sustainable yield (MSY). Based on the results of this assessment, the North Carolina blue crab resource in 2016 is overfished with a probability of 0.98, given the average spawner abundance in 2016 being estimated at 50 million (below the threshold estimate of 64 million). And, overfishing is occurring in 2016 with a probability of 0.52, given the average fishing mortality in 2016 being estimated at 1.48 (above the fishing mortality threshold estimate of 1.46).

A number of recommendations for research and monitoring are offered to identify how deficiencies in the understanding of blue crab stock dynamics can be addressed.

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1 INTRODUCTION

1.1 The Resource

Blue crabs (*Callinectes sapidus*) are present from Nova Scotia to the northern coast of Brazil (Hay 1905; Guillory et al. 2001), supporting commercial and recreational fisheries along the Atlantic and Gulf coasts of the United States. The blue crab resource supports North Carolina's most valuable commercial fishery. Blue crabs are also commonly harvested by recreational fishermen in North Carolina.

Before 1995, the North Carolina Division of Marine Fisheries (NCDMF) did not have a sampling program dedicated to blue crabs, although limited information (landings statistics, juvenile abundance) was collected through other programs. Realizing the increasing importance of the blue crab fishery to the coastal economy, crabbers petitioned the North Carolina General Assembly in 1994 to allocate funding specifically for a blue crab assessment project. The resulting program focused on the establishment of fishery-dependent and -independent databases state-wide. Section 5.5 of the Fishery Reform Act of 1997 specifically required that the North Carolina Marine Fisheries Commission adopt a Fishery Management Plan (FMP) for the blue crab fishery by January 1, 1999. The plan was adopted by the Marine Fisheries Commission on December 11, 1998 (NCDMF 1998). All of North Carolina's state Fishery Management Plans are reviewed and updated every five years. If the FMP includes a stock assessment, the assessment is reviewed and updated at the same time as the FMP. The Blue Crab FMP was first amended December 3, 2004 (NCDMF 2004), followed by a second amendment in November 2013 (NCDMF 2013) and a revision to Amendment 2 was adopted in May 2016 (NCDMF 2016). Amendment 3 to the Blue Crab FMP is currently in development.

The last benchmark assessment (a comprehensive assessment conducted every five years by re-evaluating data and modeling methods) for North Carolina blue crab stock was conducted for management purposes in 2011 using a Traffic Light approach, as part of the review and amendment of the Blue Crab FMP (NCDMF 2011). An overfishing definition and status relative to overfishing could not be determined because available data were considered insufficient for estimating reliable fishing mortality rates. Therefore, the previous assessment considered the status of the North Carolina blue crab stock relative to overfishing as unknown. The previous assessment recommended defining the overfished condition based on the blue crab production characteristic of the Traffic Light such that when the proportion of red for the production characteristic is greater than or equal to the third quartile (>=0.75) for three consecutive years, the blue crab stock is considered overfished. Based on this definition, the results of the previous assessment suggested the North Carolina blue crab stock was not overfished.

However, the NCDMF currently lists the stock as one of "concern" in its annual stock status report (NCDMF 2017). The blue crab stock was listed as one of concern due to reduced commercial landings of hard blue crabs during 2000 through 2002, 2005 through 2007, 2012 through 2014 and 2016 following record-high commercial landings observed during 1996 through 1999. Commercial blue crab landings in 2016 were the third lowest on record during the 10-year period of 2007 through 2016.

The current stock assessment was developed as part of Amendment 3 to the Blue Crab FMP.

1.2 Life History

1.2.1 Stock Definitions

The blue crab, *Callinectes sapidus*, inhabits estuarine and nearshore coastal habitats throughout the western Atlantic and Caribbean from Maine to northern Argentina (Hay 1905; Williams 1984; Steele and Bert 1994; Guillroy et al. 2001), as well as the Gulf of Mexico (Darden 2004; McMillen-Jackson et el. 1994). The blue crab is common to all North Carolina coastal waters, but the largest aggregations tend to live in the Albemarle and Pamlico sounds and the tributaries associated with these regions.

Although blue crab larvae mix when in the larval stages on the continental shelf, the interchange of larvae from North Carolina and other states is assumed to be negligible. The unit stock includes blue crabs occurring in all coastal fishing waters of North Carolina. Tagging data from NCDMF indicate that while blue crabs do exhibit seasonal migrations, they remain in North Carolina estuarine or coastal waters (NCDMF 2008).

While there is little genetic information on blue crabs in North Carolina waters, genetic studies in the Chesapeake Bay (Zohar et al 2008), Florida (Darden 2004)., and their range in the eastern United States (McMillen-Jackson et al. 1994) indicate that populations of blue crab geographically close together are more genetically similar than populations geographically far apart.

1.2.2 Movements & Migration

The first larval stage (zoea) occurs offshore for several weeks where it undergoes several developmental stages before metamorphosing into megalopae (Van Engel 1958; Epifanio 1995). Because of the lack of inlets in Albemarle Sound, megalopae are transported through the inlets (primarily into Pamlico Sound, North Carolina) via onshore wind events and nighttime incoming spring tides (Forward et al. 2004), which may be overshadowed by tropical storm forcing, depending on frequency and wind direction (Eggleston et al. 2010). Megalopae then settle in seagrass beds in the seaward portion of the sounds before exhibiting density-dependent secondary dispersal resulting in juveniles being widely distributed throughout the estuaries of North Carolina (Etherington and Eggleston 2000).

After growth and maturation, females migrate to spawn in the high-salinity waters near the inlets (Whitaker 2006). Mature female blue crabs are more commonly found in higher salinity waters (>10 ppt) and males prefer lower salinities (3 to 15 ppt). Other studies have also shown the migratory behavior of mature female blue crabs continues between clutches, and spawning females are continually moving seaward through the spawning season (Hench et al. 2004; Forward et al. 2005; Darnell et al. 2009). Males do not migrate regularly as adults and are found predominantly in the rivers and on the western side of the sounds.

A tagging study conducted in North Carolina during 2002 through 2005 demonstrated that most mature female blue crabs were recaptured shortly after release near the release site (NCDMF 2008). However, dispersal was greater and long-distance returns were more prevalent in 2003 from the north to the south. Additionally, releases in the upper and mid-estuaries of the Albemarle-Pamlico systems and Cape Fear River show a general pattern of summer to fall movement towards the lower estuary areas and coastal inlets. This results in a general characterization of mature female movement seaward throughout the growing season.

Mature female blue crabs tagged in the southern coastal area (i.e., south of the Pamlico region) have a southward pattern of movement (NCDMF 2008). A similar trend was noted in mature female crabs released in the Atlantic Ocean south of the Cape Fear River during February to April 2005 and 2006 and suggested the warming of the estuarine waters was a cue to female blue crab movement (Logothetis et al. 2007). A significant portion of mature females in the southern area overwinter in the ocean near the coastal inlets and move back into the estuaries the following spring to forage and potentially spawn multiple times (NCDMF 2008).

1.2.3 Age & Size

Fischler (1965) reported an average life span of three years for blue crabs in North Carolina and a maximum size of around 217 mm. Estimates of maximum age have ranged between five and eight years for blue crabs in the Chesapeake Bay (Rugolo et al. 1997). Age determination of crustaceans is difficult because, unlike finfish, they lack permanent hard structures because crabs shed their hard parts through molting.

Biochemical measures for ageing blue crabs have been attempted on those in the Chesapeake Bay (Ju et al. 1999; Ju et al. 2001; Puckett et al. 2008) and Florida (Crowley 2012). Cellular oxidation products termed “lipofuscins” (LF) are used, which accumulate as stable fluorescent by-products in specific tissues of the blue crab. The amount of LF held in the tissues increases with age (Puckett et al. 2008). The level of LF was found to be positively correlated with chronological age of crabs raised in both the laboratory and in artificial ponds (Ju et al. 1999). However, a study in Florida, using two known age cohorts, found that lipofuscin indices were negatively correlated to age (Crowley 2012). These results suggest that more research is needed before this method can be used to age blue crabs.

Another method that has been used to determine age in crustaceans uses growth bands found around the calcified region of the eyestalk or gastric mill in shrimp, crabs, and lobsters (Kilada et al. 2012). While this method has been successful to estimate age in longer-lived, cold water crustaceans like the American lobster (*Homarus americanus*), this method has not been tested in blue crabs.

1.2.4 Growth

Traditional growth models used for finfish are impractical to apply to crustaceans in general because the models assume growth is continuous (von Bertalanffy 1938; Schnute 1981). For blue crabs and other crustaceans, the shell grows in discrete stages via shedding of the exoskeleton (molt). However, the von Bertalanffy growth function returned similar results to crustacean-specific growth models that accounted for the unique growth characteristics of the blue crab (Eggleston et al. 2004; Johnson 2004). The similarity of the two growth models is likely due to the increasing time between molts that occurs as the crabs grow larger, mirroring the decreasing rate of growth with size evident in the von Bertalanffy growth function.

Carapace-width-to-length relationships have been estimated for blue crabs sampled from many estuaries throughout their range in the eastern United States. Murphy et al. (2007) used carapace width and body weight of blue crabs collected commercially from six locations in Florida. The carapace-width (mm)-to-weight (g) relationships for crabs collected in Florida (females: n = 2,254, males: n = 3,050) were:

Female: $W = 0.0000551 * CW^{1.8660}$; $r^2 = 0.620$

Male: $W = 0.0000397 * CW^{2.1430}$; $r^2 = 0.602$

Rothschild and Ault (1992) estimated a carapace-width-to-length relationship for blue crabs using 5,000 crabs collected in Chesapeake Bay. Their sex-specific carapace-width (mm)-to-weight (g) relations were:

Female: $W = 0.0034865 * CW^{2.1165}$

Male: $W = 0.00022105 * CW^{2.7208}$

Growth in blue crabs is rapid the first summer and is dependent on temperature, molt frequency, food quality and availability, and life stage. Optimum growth of blue crabs occurs at temperatures between 15°C to 30°C, and growth stops when the temperature goes below 10°C (Cadman and Weinstein 1988). In temperate regions, where winter temperatures regularly fall below this threshold, blue crabs bury into the sediment. During this dormant period, no growth occurs, thereby extending the time to reach maturity (Bauer and Miller 2010). Laboratory observations indicate blue crabs grow 12% to 35% per molt (Cadman and Weinstein 1988). Most blue crabs go through 18 to 20 post-larval molts before becoming sexually mature (Van Engel 1958).

1.2.5 Reproduction

Blue crabs mature between one and two years of age in North Carolina (Johnson 2004). Mating occurs during the spring or summer in brackish estuarine waters as female blue crabs molt into maturity (Forward et al. 2003; Whitaker 2006). Males may mate after their third or fourth intermolt, females mate only once in their lives (Hill et al. 1989). The sperm from this mating is stored in seminal receptacles of the female and used as often as the female spawns during a one or two year period (Hill et al. 1989). All young produced by a female must be fertilized by stored sperm (Darnell et al. 2009). Spawning typically occurs within two months after mating if mating occurs early in the growing season; however, females can retain sperm through the winter for spawning the following spring (Hill et al. 1989; Forward et al. 2003).

Spawning is initiated after migration to high-salinity areas near oceanic inlets. In the Chesapeake Bay, Prager et al. (1990) found that fecundity was significantly related to carapace width and

estimated the average fecundity was 3,200,000 eggs per clutch. Females may spawn once or several times a season. Spawning has two peak pulses, April–June and August–September, in North Carolina (Darnell et al. 2009).

For the current assessment, length at maturity (50% mature, L_{50}) for female blue crabs was determined by fitting a logistic model to the available maturity data. It was necessary to pool maturity data across multiple programs and areas to ensure sufficient sample sizes. Additionally, Otto et al. (1990, cited by Hjelset et al. 2009) recommended pooling data from different sampling methods to reduce bias in estimates of size at maturity. Maturity data collected by the NCDMF's Estuarine Trawl Survey (Program 120), Juvenile Anadromous Trawl Survey (Program 100), Pamlico Sound Survey (Program 195), and commercial fish house sampling (Program 436) were included in the model. Programs 100, 120, and 195 are described in more detail in section 2.2 of this report. Program 436 is described in more detail in section 2.1.1.3 of this report. Length at maturity was estimated by year for 1987 through 2015 to derive annual estimates of length at 50% maturity (L_{50}). Estimates of L_{50} ranges from 98.8 mm in 1999 to 125.7 mm in 2015 (Figure 1.1). Estimates were used to determine maturity of female recruits and fully recruited females in the assessment method (see section 3.2 of this report).

1.2.6 Mortality

The natural mortality rate (M) is a key parameter in stock assessments but often is one of the most uncertain. Johnson (2004) estimated natural mortality of blue crabs in North Carolina using Hoenig's method (1983), which relates M to the maximum age in the population. Assuming a maximum age of 5 years, Johnson (2004) estimated M to equal 0.87. This value of M was assumed in the 2004 stock assessment of North Carolina blue crabs (Eggleston et al. 2004).

Hewitt et al. (2007) estimated M for blue crabs in the Chesapeake Bay using a variety of methods and concluded that M values ranging between 0.7 and 1.1 per year were reasonable for that stock. Wong (2010) assumed $M = 0.80$ in the 2010 assessment of the Delaware Bay blue crab stock.

Total mortality (Z) is the sum of natural, fishing, and any other sources of mortality. Johnson (2004) and Eggleston et al. (2004) estimated Z using length-based methods based on data collected during June by NCDMF Program 195. The length-based Z estimates ranged from 0.91 to 1.22 between 1987 and 2003 and averaged 1.03 per year during that time period. Estimates of Z for blue crabs in the Chesapeake Bay in the 1990s ranged from 1.0 to 1.5 (Rugolo et al. 1997). Estimates of Z derived from the results of a catch-survey analysis applied to the Delaware Bay blue crab stock ranged from 0.50 to 2.69 and averaged 1.51 per year during 1978 to 2009 (Wong 2010).

Fishing mortality rates (F) can be estimated directly (e.g., tagging studies) or indirectly. The results of a catch-survey analysis applied to the North Carolina blue crab stock were used to derive estimates of F, which ranged from 0.13 to 2.03 between 1987 and 2003 when M was assumed equal to 0.87 (Eggleston et al. 2004; Johnson 2004). Wong (2010) applied a catch-survey analysis to the Delaware Bay blue crab stock and the results were used to estimate the upper bound of F (see reference for details). Estimates of the upper bound for F ranged between 0.22 and 1.74 during 1978 to 2009 and averaged 0.75 per year.

Fishing mortality rates are difficult to estimate, especially when losses to the fishery are unknown. For example, reporting of discards and bycatch is not always required; if these

quantities are significant and associated mortality is high, estimating F is made increasingly difficult. For blue crabs, the mortality associated with shedding operations may be substantial, with estimated losses of 10 to 30% daily after the crabs are taken from the water but before they are sold as soft crabs (Chaves and Eggleston 2003).

1.2.7 Food & Feeding Habits

Blue crabs consume a wide variety of food, fulfilling roles as predators and detritivores. They are large consumers of annelids, polychaetes, crustaceans, live or dead fish, vegetation, detritus, and feed heavily on oyster spat and juvenile clams (Williams 1984). Bivalve mollusks are a major portion of blue crab diets (Hines et al. 1990; Laughlin 1982; Cordero and Seitz 2014). They are also cannibalistic, and larger crabs are capable of exhibiting a check on population growth by consuming large amounts of small crabs and juveniles.

1.3 Habitat

1.3.1 Overview

The blue crab life cycle consists of an offshore phase and an estuarine phase. The offshore phase primarily consists of mature females that spawn in ocean waters, and planktonic larvae prior to migrating into the estuary. Blue crabs use a wide range of habitats based on life stage, sex, maturity, and associated salinity preferences, and occur across a broad spectrum of water quality parameters (Table 1.1). Wetlands, submerged aquatic vegetation (SAV), shell bottom, and unvegetated estuarine and ocean soft bottom are used by this species at various stages of their life cycle. The blue crab is common to all North Carolina coastal waters.

1.3.2 Spawning Habitat

Blue crabs spawn weeks after mating in late spring to early fall (Whitaker 2006). After mating, inseminated female blue crabs migrate from their usual brackish areas to high-salinity waters near ocean inlets. Females rely on high-salinity cues to ensure eggs are released for their development on the continental shelf. Ogburn and Habegger (2015) used SEAMAP data from 1990-2011 to assess spawning habitat in the South Atlantic Bight. Using reproductive condition of mature females as an indicator of spawning, they found that blue crabs spawned throughout the South Atlantic Bight and as far as 13 km offshore. In North Carolina, mature females were most abundant in the ocean in the summer, where approximately 84% had spawned and had only remnant eggs. The analysis indicated a South Atlantic regional decline in the number of offshore spawners, high inter-annual fluctuations in female crab density in Raleigh Bay, moderate but consistent densities in Onslow Bay, and low and declining densities in Long Bay. Results of this study and Ramach et al. (2009) suggest that inlets are serving more as migration corridors to the ocean where eggs are released and dispersed.

The first larval stage (zoeae) is carried offshore by ocean currents (Costlow and Bookhout 1959; Costlow et al. 1959; Epifanio 1995). Zoeae larvae are restricted to high salinity areas because of their intolerance of low salinity water (Costlow and Bookhout 1959). Their intolerance of low salinity water continues into the megalopal stages, when they return to the estuary.

1.3.3 Nursery & Juvenile Habitat

Once within the estuary, postlarvae (megalopae) settle in beds of submerged aquatic vegetation and other available complex habitats (i.e., salt marsh, detritus, and oyster shell) where they undergo further metamorphosis to become juveniles (Heck and Thoman 1981; Orth and van

Montfrans 1987; Hill et al. 1989; Ruiz et al. 1993; Pardieck et al. 1999; Posey et al. 1999; Etherington and Eggleston 2000).

Submerged aquatic vegetation is an important nursery habitat, particularly for early juveniles (<12 mm carapace width) that provide refuge from predators. In the Albemarle-Pamlico system, most initial recruitment of juvenile crabs occurs in SAV beds around inlets behind the Outer Banks, excepting major storm events. In years with large storm events, crabs disperse into lower salinity habitats (Etherington and Eggleston 2000). Studies have indicated that juvenile blue crabs occur in greater abundance in large or continuous SAV than in shallow unvegetated bottom or small patchy grass beds (Williams et al. 1990; Murphey and Fonseca 1995; Eggleston et al. 1998; Hovel 2003). Subtidal oyster reefs are also used as nursery habitat for early juveniles (Eggleston et al. 1998). After metamorphosis, juveniles undergo a secondary migration to shallow, less-saline waters in the upper estuaries and rivers or western Pamlico Sound (Etherington and Eggleston 2000). Ralph (2014), using a habitat-specific demographic model to quantify the effects of habitat on population fitness, found increased survival of age-0 crabs when vegetated habitats were present, which resulted in increased population growth rates. They concluded that since the vegetated habitats provided protection from fishing and predator mortality, the population could be subjected to higher fishing mortality rates and still maintain or increase population size.

Where SAV and subtidal oyster reefs are absent from estuaries in North Carolina and in the South Atlantic, lower salinity regions in the river-dominated estuaries provide important nursery areas for the blue crab population (Posey et al. 2005). Research in the Cape Fear and New rivers confirmed that marsh and shallow soft bottom in oligohaline and mesohaline portions of these rivers were important nursery areas with increased growth and reduced predation relative to the lower more saline portions of the rivers (Posey et al. 2005). The NCDMF estuarine trawl survey data show that blue crab is one of the dominant juvenile species in marshes and shallow tidal creeks (NCDMF unpub. data; Epperly and Ross 1986).

Wetlands, SAV, oyster reefs, and shallow soft bottom provide refuge and foraging area for juvenile crabs. Blue crabs forage heavily on oyster reefs, particularly oyster spat (Coen et al. 1999; Posey et al. 2004). Connectivity between these habitats provides a corridor for blue crabs to move through the estuary and enhances the ability to forage (Micheli and Peterson 1999; Grabowski et al. 2000).

1.3.4 Adult Habitat

Adult blue crabs use many of the same habitats as juveniles and are an important predator on submerged soft flats, marsh edge, and oyster reefs (NCDEQ 2016). Habitat partitioning by sex, maturity state, egg stage and salinity has been documented (Millikin and Williams 1984; Hines et al. 1987; Wolcott and Hines 1990; Ramach et al. 2009). General patterns include adult males and juvenile females being located further upstream and away from the waterbody mouth than females; juvenile females in shallower water than males and mature females in deeper water than juveniles and males; and females with late-stage eggs closer to the waterbody's mouth than females with early stage eggs. Egg bearing crabs migrate out of the estuary using ebb tide transport (Forward et al. 2003; Carr et al. 2004). Since females undergo a spawning migration and are observed migrating even when not gravid (Darnell et al. 2009), they are more likely to be found in higher-salinity waters near the oceanic inlets than in oligohaline areas.

1.3.5 Habitat Issues & Concerns

Portions of estuarine habitats used by various life stages of blue crab have been degraded or lost over time by a variety of anthropogenic sources (NCDEQ 2016). Dredge and fill activities, navigational dredging, shoreline stabilization, and erosion from boat wakes and natural sources have contributed to wetland loss. When assessing the effect of bulkheads and living shorelines on fish and invertebrates, Scyphers et al. (2011) found living shorelines to support a greater abundance and diversity of aquatic life, with blue crabs being the most clearly enhanced (300% more abundant). Land use changes, ditching and draining, and land disturbance lead to increased stormwater runoff, which can carry nutrients, sediment, toxins, and pathogens into surface waters. This, along with point source wastewater discharges and impacts from water based activities like marinas, can degrade water quality, resulting in loss of SAV, and water quality conditions that are stressful to blue crabs (e.g., low dissolved oxygen, increased susceptibility to disease, excessive nutrients, high organic loading, and chemical pollution). Sea level rise, subsidence, invasive species, and storms are also stressors that impact critical habitat. The effect of anthropogenic threats on SAV, wetlands, shell bottom, soft bottom, and water quality are summarized in the NC Coastal Habitat Protection Plan (NCDEQ 2016).

Although indirect, blue crabs are affected by natural disturbances of their environment. In particular, tropical cyclones can affect blue crab harvest in the short term by concentrating blue crabs in areas where they are vulnerable to fishing gear (Eggleston et al. 2004). These effects can have long-term effects as well. Since the relocation of individuals induces a change in localized abundance, harvest could be affected. Not all the effects of tropical cyclones are detrimental. For example, peaks in post-larval blue crab settlement coincided with tropical cyclone tracks that came from a southwesterly direction (Eggleston et al. 2010). The massive ingress of post-larval blue crabs could make a significant contribution to the blue crab population. The caveat is that storm forces must be moderate. Excessive freshwater input can alter the salinity of large bodies of water, increasing megalopae and juvenile blue crab mortality, and thereby negating the benefits of increased settlement.

Prevalence and lethality of diseases and parasites can increase under stressful conditions and potentially impact blue crab populations. For example, infection rates by the parasitic dinoflagellate *Hematodinium perezi* along the Atlantic and Gulf coasts can exceed 50% and is usually lethal (Butler et al. 2014). A Gulf coast study found shell disease present in blue crabs at a rate of 55%, and *Vibrio* spp. present in the hemolymph of 22% of blue crabs (Rogers et al. 2015).

Endocrine disrupting chemicals that enter surface waters through point or nonpoint sources can cause mortality or sub-lethal stress on shellfish and crustaceans, depending on the concentration and extent of exposure. Flame retardants (polybrominated diphenyl ethers), which have widespread occurrence in surface waters, have been linked to inhibiting molting in blue crabs (Booth and Zou 2016).

1.4 Description of Fisheries

1.4.1 Commercial Fishery

The blue crab resource supports North Carolina's most valuable commercial fishery. During 1950 through 2016, commercial landings of blue crabs have ranged from a low of 6.29 million pounds per year to a high of 67.1 million pounds per year (Figures 1.2 and 1.3). During the last decade (2007-2016), an average of 26.9 million pounds per year has been landed by the

commercial fishery. The ex-vessel value of commercial blue crab landings was highest during 1994 through 2003, averaging 54.6 million dollars (2016 USD)[1] per year. Before 1994, the average ex-vessel value of North Carolina's commercial blue crab landings was 9.9 million dollars (2016 USD) per year (1950–1993 average). During 2004 through 2016, the ex-vessel value of commercial blue crab landings averaged 28.0 million dollars (2016 USD) per year.

Commercial fishermen have harvested blue crabs with a variety of different gears over time, including dredges, trotlines, pots, and trawls (Figure 1.2). The majority of blue crabs (83.5%) landed from 1950 to 2016 was harvested by pots. Pots have accounted for 98.5% of North Carolina's commercial blue crab landings during the last decade (2007-2016).

Peeler and soft crabs have been a relatively small portion of the commercial fishery for blue crabs, comprising 2.1% of the total blue crab landings reported from 1950 to 2016 (Figure 1.3). Peeler crabs are a value-added harvest that is captured via peeler pots and trawling for hard crabs and shrimp, mainly during the spring, as well as peeler trawls that target peeler crabs. The peelers are then held in shedding systems until they molt and are sold as soft crabs, either shipped live or cleaned and frozen. The peeler crab portion of the overall blue crab commercial fishery is small; however, the impact of the peeler crab fishery may be underestimated due to unreported mortality in shedding operations. Blue crabs placed in shedding operations are not reported until they are sold and thus any mortalities are not currently represented in the landings.

The commercial fishery for blue crab primarily occurs during late spring through the fall (Figure 1.4). Reported landings are highest in July and August, and this pattern has persisted for at least the last four decades.

The number of commercial fishermen that have reported landings of blue crabs and the associated number of trips have generally decreased from 1994 to 2016 (Table 1.2). The number of commercial fishermen that have reported landings of blue crabs has ranged between 884 and 2,287 during that time period. The number of trips in which blue crabs were landed in North Carolina ranged from a low of 51,707 to a high of 143,055 over the same period.

1.4.2 Recreational Fishery

Recreational fishermen in North Carolina harvest blue crabs with a variety of gears, including pots (collapsible and rigid), gill nets, trawls, hand lines, and dip nets. A separate license category, the Recreational Commercial Gear License (RCGL), allows recreational fishermen to use limited amounts of certain commercial gear to harvest seafood for personal consumption (see section 1.5.4.2, this report). Estimates of the RCGL blue crab harvest are available from NCDMF surveys conducted from 2002 to 2008. During 2002 through 2008, an estimated average of 26,402 RCGL recreational fishing trips per year was directed at blue crabs (Table 1.3). In that same time period, RCGL-licensed recreational fishermen harvested from 94.6 thousand pounds to 117 thousand pounds of blue crabs per year. In terms of number of blue crabs, recreational harvest by RCGL licensees has averaged 321 thousand blue crabs per year between 2002 and 2008. The amount of blue crabs discarded by recreational fishermen has been approximately half the recreational harvest during this time period. Total catch (including

[1] All values converted to 2016 U.S. dollars (USD) based on the annual average producer price index (PPI) values (U.S. Bureau of Labor Statistics, pers. comm.). The PPI is used to deflate revenue streams to measure real growth in output. The PPI tracks changes in manufacturer selling prices for consumer goods. For 1981-2016 the PPI for unprocessed shellfish was used, prior to 1981 the meat, poultry, and fish PPI was used to adjust values for inflation.

harvest and discards) during 2011-2016 is based on the Coastal Angling Program (CAP) recreational crabbing mail survey (see section 2.1.2, this report) was estimated ranging between 131,690-200,051 crabs annually (Table 1.4). The mortality of blue crabs discarded from the recreational fishery is unknown.

Individuals are allowed to fish one pot per person from privately owned land or a privately owned pier with no license. It is not known whether this unlicensed recreational fishery constitutes a significant proportion of total recreational fishery for blue crabs.

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 (Figure 1.5). There are no federal or interstate FMPs that apply specifically to the blue crab fishery in North Carolina.

1.5.2 Management Unit Definition

The management unit includes the blue crab and its fisheries in all of North Carolina's coastal fishing waters.

1.5.3 Regulatory History

In December 1998, the first FMP for blue crabs was approved for North Carolina (NCDMF 1998). The 1998 FMP maintained the previously established minimum size limit of 5 inches and a 10% tolerance per container for undersize blue crabs on commercial fishing vessels. Mature females, soft crabs, and peeler crabs were exempt from the minimum size limit. The original FMP also modified existing rules to clarify language on fishing in or near blue crab spawning sanctuaries and recommended use of a 4 or 4.5-inch mesh trawl in inland waters. These changes included limits on allowable blue crab landings as bycatch from the shrimp fishery (50 crabs per person and a 100 crab vessel limit for RCGL holders and the larger of 50% of combined catch or 300 pounds for commercial operations), prohibited the baiting of peeler pots with anything but live male crabs, and made it unlawful to possess white-line peeler crabs between June 1 and September 1.

The Blue Crab FMP was amended in 2004 (NCDMF 2004). The 2004 amendment adopted a spawning stock trigger and associated measures to protect the blue crab spawning stock (see section 1.5.4.3, this report). Management measures included implementing by proclamation a seasonal maximum size limit of 6.75 inches (5% tolerance) for mature female hard crabs and 5.25 inches for mature female peeler crabs from September 1 through April 30 when the spawning stock index is abnormally low. This maximum size limit was enacted in January of 2006 and remained in effect through April 2014. Compliance with the female seasonal maximum size limit was marginal and largely ineffective at protecting large mature females. Even when crabbers complied with the management measure by releasing large females, these females may have been captured multiple times and injured, or ultimately harvested by another crabber during their migration to the lower estuaries and into the sounds.

The Blue Crab FMP was amended again in 2013 (NCDMF 2013). The 2013 amendment removed the spawning stock trigger and its associated measures. The amendment incorporated the use of a traffic light stock assessment and an adaptive management plan for management of the blue crab stock. The traffic light is divided into three characteristics: 1) adult abundance, 2)

recruit abundance, and 3) production. Each characteristic uses data from several division biological surveys and sampling programs to determine the relative abundance of adult and recruit blue crabs in the population and various production indictors for the stock each year. Under the adaptive management framework, the traffic light is updated annually and evaluated for management need. Moderate management measures (Table 1.5) will be implemented in the blue crab fishery if either the adult abundance or production characteristic of the traffic light are at or above the 50% red threshold for three consecutive years. Elevated management measures will be implemented if either the adult abundance or production characteristic of the traffic light are at or above the 75% red threshold for two of three consecutive years. The recruit abundance indicator, while not used to trigger management action, may be used to augment any management action taken if a trigger is activated. The three-year time period was chosen to prevent taking management action as a result of annual variability in the blue crab stock and instead base any management response on the observation of a short but continued declining trend in the population. The 2013 amendment also established the blue crab stock is considered overfished when the proportion of red in the production characteristic of the traffic light is greater than or equal to 75% red for three consecutive years.

In May 2016, a revision to the 2013 amendment was adopted in response to the moderate management trigger being met for the adult abundance characteristic of the traffic light (NCDMF 2016). This revision required one additional escape ring in crab pots and one of the three escape rings must be located within one full mesh of the corner of the pot and within one full mesh of the bottom of the apron/stairs (divider) of the upper chamber of the pot; eliminated the harvest of v-apron immature female hard crabs (excluding peeler crabs) and included v-apron immature female hard crabs in the culling tolerance; prohibited the harvest of dark sponge crabs (brown and black) from April 1 to April 30 each year and included dark sponge crabs in the culling tolerance; lowered the culling tolerance from 10 percent to 5 percent for all crabs, except mature females; and prohibited the harvest of crabs with dredges except incidental to lawful oyster dredging as outlined in North Carolina Marine Fisheries Commission (NCMFC) Rule 15A NCAC 03L .0203(a)(2).

1.5.4 Current Regulations

1.5.4.1 Commercial Fishery

The Standard Commercial Fishing License (SCFL) and Retired Standard Commercial Fishing License are annual licenses issued to commercial fishermen who harvest and sell fish, shrimp, or crab. The number of SCFL licenses is currently capped at 8,896. A Commercial Fishing Vessel Registration is also required for fishermen who use boats to harvest seafood.

There is no regulatory season for commercial harvesting of blue crabs with the exception of a restriction on crab dredge usage from January 1 to March 1 and a cleanup period for lost and abandoned pots between January 15 and February 7. For trawls, a 4-inch stretch mesh tailbag is required west of a line dividing Pamlico Sound down the middle and a 3-inch stretch mesh tailbag is required to the east of this line.

From March 1 to August 31, it is unlawful to use trawls, pots, and mechanical methods for oysters or clams or take blue crabs with the use of commercial fishing equipment from crab spawning sanctuaries (Figure 1.6). During the remainder of the year the director of the NCDMF may, by proclamation, close these areas and may impose any or all of the following restrictions:

number of days, areas, means and methods which may be employed in the taking, time period, and limit the quantity.

Prior to June 6, 2016

Commercial fishery regulations include a year-round carapace width minimum size limit of 5 inches for male and immature female hard blue crabs and a 10% tolerance for undersize blue crabs based on the number of blue crabs in any storage container on a vessel. Mature females, soft and peeler crabs, and male crabs for use as peeler bait are exempt from this size limit. If pots are used, they must contain two unobstructed escape rings no less than 2 5/16 inches in inside diameter and must be fished at least every five days. Peeler pots with a mesh size less than 1 ½ inches are exempt from the escape ring requirement. Targeted crab dredging is allowed from January 1 to March 1 in a northern area of Pamlico Sound adjacent to Oregon Inlet. Oyster dredges may also be used to harvest blue crabs but blue crabs cannot exceed 50% of the total weight of the oyster and crab catch or 500 pounds, whichever is less.

June 6, 2016–Present

Commercial fishery regulations include a year-round carapace width minimum size limit of 5 inches for male hard blue crabs, no size limit for mature female blue crabs, no possession of immature female blue crabs (excluding peeler crabs), and no possession of dark sponge crabs (brown and black) from April 1 through April 30. Soft and peeler crabs, and male crabs for use as peeler bait are exempt from this size limit. A 5% tolerance for immature female, dark sponge crabs, and undersize male blue crabs based on number in any storage container on a vessel. Peeler pots with a mesh size less than 1 ½ inches are exempt from the escape ring requirement. The harvest of blue crabs with dredges is prohibited except incidental to lawful oyster dredging.

January 15, 2017–Present

Pots used to harvest blue crabs must contain three unobstructed escape rings no less than 2 5/16 inches in inside diameter and one escape ring must be located within one full mesh of the corner of the pot and within one full mesh of the bottom of the apron/stairs (divider) of the upper chamber of the pot.

Detailed information regarding North Carolina's current commercial fishery regulations is available on the NCDMF website (http://portal.ncdenr.org/web/mf/home).

1.5.4.2 Recreational Fishery

Prior to 1999, no recreational fishing license was required unless a vessel was used. After July 1, 1999, the RCGL was required when using certain allowable commercial gear. No license is required for the following non-commercial equipment: collapsible crab traps, cast nets, dip nets, and seines less than 30 feet. A RCGL is required to use commercial gear to harvest finfish and crustaceans for personal consumption. Recreational crabbers are prohibited by law from selling their catch, even if in possession of a RCGL. With a RCGL, a maximum of five pots of any type (peeler pots are disallowed) is allowed and must be fished at least every five days; pots cannot be fished at night. Pots must be removed from the water during January 15 through February 7. One pot per person may be used without a RCGL to fish from privately owned land or a privately owned pier with no license. The recreational fishery is not subject to reporting requirements. The current possession limit for the recreational fishery is 50 blue crabs per person per day not to exceed 100 blue crabs per vessel per day.

Prior to June 6, 2016

Recreational fishery regulations include a year-round carapace width minimum size limit of 5 inches for male and immature female hard blue crabs and a 10% tolerance for undersize blue crabs based on the number of blue crabs in any storage container on a vessel. Mature females, soft and peeler crabs are exempt from this size limit. If pots are used, they must contain two unobstructed escape rings no less than 2 5/16-inches in inside diameter.

June 6, 2016–Present

Recreational fishery regulations include a year-round carapace width minimum size limit of 5 inches for male hard blue crabs, no size limit for mature female blue crabs, no possession of immature female blue crabs (excluding peeler crabs), and no possession of dark sponge crabs (brown and black) from April 1 through April 30. A 5% tolerance for immature female, dark sponge crabs, and undersize male blue crabs based on number in any storage container on a vessel.

January 15, 2017–Present

Pots used to harvest blue crabs must contain three unobstructed escape rings no less than 2 5/16-inches in inside diameter and one escape ring must be located within one full mesh of the corner of the pot and within one full mesh of the bottom of the apron/stairs (divider) of the upper chamber of the pot.

Detailed information regarding North Carolina's current recreational fishery regulations is available on the NCDMF website (http://portal.ncdenr.org/web/mf/home).

1.5.4.3 Spawning Stock Trigger

In addition to the regulations described above, the 2004 amendment to the Blue Crab FMP adopted a spawning stock trigger to protect the blue crab spawning stock (NCDMF 2004). A spawning stock index derived from September data collected by the NCDMF Pamlico Sound Survey (Program 195; see section 2.2.3, this report) is evaluated annually to determine whether the trigger has been activated (Figure 1.7). The spawning stock index is calculated as the sum of the carapace widths of mature female blue crabs divided by the total number of tows. The trigger is activated when the spawning stock index falls below the lower 90% confidence limit of the reference baseline average for two consecutive years. In the 2004 amendment, the reference baseline was 1987 through 2003. The amendment states that the reference baseline will be updated every five years as part of the FMP review. However, if the trigger is active at the time of the review, the reference baseline update will be delayed until the trigger is no longer active.

When the trigger is activated, the NCDMF has the proclamation authority to implement spawning stock protection measures. These measures include a 6 ¾-inch maximum size limit on mature female blue crabs and a 5 ¼-inch maximum size limit on female peeler crabs from September through April for all fisheries in order to protect mature female crabs during their spawning migration. In addition, the culling tolerance of blue crabs in any container on a vessel in the commercial fishery will be lowered from 10% by number to 5% by number.

The spawning stock trigger was activated every year from 2006 through 2013 (repealed effective in 2014; NCDMF 2013), and the associated measures were implemented.

1.5.5 Management Performance

The decline of commercial blue crab landings continued after the adoption of the Blue Crab FMP in 1998 (Figures 1.2 and 1.3). Based on data collected from the NCDMF Trip Ticket Program (see section 2.2.1, this report), commercial landings of blue crabs during 1994 through 1997 averaged 55.8 million pounds per year. During 1998 through 2016, commercial fishermen landed an average of 33.4 million pounds of blue crabs per year. The decrease in commercial landings is due, at least partly, to the shutting down of crab processing plants, which reduced the amount of crabs that seafood dealers could move, thereby reducing demand and ultimately reducing harvest. It is not certain how much of the decline in landings is attributable to the FMP. Changes in stock size may also be a factor in the decline. Other potential contributing factors could include changes in effort and environmental variability.

1.6 Assessment History

1.6.1 Review of Previous Methods & Results

The last benchmark assessment of blue crab in North Carolina waters for management purposes was performed by NCDMF in 2011. The assessment applied the Traffic Light approach to evaluate stock status. The previous assessment recommended defining the overfished condition based on the blue crab production Traffic Light such that when the proportion of red for the production Traffic Light is greater than or equal to the third quartile (>=0.75) for three consecutive years, the blue crab stock is considered overfished. Based on this definition, the results of the previous assessment suggested the North Carolina blue crab stock was not overfished. An overfishing definition and status relative to overfishing could not be determined because available data were considered insufficient for estimating reliable fishing mortality rates. Therefore, the previous assessment considered the status of the North Carolina blue crab stock relative to overfishing as unknown. Details of the Traffic Light approach are provided in Appendix A.

1.6.2 Previous Research Recommendations

Research recommendations identified from the 2011 stock assessment (NCDMF 2011) focused on the lack of sufficient data to apply a traditional method to assess the status of the blue crab stock as identified in Amendment 1 (NCDMF 2004). To address this deficiency, the following recommendations for research and monitoring were offered (no particular order):

- Continue existing programs that have been used to monitor North Carolina's blue crab stock to maintain baseline data
- Identify key environmental factors that significantly impact North Carolina's blue crab stock and investigate assessment methods that can account for these environmental factors
- Conduct a study of the selectivity of the gear used in the Juvenile Anadromous Trawl Survey (Program 100) to evaluate the size at which blue crabs are fully-selected to the survey gear; the results of such a study could help determine whether the survey data could be used to develop a reliable index of blue crab recruitment for the Albemarle region; no such index is currently available
- Expand spatial coverage of the Estuarine Trawl Survey (Program 120) to include shallow-water habitat in Albemarle Sound; sampling in shallow-water habitat is intended to target juvenile blue crabs so that a recruitment index for the Albemarle Sound could be developed

- Expand temporal coverage of the Estuarine Trawl Survey (Program 120) beyond May and June sampling; additional sampling later in the blue crab's growing season would provide more information on within-year changes in growth, mortality, and abundance; at a minimum, recommend addition of September sampling in order to capture the fall settlement peak
- Expand spatial coverage of Pamlico Sound Survey (Program 195) to include deepwater habitat in Albemarle Sound and the Southern Region; expanding the sampling region of adult blue crab habitat would allow for a more spatially-comprehensive adult index; additionally, there would be increased confidence in comparison of adult abundance trends among regions since all would derive from the same sampling methodology
- Implement a statewide survey with the primary goal of monitoring the abundance of blue crabs in the entire state; such a survey would need to be stratified by water depth to ensure capture of all stages of the blue crabs' life cycle and standardized among North Carolina waters
- Implementing monitoring of megalopal settlement near the ocean inlets could potentially add a predictive function to the blue crab stock assessments in the future; Forward et al. (2004) detected a positive, linear relationship between megalopal abundance and commercial landings of hard blue crabs for both the local estuarine area and the entire state of North Carolina when a two-year time lag was implemented (Forward et al. 2004); such monitoring is critical to track larval ingress peaks and the effect of natural forces, such as tropical storms and prevailing winds, on ingress.
- Continue surveys of recreational harvest and effort to improve characterization of the recreational fishery for blue crabs
- Identify programs outside the NCDMF that collect data of potential use to the stock assessment of North Carolina's blue crabs
- Perform in-depth analysis of available data; consider standardization techniques to account for year and other effects in development of indices; explore utility of spatial analysis in assessing the blue crab stock.

2 DATA

2.1 Fisheries-Dependent

2.1.1 Commercial Fishery Monitoring

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 trip-ticket system to track commercial landings.

2.1.1.1 Survey Design & Methods

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. In 2004, electronic reporting of trip tickets became available to all dealers who chose to use it. In 2013, a NCMFC rule was implemented making it mandatory to report electronically if a seafood dealer averaged 50,000 pounds of finfish over the most recent three-year period. Many federal dealers were already required to report electronically to NMFS and used the NC Trip Ticket Software Program to meet their reporting requirements for NMFS and NC.

2.1.1.2 Sampling Intensity

North Carolina dealers are required to record the transaction at the time of the transactions and report trip-level data to NCDMF on a monthly basis.

2.1.1.3 Biological Sampling

Program 436 (P436) was initiated in April 1995 to collect fisheries-dependent data at fish houses from North Carolina's commercial blue crab fishery. The program aimed to determine size, sex, and maturity (female) for blue crabs and length/weight of non-blue crab species harvested in the commercial crab fisheries and obtain information from the commercial harvester on harvest location, soak time, weight of catch (Trip Ticket information), and specifications on gear type and amount. Initially, sampling was limited to the northeast and Pamlico Sound regions of North Carolina. Statewide sampling was initiated in 1998. Subsamples of sorted (by market category) and unsorted catches are taken and biological information is recorded. All blue crabs in a subsample are measured and sexed, and maturity of females is recorded. Program 436 only samples voluntarily cooperative fish houses, and sampling distribution may not reflect landing patterns.

2.1.1.4 Biases

Because trip tickets are only submitted when fish are transferred from fishermen to dealers, records of unsuccessful fishing trips are not available. 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 relates to the reporting of multiple gears on a single trip ticket. This bias is considered minimal for blue crab landings because the commercial blue crab fishery uses gears specific to crabbing (e.g., crab pots, crab trawls, trotlines). Therefore, it is often possible to identify the gear used to catch blue crabs on a trip ticket that lists multiple gears and species.

2.1.1.5 Development of Estimates

All trips landing blue crab from 1994 to 2016 were subset from the trip ticket database. This subset contains 51,305,547 observations and 48 variables including species other than blue crab caught on each trip. Blue crab landings are divided into hard blue crabs, peeler blue crabs, and

soft blue crabs. Each type of blue crab is recorded with its own unique species code. Therefore, landings can be split between hard, peeler, and soft blue crabs as opposed to years prior to 1994.

The length-frequency distribution of blue crabs in North Carolina's commercial landings was calculated using biological sampling data from P436. The length-frequency distributions were computed by year for 1995 to 2016.

2.1.1.6 Estimates

The landings of blue crab have generally declined overall since 1994. However, in recent years, the landings have started to show an increasing trend (Figures 1.2 and 1.3). Also, the majority of landings occur from two areas, the Pamlico Area (51%) and Albemarle Area (44%). Historically, the majority of the blue crab landings came from the Pamlico Area, but in more recent years, the Albemarle Area has been the top producer (Figures 2.1). The majority of hard blue crabs occurred during the summer months while peeler and soft crabs were primarily landed during spring months (Figure 2.2).

The modal peak of hard crabs is 140 mm CW bin with the majority of crabs in the 130 through 150 mm CW bins (Figure 2.3). Peeler crabs have a modal peak in the 110 mm CW bin with the majority of crabs in the 90 through 120 mm CW bins.

The commercial catch data during 1995-2016 were further partitioned by sex and stage (<127 mm CW as recruits and ≥127 mm CW as fully recruited crabs; Figure 2.4) for assessment model input based on the biological sampling from P436. See Section 3 of this report for assessment model input.

2.1.2 Recreational Fishery Monitoring

2.1.2.1 Survey Design & Methods

During 2001 through 2002, a telephone survey of RCGL holders was conducted to determine the 2001 recreational harvest of blue crabs (Nobles et al. 2002). Phone surveys of 388 RCGL holders were conducted between September 2001 and March 2002 to determine use of the RCGL, type of equipment, location of harvest, number of days harvesting, and daily and seasonal harvest estimates.

A mail survey of coastal and estuarine landowners was conducted in North Carolina between May 1, 2002 and April 30, 2003 (Vogelsong et al. 2003). The survey requested information on property characteristics, crabbing effort, and harvest. A total of 382 surveys were returned.

The NCDMF conducted monthly surveys of RCGL holders from 2002 to 2008 to collect information on recreational fishing. Participants were randomly selected and were asked about the number of trips taken and the type and number of gears used during the survey month. Participants were also asked to provide estimates for the numbers and pounds of each species caught and retained as well as the numbers of each species discarded.

From 2007 to 2010, the NCDMF surveyed approximately 20% of Coastal Recreational Fishing License (CRFL) holders regarding their participation in saltwater fishing activities including gigging, use of a cast net, shellfish collection, and crabbing.

Since 2010 through present, the NCDMF the Costal Angling Program (CAP) evaluates recreational crabbing with a mail survey. The CAP survey aims to collect data for estimating the participation in recreational crabbing among CRFL and grandfathered license holders, the number of trips taken and the amount of catch including harvest and discards. Descriptive

characteristics of crabbing trips including: duration, party size, methods of harvest, county, waterbody, and access locations are also collected during this survey. Individuals are randomly selected and stratified by a combination of region of residence and license duration. The survey was conducted every two months.

2.1.2.2 Biological Sampling

There are currently no programs that collect biological samples of blue crabs from North Carolina's recreational fishery.

2.1.2.3 Biases

The Nobles et al. (2002) survey and NCDMF survey of RCGL holders were limited to fishermen in possession of a RCGL, thereby omitting non-licensed recreational fishermen that harvested blue crabs. The NCDMF survey of CRFL holders also omitted non-licensed recreational fishermen that harvested blue crabs. Estimates of recreational harvest by non-licensed fishermen are unknown. While initiating an estuarine landowner survey filled some of this gap, including many recreational crabbers who are exempt from RCGL and CRFL licensing, it does not take into account harvest from renters or that of fishermen legally harvesting blue crabs without a license.

2.1.2.4 Development of Estimates

In the CAP program, the number of potential participants is a product of the number of valid recreational licenses for the survey period and the percent of those who answered affirmatively to a crabbing participation question at the time of license purchase (or while updating contact information). The ineligibility rate is the number of anglers reporting they do not participate in crabbing divided by the total number of responses received. The estimated participation is a product of the number of potential participants and one minus the ineligibility rate. The mean number of trips per license holder is calculated by dividing the sum of all trips reported by all respondents by the number of respondents. Estimated effort is the product of the estimated number of potential crabbers participating and the mean trip per license holder. Catch is the number of a species harvested by each angler expanded to represent the population of license holders. The mean number of crabs caught per license holder is calculated by dividing the sum of crabs reported by all respondents by the number of respondents. Estimated catch is the product of the estimated number of potential crabbers participating and the mean number of crabs harvested per crabber.

2.1.2.5 Estimates

Fifty percent of all blue crabs were harvested along the Intracoastal Waterway, between Pamlico Sound and the Cape Fear River (Nobles et al. 2002). The total estimated blue crab harvest from RCGL holders in 2001 was 118,051 pounds. In this survey, 23.5% of the surveyed RCGL holders indicated that they targeted blue crabs.

The NCDMF survey of RCGL holders estimated that RCGL licensees took an average of 26,402 blue crab directed trips per year between 2002 and 2008 (Table 1.3). During this time period, RCGL holders harvested an average of 116,797 pounds per year, which amounted to 20% of the total estimated RCGL harvest.

Estimated blue crab harvest by RCGL holders was less than 0.40% of total blue crab commercial landings for 2001 through 2008. While the harvest of exempted shore- and pier-based pots and

other non-commercial gear are unknown, it is unlikely that recreational harvest of blue crabs is significant in North Carolina.

The CAP survey estimated 44% of trips from central coastal area (Figure 2.5). Majority of the trips were contributed by Carteret (19%), Dare (21%), and Brunswick (17%) counties. Total catch (harvest + discards) ranged between 131,690 and 200,051 crabs annually (Table 1.4). Total effort and catch were concentrated during the summer and fall with a marked increase in trips being observed between May and October.

Recreational catch was not included in this assessment because the recreational catch of blue crab in North Carolina accounts for less than 0.4% of its commercial catch and no detailed information regarding recreational catch is available throughout the assessment time period.

2.2 Fisheries-Independent

2.2.1 Estuarine Trawl Survey (Program 120)

2.2.1.1 Survey Design & Methods

In 1971, the NCDMF initiated a statewide Estuarine Trawl Survey, also known as Program 120 (P120). The objectives of the program are to: 1) identify primary nursery areas and other critical habitats, 2) provide a long-term data base of annual juvenile recruitment for economically important species, and 3) provide a database for evaluation/permit comment on projects with potential environmental impact.

The survey samples shallow-water areas south of the Albemarle Sound system (Figure 2.6). Major gear changes and standardization in sampling occurred in 1978 and 1989. In 1978 tow times were set at one minute during the daylight hours. In 1989 an analysis was conducted to determine a more efficient sampling time frame to produce juvenile abundance indices with acceptable precision levels for the target species. A set of 104 core stations was identified, sampling would be conducted in May and June only, except for July sampling for weakfish (dropped in 1998, program 195 deemed adequate), and only the 10.5 ft. head rope trawl would be used. July sampling for a subset of the cores was reinstituted in 2004 in order to produce a better index for spotted seatrout.

The current gear is a 3.2-m otter trawl with 6.4-mm bar mesh body netting of 210/6 size twine and a tailbag mesh of 3.2-mm Delta-style knotless nylon with a 150-mesh circumference and 450-mesh length. The gear is towed for one minute during daylight hours during similar tidal stages and covers 75 yards.

All species taken are sorted, identified, and a total number is recorded for each species. For target species, a subset of at least 30-60 individuals is measured. Environmental data are recorded, including temperature, salinity, dissolved oxygen, wind speed, and direction. Additional habitat fields were added in 2008.

2.2.1.2 Sampling Intensity

Prior to 1989, sampling was year-round. From 1989 to 2003, a set of 104 fixed core stations was identified and sampling was conducted in May and June only. Since 2004, additional July sampling of a subset of the core stations has been conducted.

2.2.1.3 Biological Sampling

All blue crabs caught are counted. The catch of blue crabs is subsampled if there are more than 30 individuals that are less than 20 mm carapace width (CW). These crabs (<20 mm CW) are measured but not sexed. Larger blue crabs (>=20 mm CW) are sexed and measured.

2.2.1.4 Biases

Mature female blue crabs are present throughout the coastal waterways of North Carolina. When it is time to spawn, mature females migrate to the oceanic inlets near the barrier islands. Depending on the timing of sampling, the migration could artificially inflate the perceived abundance of mature females in Pamlico Sound by including transient, not resident, mature female crabs. Adult blue crabs more commonly occupy deeper water (<2 m) and are therefore less likely to be encountered by the gear in the locations sampled by Program 120.

2.2.1.5 Development of Estimates

Overall, a total of 7,779 samples captured 55,894 blue crabs from 1971 to 2016 (Table 2.1). The number of samples per year from core stations ranged from a low of zero (1972) to a high of 209 (1988). The number of blue crabs caught annually ranged from 18 to 2,794. The modal peak for blue crabs captured was 10 mm CW, with approximately 65% of blue crabs being less than 50 mm CW (Figure 2.7). The CW for blue crab ranged from 3 to 266 mm. The mean annual CW varied little throughout the time series, hovering around 50 mm.

Examination of the available data lead to the decision to develop sex-specific indices of relative abundance for blue crab recruits (crabs less than 127 mm CW). To generate these sex-specific indices, when individual sex information was unavailable the overall male:female sex ratio (60:40) was applied to the unsexed portions of the catch.

The nominal annual CPUE for both male and female recruits shows inter-annual variability with an overall declining trend through the time series (Figure 2.8). Male recruit CPUE ranged from a high of 7.9 in 1996 to a low of 1.6 in 2016. Female recruit CPUE ranged from a high 5.2 in 1996 to a low of 1.1 in 2016.

The standardized indices were input to the assessment models. A generalized linear model (GLM) framework was used to develop the standardized indices. Both Poisson and negative binomial error distributions were considered and the selected distribution was based on the estimate of dispersion (ratio of variance to the mean; Zuur et al. 2009). The Poisson distribution assumes equi-dispersion—that is, the variance is equal to the mean. Count data are more often characterized by a variance larger than the mean, known as overdispersion. Some causes of overdispersion include missing covariates, missing interactions, outliers, modeling non-linear effects as linear, ignoring hierarchical data structure, ignoring temporal or spatial correlation, excessive number of zeros, and noisy data (Zuur et al. 2009, 2012). A less common situation is underdispersion in which the variance is less than the mean. Underdispersion may be due to the model fitting several outliers too well or inclusion of too many covariates or interactions (Zuur et al. 2009). Data were first fit with a standard Poisson GLM and the degree of dispersion was then evaluated. If over- or underdispersion was detected, an attempt was made to identify and eliminate the cause of the over- or underdispersion (to the extent allowed by the data) before considering alternative models, as suggested by Zuur et al. (2012). In the case of overdispersion, a negative binomial distribution can be used as it allows for overdispersion relative to the Poisson distribution. Alternatively, one can use a quasi-GLM model to correct the standard errors for overdispersion. If the overdispersion results from an excessive number of zeros (more

than expected for a Poisson or negative binomial), then a model designed to account for these excess zeros (e.g., zero-inflated model) can be applied.

Potential covariates were evaluated for collinearity by calculating variance inflation factors, applying a correlation analysis, or both. Collinearity exists when there is correlation between covariates and its presence causes inflated *P*-values.

Covariate selection started with a null model including only the intercept. The significant covariates were identified and added to the null model through a forward selection procedure based on Akaike Information Criterion (AIC, Akaike, 1974; Burnham and Anderson, 2002). At each step, the covariate that most greatly reduced the AIC value was added to the null model, and this process was repeated until inclusion of an additional covariate would not substantially improve model performance (i.e. the decrease in AIC was less than five).

2.2.1.6 Estimates

The GLM frequently selected depth, salinity, sediment size (i.e., hard rock, hard sand, soft mud, hard mud, clay, silt, muddy sand, sandy mud, sand and mud) and bottom composition (i.e., shell, grass, algae and detritus) as significant covariates for both male and female recruit abundance indices. The standardized CPUE for both male and female recruits varied annually with relatively low recruits in last three years, especially in 2016 (Figure 2.9).

2.2.2 Juvenile Anadromous Trawl Survey (Program 100)

2.2.2.1 Survey Design & Methods

The NCDMF Juvenile Anadromous Trawl Survey, also known as Program 100 (P100), was initiated in 1982 to determine relative abundance, growth, and distribution of juvenile alosine fishes and striped bass in Albemarle Sound (Figure 2.10). Since its inception, the survey has sampled seven stations (Hassler stations) in western Albemarle Sound. In July 1984, twelve sampling stations were added in the central Albemarle Sound area (Central Sound stations) to monitor juvenile striped bass abundance and to determine if a shift in the striped bass nursery area had occurred.

The program surveys a total of 62 fixed trawl sites, of which 19 are considered core sites. Continuous time series are available for Hassler and Central Sound trawls. Historic trawls were introduced to the program in 2004.

The survey uses an 18-foot semi-balloon trawl with a body mesh size of 0.75 inch and a 0.25-mesh tailbag. A 10 or 15-minute tow pulled at 2.4 knots with the balloon trawl constitutes one unit of effort. Hassler trawls are pulled for 15 minutes while all others are 10 minute tows. Water quality and habitat information such as temperature, salinity, and dissolved oxygen are recorded. In 2004, forty-three stations were reactivated. Not all sampling was conducted in 2005 due to a gas shortage. In 2010 blue crab sex became a mandatory field and maturity and sponge stage fields were added.

2.2.2.2 Sampling Intensity

Program 100 trawls are conducted June through October, except Hassler and Central Sound trawls are conducted bimonthly from July through October. Due to difference in sampling and lack of blue crab catch in June, only July through October were used in this analysis.

2.2.2.3 Biological Sampling

The catch of each tow is sorted by species, counted, and measured. The carapace width, sex, and maturity (if female) are recorded for blue crabs. Subsampling methods are used if the catch of blue crabs is excessive.

2.2.2.4 Biases

The Program 100 survey samples only a couple of deep-water areas in Albemarle Sound, and the sampling does not include many of the tributaries or parts of the sound east of the Alligator River. This gap in sampling potentially omits mature females on their spawning migration to the oceanic inlets. Also, the survey trawl cannot sample in shallow waters in Albemarle Sound because of the complex structure, primarily stumps, associated with the shoreline. This potentially omits capture of juvenile blue crabs using the complex, shallow-water habitat as refuge from predators.

2.2.2.5 Development of Estimates

Data was analyzed for July through October. Core stations (Hassler and Central Sound trawls) were used for the analysis as they represent stations that were sampled continuously throughout the assessment period. CPUE was evaluated with effort being equal to one tow.

Overall, a total of 5,163 samples captured 27,453 blue crabs from 1972 to 2016 (Table 2.2). The number of samples per year from core stations ranged from a low of 12 (1972) to a high of 162 (1987). The number of blue crabs caught annually ranged from 3 to 3,593. There are modal peaks for blue crabs captured at 110 and 150 mm CW (Figure 2.11). The CW for blue crab ranged from 2 to 210 mm. The mean annual CW varied throughout the time series, averaging around 115 mm.

Examination of the available data lead to the decision to develop seasonal sex-specific indices of relative abundance for fully recruited blue crabs (crabs greater or equal to 127 mm CW). The summer season is July-August and the fall season is September-October. To generate these seasonal sex-specific indices, when individual sex information was unavailable the overall male:female sex ratio (63.5:36.5) was applied to the unsexed portions of the catch.

The annual summer CPUE for both male and female fully recruited blue crabs shows inter-annual variability with an increasing trend in recent years (Figure 2.12). Male fully recruited summer CPUE ranged from a high of 6.0 in 2008 to a low of 0.01 in 1997. Female fully recruited summer CPUE ranged from a high 2.3 in 2009 to a low of zero in 1997. The annual fall CPUE for both male and female fully recruited blue crabs were lower in the earlier years of the time series and have been more variable since 2008. Male fully recruited fall CPUE ranged from a high of 15.0 in 2008 to a low of 0.03 in 1997. Female fully recruited fall CPUE ranged from a high of 10.5 in 2008 to a low of 0.04 in 1997.

The abundance indices were standardized for assessment model input. See Section 2.2.1.5 for CPUE standardization procedure.

2.2.2.6 Estimates

The GLM model frequently selected salinity and dissolved oxygen as significant covariates for explaining annual variation in fully recruited crab abundance indices. The standardized indices from P100 increased since 2007 for both male and female fully recruited crabs (Figure 2.13).

2.2.3 Pamlico Sound Survey (Program 195)

2.2.3.1 Survey Design & Methods

The Pamlico Sound Survey, also known as Program 195 (P195), was instituted in March 1987 to provide a long-term, fishery-independent database for important recreational and commercial fish species in the Pamlico Sound, and the lower Neuse, and Pamlico rivers (Figure 2.14). Data collected from the survey have been used to calculate juvenile abundance indices and estimate population parameters for interstate and statewide stock assessments of recreationally and commercially important fish stocks.

This is a stratified-random survey. Fifty-two to fifty-four randomly selected stations are trawled each sampling event for a minimum of 104 stations trawled each year. Initially stations were allocated in proportion to the size of the strata (Table 2.3). The number of stations per strata was determined by the following formula:

$$N_S = N_T * (F_S / F_T)$$

Where N_S = number of hauls per stratum
N_T = total number of hauls
F_S = area of stratums
F_T = total survey area

Currently randomly drawn stations are optimally allocated among the strata based upon all the previous sampling in order to provide the most accurate abundance estimates (PSE <20) for selected species (BDB program NCEFF42S). A minimum of three stations (replicates) are maintained in each stratum, and 5 stations each are set for the Neuse and Pamlico rivers and 3 stations for the Pungo River.

Sampling is conducted aboard the RV *Carolina Coast*, equipped with double-rigged demersal mongoose trawls. The RV *Carolina Coast* is a 44-ft fiberglass hulled double-rigged trawler. The trawl consists of a body made of #9 twine with 1.875-in (47.6-mm) stretch mesh. The codend of the net is constructed of #30 twine with 1.5-in (38.1-mm) stretch mesh. The tailbag is 80 meshes around and 80 meshes long (approximately 10-ft). A 120-ft (36.58-m) three-lead bridle is attached to each of a pair of wooden doors that measure 4 ft by 2 ft (1.22-m X .061-m) and to a tongue centered on the headrope. A 60-cm “poly-ball” is attached between the end of the tongue and the tongue bridle cable. A 0.1875-in (4.76-mm) tickler chain that is 3.0-ft (0.9.-m) shorter than the 34-ft (10.36-m) footrope is connected to the door next to the footrope. A bib or tongue of webbing is built into the center of the top body panel. This tongue extends forward from the point that would be the headrope location on a flat, balloon, or semi-balloon trawl. Use of a large float at the point of the tongue where it is attached to a center bridle allows the tongue to fish higher in the water column. The tongue helps to reduce escapement over the top of the trawl. Tow duration is 20 minutes at 2.5 knots.

Environmental and habitat data are recorded during the haul back of each trawl. Parameters measured include: weather description, light phase, surface and bottom temperature (°C), surface and bottom salinity (ppt), surface and bottom dissolved oxygen (DO)(mg/L), start time, secchi depth (cm; added 2008), sediment size, wind speed (knots), wind direction, precipitation, start and end latitude, and start and end longitude.

The entire catch is sorted by species; each species is enumerated and a total weight is taken for each species. Individuals of each target species are measured. If present in large numbers, a sub-sample of 30-60 individuals of each target species is measured and a total weight of the measured individuals for each species is taken. If not on the target species list, the species is enumerated and a total weight taken. Blue crab are on the target species list and measured to the nearest millimeter carapace width and an aggregate weight of all individuals is taken to the nearest 0.1 kg.

2.2.3.2 Sampling Intensity

Currently, sampling occurs annually during the months of June and September, typically during the middle two weeks of each month. Sampling has undergone some changes. From 1987 to 1989 sampling occurred in eastern Albemarle Sound. From 1987 to March 1989, sampling occurred in March and December (in addition to June and September). The Pungo River was added to the survey area in 1990.

There were six years where the survey did not occur over the same time series; 1988, 1999, 2003, 2009, 2012, and 2013. In 1988, the December leg of the cruise was partially extended into January 1989 because of scheduling conflicts and adverse weather conditions. In 1999, samples were collected during the month of July and the end of September and beginning of October because vessel repairs and hurricanes prevented following the normal schedule. In September 2003, hurricane Isabel caused a delay and sampling was completed two days into October. In September 2009, vessel repairs caused a delay and sampling was completed during the first week of October. In June 2012, vessel repairs caused a delay in sampling causing the cruise to extend into a third week. In 2013, weather delays caused sampling to extend to a third week in June and September.

2.2.3.3 Biological Sampling

All blue crabs are counted and the sum weight of the catch is recorded. Carapace width, sex, maturity stage, and sponge color are recorded for all mature female blue crabs and from all subsampled blue crabs.

Beginning in September 2002, catches of blue crabs that were too large to process efficiently in the field were set aside for processing later. Subsamples were taken if the amount of crabs in the catch consisted of about ¼ of a 50-lb orange basket or more. The subsampling process involved dumping the basket on the culling table and immediately dividing the sample into quarters. The carapace width and sex were recorded and the sum of the crab weights in the subsample was taken. The remaining crabs (the other three quarters) were counted and mature females segregated. The sum weight of mature females was recorded and the carapace width of mature females was taken.

In 2005, the subsampling protocol was modified for situations where the number of blue crabs caught exceeds 100 individuals. In this situation, all mature females are separated, counted, weighed, and measured. The sum weight of all remaining crabs (males and immature females) is recorded before being subdivided into quarters. One quarter of the sample is then processed, recording the same data that are recorded for samples with fewer than 100 crabs. This process is repeated if necessary until a minimum of 100 crabs are measured.

2.2.3.4 Biases

One shortfall is that this survey, due to the vessel's size, cannot sample shallow water. The survey also cannot sample areas with complex benthic structure, like stumps or other submerged aquatic vegetation. These two limitations could omit important blue crab habitat.

Mature female blue crabs are present throughout the waterways of North Carolina. When it is time to spawn, mature females migrate to the oceanic inlets. Depending on the timing of sampling, the migration could artificially inflate the perceived abundance of mature females in Pamlico Sound by including transient, not resident, mature female crabs.

2.2.3.5 Development of Estimates

Effort is defined at the sample level with a sample consisting of double rigged trawls towed for 20 minutes. Precision of CPUE estimates was evaluated using the proportional standard error (PSE). Index values are design-based but data is available to develop model-based estimators (e.g. GLM). Indices represent the relative abundance of recruit, fully recruited, and mature female blue crabs in the survey.

A total of 3,153 samples captured 150,878 blue crabs from 1987 to 2016 (Table 2.4). The number of samples per year ranged from 90 to 108. The number of blue crabs caught annually ranged from 106 to 15,524. The modal peak for blue crabs captured in June was 50 mm CW, with approximately 50% of blue crabs occurring in the 40 mm to 70mm CW bins (Figure 2.15). In September there were modal peaks at both the 60 mm and 130 mm CW bins. The CW for blue crab ranged from 5 to 235 mm in June and from 14 to 200 mm in September (Figures 2.16). The mean CW in June appears to show a declining trend through the time series, averaging 83 mm from 1987-2003 and falling to an average of 71 mm from 2004 to 2016. The mean CW in September varied little throughout the time series, hovering around 100 mm.

Examination of the available data lead to the development of sex-specific indices of relative abundance for blue crab recruits (crabs less than 127 mm CW) and fully recruited blue crabs separately by month, and a September index of mature female blue crabs. To generate the sex-specific indices, when individual sex information was unavailable the overall male:female sex ratio by stage (recruit 49.3:50.7 and fully recruited 37.3:62.7) was applied to the unsexed portions of the catch. To account for the different sizes of the strata sampled, a weighted CPUE was used for the indices based on the number of grids in each stratum (Table 2.3).

The annual June weighted CPUE (wCPUE) for both male and female recruits shows inter-annual variability with an overall declining trend through the time series (Figure 2.17). Male recruit wCPUE ranged from a high of 55.3 in 1997 to a low of 3.9 in 2009. Female recruit wCPUE ranged from a high 62.6 in 1997 to a low of 4.7 in 2009. The annual September wCPUE for both male and female recruits was much higher in the earlier years of the time series and have been at stable low levels since 2000 (Figure 2.18). Male recruit wCPUE ranged from a high of 12.2 in 1996 to a low of 0.7 in 2011 and 2015. Female recruit wCPUE ranged from a high of 14.9 in 1996 to a low of 0.4 in 2008.

The annual June weighted CPUE (wCPUE) for both male and female fully recruited blue crabs shows inter-annual variability with an overall declining trend through the time series (Figure 2.18). Male fully recruited wCPUE ranged from a high of 10.0 in 1999 to a low of 0.1 in 2007 and 2009. Female fully recruited wCPUE ranged from a high 9.6 in 2004 to a low of 0.5 in 2007. The annual September wCPUE for both male and female fully recruited blue crabs were

higher in the earlier years of the time series and have been at stable low levels since 2000. Male fully recruited wCPUE ranged from a high of 7.2 in 1996 to a low of <0.1 in 2006. Female recruit wCPUE ranged from a high of 26.6 in 1996 to a low of 0.3 in 2014.

The September mature female wCPUE has been variably but generally low since 2000 (Figure 2.19). Mature female wCPUE ranged from a high of 29.2 in 1996 to a low of 0.3 in 2014.

The abundance indices were standardized for assessment model input. See Section 2.2.1.5 for CPUE standardization procedure.

2.2.3.6 Estimates

The GLM model frequently selected strata, salinity, water temperature and water depth as significant covariates for male and female recruits and fully recruited crabs. All standardized indices showed an overall declining trend over years with a rebound since 2007 (Figures 2.20).

2.2.4 SEAMAP Trawl Survey

2.2.4.1 Survey Design and Methods

This program is a shallow water trawl survey to monitor the status and trends of coastal species in the South Atlantic Bight, including fish, shrimp, crabs, horseshoe crabs, sea turtles, mantis shrimp, and squid, to amass a long-term data base for research and fisheries management use. Samples are taken by trawl from the coastal zone of the South Atlantic Bight between Cape Hatteras, North Carolina, and Cape Canaveral, Florida (Figure 2.21).

Strata are delineated by the 4-m depth contour inshore and the 10-m depth contour offshore. Stations are randomly selected from a pool of stations within each stratum. The number of stations sampled in each stratum is determined by optimal allocation. A total of 102 stations are sampled each season within twenty-four shallow water strata.

The R/V Lady Lisa, a 75 ft. (23 m) wooden-hulled, double-rigged, St. Augustine shrimp trawler owned and operated by SCDNR, is used to tow paired 75 ft. (22.9 m) mongoose-type Falcon trawl nets without turtle excluder devices. The body of the trawl is constructed of #15 twine with 1.875 in (47.6 mm) stretch mesh. The cod end of the net is constructed of #30 twine with 1.625 in (41.3 mm) stretch mesh and is protected by chafing gear of #84 twine with 4 inch (10 cm) stretch “scallop” mesh. A 300 ft. (91.4-m) three-lead bridle is attached to each of a pair of wooden chain doors which measured 10 ft. x 40 in (3.0 m x 1.0 m), and to a tongue centered on the head-rope. The 86-ft (26.3 m) head-rope, excluding the tongue, had one large (60 cm) Norwegian “polyball” float attached top center of the net between the end of the tongue and the tongue bridle cable and two 9-in (22.3 cm) PVC foam floats located one-quarter of the distance from each end of the net webbing. A 1ft chain drop-back is used to attach the 89-ft. foot-rope to the trawl door. A 0.25-in (0.6 cm) tickler chain, which is 3.0 ft. (0.9 m) shorter than the combined length of the foot-rope and drop-back, is connected to the door alongside the foot-rope.

Trawls are towed for twenty minutes, excluding wire-out and haul-back time, exclusively during daylight hours (1 hour after sunrise to 1 hour before sunset). Contents of each net are sorted separately to species, and total biomass and number of individuals are recorded for all species of finfish, elasmobranchs, decapod and stomatopod, crustaceans, cephalopods, sea turtles, xiphosurans, and cannonball jellies. Only total biomass is recorded for all other miscellaneous

invertebrates (excluding cannonball jellies) and algae, which are treated as two separate taxonomic groups.

Where large numbers of individuals of a species occur in a collection, the entire catch is sorted and all individuals of that species are weighed, but only a randomly selected subsample are processed and total number is calculated. For large trawl catches, the contents of each net are weighed prior to sorting and a randomly chosen subsample of the total catch is then sorted and processed. In every collection, each of the priority species is weighed collectively and individuals are measured. For large collections of the priority species, a random subsample consisting of thirty to fifty individuals is weighed and measured. Depending on the species, measurements of finfish are recorded as total length or fork length, measured to the nearest centimeter.

Additional data are collected on individual specimens of penaeid shrimp, blue crabs, sharks, horseshoe crabs, and sea turtles. Gonad and otolith specimens are also collected during seasonal cruises. A representative sample of specimens from each centimeter size range within each stratum are measured to the nearest mm (TL and SL), weighed to the nearest gram, and assigned a sex and maturity code. Sagittal otoliths and a representative series of gonadal tissue are removed, preserved, and transported to the laboratory at MRRI, where samples are processed. Hydrographic data collected with a Seabird SBE-19 CTD profiler at each station.

Fewer (78) stations were sampled in the same strata by the trawl survey in 1990-2000. In 1990-2000, stations were sampled in deeper strata with station depths ranging from 10 to 19 meters to gather data on the reproductive condition of commercial penaeid shrimp. Those strata were abandoned in 2001 to intensify sampling in the shallower depth-zone. From 2001 to 2008, a total of 102 stations were sampled each season (306 stations/year) within twenty-four shallow water strata, representing an increase from 78 stations previously sampled in those strata by the trawl survey (1990-2000). In 2009, the number of stations sampled each season increased to 112 (336 total). In the spring of 2013, the Raleigh Bay region of the North Carolina coast was not sampled due to weather and boat issues

2.2.4.2 Sampling Intensity

Multi-legged cruises are conducted in spring (early April - mid-May), summer (mid-July - early August), and fall (October - mid-November).

2.2.4.3 Biological Sampling

The contents of each net are sorted separately to species, and total biomass and number of individuals are recorded for all species of finfish, elasmobranchs, decapod and stomatopod crustaceans, and cephalopods. Only total biomass is recorded for all other miscellaneous invertebrates and algae, which are treated as two separate taxonomic groups. Marine turtles captured incidentally are measured, weighed, tagged, and released according to NMFS permitting guidelines. When large numbers of specimens of a species occur in a collection, the entire catch is sorted and all individuals of that species are weighed, but only a randomly selected subsample is processed and total number is calculated. For trawl catches where visual estimation of weight of total catch per trawl exceeds 500 kg, the contents of each net are weighed prior to sorting and a randomly chosen subsample of the total catch is then sorted and processed. In every collection, each of the twenty-seven target species is weighed collectively and individuals are measured to the nearest centimeter. For large collections of the target species, a random subsample consisting of thirty to fifty individuals is weighed and measured.

2.2.4.4 Biases

While sampling covers many different bottom types, tows cannot be conducted over hard bottom structures such as artificial reefs where blue crabs have been observed.

2.2.4.5 Development of Estimates

A total of 2,107 samples captured 4,086 blue crabs from 1989 to 2016 (Table 2.5). The number of samples per year ranged from 39 to 102. The number of blue crabs caught annually ranged from 22 to 715. Most blue crabs were captured in the summer portion of the survey (approximately 81%). The modal peak for blue crabs captured in the spring was 140 mm CW and 130 mm CW in both the summer and fall (Figure 2.22). The CW for blue crab ranged from 65 to 184 mm in the spring, 42 to 200 mm in the summer and from 36 to 175 mm in the fall (Figures 2.23). The mean CW in spring is difficult to interpret because in many years no blue crabs were caught or measured. The mean CW in the summer was variable but averaged approximate 130 mm through the time series. The mean CW in the fall was variable but is difficult to interpret due to low catch numbers.

Examination of the available data lead to the development of a summer index of relative abundance for mature female blue crabs. Most blue crabs captured in the summer are female (Figure 2.24) and although maturity stage is not recorded, immature females are rare in the survey (SCDNR personal communication). In developing the estimate all female blue crabs were assumed to be mature.

The September mature female wCPUE has been variably but generally low since 2007 (Figure 2.25). Mature female wCPUE ranged from a high of 22.8 in 1990 to a low of 0.3 in 2008.

The abundance indices were standardized for assessment model input. See Section 2.2.1.5 for CPUE standardization procedure.

2.2.4.6 Estimates

The GLM model selected salinity and water temperature as significant covariates for explaining annual variation in spawner abundance index from SEAMAP. The standardized spawner index declined to a low level since 2008 (Figures 2.26).

3 ASSESSMENT

3.1 Overview

3.1.1 Scope

In this assessment, the unit stock contains all blue crabs occurring within North Carolina coastal fishing waters, and the assessment is conducted for the time period of 1995-2016.

3.1.2 Previous Method

Establishing a comprehensive stock assessment (e.g., statistical catch-at-age or catch-at-length analysis; Quinn and Deriso 1999) for blue crab has been challenging. Determination of age for blue crabs is still an unresolved issue or is at best uncertain because they do not retain any hard parts throughout their life cycle, such as otoliths and scales. This difficulty in ageing has limited the application of age-based and length-based analysis for blue crabs (Hilborn and Walters 1992).

The surplus production model and the traffic light method have been used in the 2004 (Eggleston et al. 2004) and 2011 (NCDMF 2011) blue crab stock assessment in North Carolina, respectively. The surplus production model, as one of the age-aggregated methods, does not require any age-structure, but may fail to produce reliable estimates for management purposes when data lack contrast or when fluctuations in recruitment rather than harvest intensity drive population dynamics, and it cannot incorporate a recruitment or spawner abundance index even if available (Hilborn and Walters 1992). The traffic light method is a qualitative approach that heavily relies on abundance indices as indicators (e.g., Halliday et al. 2001; Ceriola et al. 2007). Selection of indicators and determination of thresholds are arbitrary and conclusions are limited to theoretical applications.

Catch-survey analysis (Collie and Sissenwine 1983) has been widely applied to crustaceans that are difficult to age (e.g., Zheng et al. 1997; Cadrin 2000), and has been adapted to blue crab stock assessments along the east coast of the USA with various modifications (e.g., Eggleston et al. 2004; Murphy et al. 2007; Wong 2010; Miller et al. 2011; VanderKooy 2013). For example, the 2011 Chesapeake Bay blue crab stock assessment used a sex-specific catch-survey analysis (Miller et al. 2011), and 2007 Florida blue crab stock assessment applied a catch-survey analysis with a 6-month time step (Murphy et al. 2007). Instead of requiring a full age structure, as in an age-based model, the catch-survey analysis splits the population into two stages in which the recruit stage can be easily distinguished from the fully recruited stage containing older animals. The animals in the recruit stage grow to the fully recruited stage at the next time step, which is the same assumption in age-based models if the time step is one year.

For North Carolina blue crabs, catch-survey analysis was attempted in the 2004 stock assessment but was not included in development of the management plan (Eggleston et al. 2004). Major reasons that catch-survey analysis was not adopted in recent stock assessments include: (1) lack of information to determine the partial fishing mortality on recruits and natural mortality, (2) environmental factors play an important role in population variability, (3) recruitment is very dynamic, and (4) abundance indices show spatial variation and the lack of a state-wide index.

3.1.3 Summary of Current Method

In this assessment, the working group developed a sex-specific two-stage model that is adapted from catch-survey analysis for assessing North Carolina blue crabs. In this model, a sex-specific recruits fishery selectivity and a sex- and stage-specific natural mortality are assumed free parameters to estimate based on data; standardized abundance indices were used to avoid influences of environmental factors on annual trend, including spatial locations and geographic features such as sediment size and bottom habitat structure; recruitment was modeled as free parameters to estimate instead of assuming any spawner-recruitment relationship; both process error and observation error were included to account for natural variation in population additional to the variation in response to harvesting; the Bayesian approach was applied to sufficiently incorporate data uncertainty and expert opinion in parameter estimation.

3.2 Two-Stage Model

3.2.1 Model Structure and Assumptions

In the two-stage model (also known as catch-survey analysis, Figure 3.1), the blue crab population consists of two stages, the recruit and the fully recruited crabs (Collie and Sissenwine 1983). The recruit stage contained crabs smaller than 127 mm CW, that is the legal harvestable size for male and immature female blue crabs in North Carolina, and the fully recruited stage

included crabs larger than or equal to 127 mm CW. In the model, all fully recruited blue crabs were subject to fishing mortality, and the recruits were subject to a partial fishing mortality because mature females at this stage are harvestable, and those male and immature female blue crabs at this stage may also be retained if so long as they do not account for more than 10% of the catch. The population was modeled at annual time step. All recruits became fully recruited at the beginning of the next year. The population dynamics of blue crab in the sex-specific two-stage model was described in terms of the number of male and female crabs at each stage over time (Miller et al. 2011):

Population size of fully recruited animals

$$N_{y+1,\,s} = \left(N_{y,\,s}\exp\left(-M_{N,\,s} - F_{N,\,y,\,s}\right) + R_{y,\,s}\exp\left(-M_{R,\,s} - F_{R,\,y,\,s}\right)\right)\exp\left(\varepsilon_{N,\,y+1,\,s}\right),$$

Population size of recruits

$$R_y = \bar{R}\exp\left(\varepsilon_{R,\,y}\right),$$

$$R_{y,\,s} = R_y v_s,$$

Catch of fully recruited animals

$$C_{N,\,y,\,s} = \left(\frac{F_{N,\,y,\,s}}{F_{N,\,y,\,s} + M_{N,\,s}}\left(1 - \exp\left(-M_{N,\,s} - F_{N,\,y,\,s}\right)\right)N_{y,\,s}\right)\exp\left(\varepsilon_{CN,\,y,\,s}\right),$$

Catch of recruits

$$C_{R,\,y,\,s} = \left(\frac{F_{R,\,y,\,s}}{F_{R,\,y,\,s} + M_{R,\,s}}\left(1 - \exp\left(-M_{R,\,s} - F_{R,\,y,\,s}\right)\right)R_{y,\,s}\right)\exp\left(\varepsilon_{CR,\,y,\,s}\right),$$

Fishing mortality of fully recruited animals

$$F_{N,\,y,\,s} = F_y g_{N,\,s},$$

Fishing mortality of recruits

$$F_{R,\,y,\,s} = F_y g_{R,\,s},$$

Population size of spawners

$$N_{sp,\,y} = N_{y,\,s=female} w_N + R_{y,\,s=female} w_R,$$

Abundance indices of spawners

$$I_{sp,\,y,\,j} = \left(q_{sp,\,j} N_{sp,\,y}\right)\exp\left(\varepsilon_{sp,\,y,\,j}\right),$$

Abundance indices of fully recruited animals

$$I_{N,\,y,\,s,\,j} = \left(q_{N,\,s,\,j} N_{y,\,s}\right)\exp\left(\varepsilon_{IN,\,y,\,s,\,j}\right),$$

Abundance indices of recruits

$$I_{R,\,y,\,s,\,j} = \left(q_{R,\,s,\,j} R_{y,\,s}\right)\exp\left(\varepsilon_{IR,\,y,\,s,\,j}\right),$$

where R and N are the population size of recruits and fully recruited animals at the beginning of the year respectively, M and F are natural mortality and fishing mortality, v is the proportion of male or female in recruits, C is catch in number, g is selectivity, w is proportion of matured female in female recruits or female fully recruited animals, I is fishery-independent abundance index, q is the catchability; $\varepsilon_{N,\,y+1,\,s} \sim Normal\left(0,\,\sigma_N^2\right)$ and $\varepsilon_{R,\,y} \sim Normal\left(0,\,\sigma_R^2\right)$ are process errors, and $\varepsilon_{CN,\,y,\,s} \sim Normal\left(0,\,\sigma_{CN,\,s}^2\right)$, $\varepsilon_{CR,\,y,\,s} \sim Normal\left(0,\,\sigma_{CR,\,s}^2\right)$, $\varepsilon_{sp,\,y,\,j} \sim Normal\left(0,\,\sigma_{sp,\,j}^2\right)$, $\varepsilon_{IN,\,y,\,s,\,j} \sim Normal\left(0,\,\sigma_{IN,\,s,\,j}^2\right)$, and $\varepsilon_{IR,\,y,\,s,\,j} \sim Normal\left(0,\,\sigma_{IR,\,s,\,j}^2\right)$ are observation errors, which follow a normal distribution with a mean of zero and a standard deviation of σ; the subscript y indexes the yth year, s represents either male or female, j indexes the jth fishery-independent abundance index, R and N in subscripts denote the recruits and the fully recruited respectively, sp in subscripts denotes spawner.

In the model, a 1:1 sex ratio and sex-specific natural mortalities ($M_{N,\,s}$ and $M_{R,\,s}$) were assumed. The natural mortality was assumed constant over time. The mature female proportion for female recruits (w_R) and female fully recruited (w_N) was set to be 0.044 and 0.9 (Eggleston et al. 2004). The selectivity for fully recruited animals ($g_{N,\,s}$) was set to be one (Rudershausen and Hightower 2016), and selectivity for recruits ($g_{R,\,s}$) was assumed sex-specific and free parameters to estimate in the model. The annual recruitment $R_{y,s}$ was directly estimated to avoid assuming a fixed spawner-recruitment relationship because the spawner size can often only explain a small amount of the high variation in recruitment (Jiao et al. 2012). The annual recruitment $R_{y,s}$ was assumed to follow a lognormal distribution that centers around an average of $\bar{R}$. In North Carolina, fall is the primary spawning season for blue crab, and most harvest occurs during May-October. Thus, in the model, indices sampled since September in the current year (i.e., the P100 fall and P195 September indices) were related to the abundance in the following year, except for the spawner indices (i.e., P195 spawner and SEAMAP spawner indices).

3.2.2 Model Calibration

In this assessment, the Bayesian approach was applied to estimate parameters. The posterior distribution was obtained through the Metropolis-Hasting algorithm using Markov Chain Monte Carlo (MCMC) simulation (Hilborn et al. 1994; Hoff 2009). Three concurrent chains were run with a total of 500,000 iterations for each chain. The first 470,000 iterations were discarded as burn-in and every 10th iteration from the remaining sample from each chain was used for analysis. The working group used JAGS (Version 4.0.1) to run the Bayesian analysis.

Noninformative priors were used, i.e., uniform priors, for initial population size ($N_{y=1997,\,s}$), averange annual recruitment ($\bar{R}$), fishing mortaltiy (F_y), recruts selectivity ($g_{R,\,s}$), catchability ($q_{sp,\,j}$, $q_{N,\,s,\,j}$ and $q_{R,\,s,\,j}$), and standard deviation (σ_N, σ_R, σ_{CN}, σ_{CR}, $\sigma_{sp,\,j}$, $\sigma_{IN,\,s,\,j}$ and $\sigma_{IR,\,s,\,j}$) of process and obseration errors. The working group constructed a hierarchical prior for natrual mortality parameters where $M_{N,\,s}$ and $M_{R,\,s}$ follow an unknown lognormal distribution centering around $\bar{M}$ that is further governed by a uniform distribution bounded by m_1 and m_2:

$$M_{N,\,s} \; or \; M_{R,\,s} = \bar{M}\exp\left(\varepsilon_M\right),$$

$$\bar{M} \sim Uniform\left(m_1,\,m_2\right),$$

where $\varepsilon_M \sim Normal\left(0,\,\sigma_M\right)$ is a random error. Priors and parameters are listed in Tables 3.1 and 3.2.

3.2.3 Sensitivity Analysis

In addition to the baseline model above (Model 1), the working group considered three more candidate models (Models 2-4, Table 3.3). These candidate models were similar to Model 1 except that the Model 2 assumed a constant unknown natural mortality over sex and stage; Model 3 used a constant known natural mortality (M = 0.55; Eggleston et al. 2004) for both sexes and stages; Model 4 assumed a Ricker stock-recruitment model for recruits (Ricker 1954):

$$R_{y+1} = \left(\alpha N_{sp,\,y} \exp\left(-\beta N_{sp,\,y}\right)\right)\exp\left(\varepsilon_{R,\,y+1}\right),$$

$$\varepsilon_{R,\,y} \sim N\left(0,\, \sigma_R^2\right),$$

where α is the productivity parameter that represents the number of recuits per spawner at low density of spawners and is proportional to fecundity, β ($\beta > 0$) is the density-dependent parameter that controls the level of density dependence. Other major sensitivity runs that the working group have tested but are not presented here include time-block catchability, random-walk catchability, recruits June index only, recruits September index only, initial year of 1997 (when abundance indices start), sex-constant recruits selectivity to estimate, sex-constant recruits selectivity to input (0.03; Rudershausen and Hightower 2016), sex-constant recruits natural mortality, wider natural mortality constraint, and fixed catch and index standard deviation input.

The working group also conducted a retrospective analysis on spawner abundance and F for the baseline model (Model 1), which estimates the systematic changes in these two parameters as additional years of data were added (Mohn 1999). The working group started with the data from 1995 to 2011, and added one additional year of data at a time up to 2016. The retrospective error is calculated as follows (Mohn 1999; Hurtado-Ferro et al. 2015):

$$\frac{1}{n_{peel}} \sum_{t=2016-n_{peel}}^{2016} \frac{X_t\left|data\ to\ year\ t - X_t\right|data\ to\ year\ 2016}{X_t\left|data\ to\ year\ 2016\right.},$$

where X = spawner abundance or F, and n_{peel} = 5 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 that any values falling outside this range should indicate a problem of retrospective error and should be cause for concern. Retrospective error may either result from inconsistent or insufficient data, or result from natural variation in population dynamics.

3.2.4 Results

In the baseline model, catch data were fitted well but the fits of abundance index data were not as well as the catch data (Figures 3.2-3.3). Estimated catch for both sexes and both stages declined overall from 1995 to 2016 with a rebound occurring near 2007, especially for fully recruited crabs, but the estimated catch remained low since then (Figure 3.2). The models yielded a declining trend in all abundance indices before 2007 and a rebound afterwards (Figure 3.3). High uncertainty was associated with early years' index estimates either due to lack of data (e.g., 1995 and 1996 in some indices) or due to large across-year variation in index data (e.g., 2007-2014 of P100 indices).

Estimated population size of male recruits, female recruits and overall recruitment showed an overall declining trend with some intermittent periods of population increase, especially the period of 2007-2013 (Figure 3.4). Estimated population size of fully recruited male, female and

spawners remained high until a sharp decrease starting in 1998, then followed by a rebound starting in 2007. This rebound sustained the population size of fully recruited females and spawners approximately 50%-75% of those in mid 1990s, and sustained the population size of fully recruited males almost equivalent to the level in mid 1990s. Females had higher natural mortality estimates than males (Figure 3.5). Natural mortality estimates for fully recruited females were associated with higher uncertainty than other stages.

The estimated fishing mortality was high from 1995 to 2006, with a mean ranging from 1.78 to 2.64 (Fig. 3.6). Starting in 2007, fishing mortality estimates decreased to at least 50% of those before 2007, with a mean ranging from 0.72 to 1.49 and the lowest value of 0.72 occurring in 2013. Estimates of fishing mortality in the early years before 2007 were associated with large uncertainty.

Retrospective analysis showed consistent estimates of spawner abundance and *F* with additional years of data added (Figure 3.7). The retrospective errors for spawner abundance and *F* were 0.012 and 0.018, respectively, which fell within the recommended range of -0.22–0.3 and suggested that the retrospective error is less of a concern in this analysis.

The four candidate models produced consistent outcomes (Figures 3.8-3.12). In the two candidate models with sex- and stage-constant natural mortality, the estimated natural mortality from Model 2 (mean = 0.48 and 95% credible interval, 95%CI = 0.4-0.68) was close to the one input in Model 3 (0.55; Figure 3.11). Recruitment estimates from Models 1-3 showed density-dependence (Figure 3.13). At low spawner population size, estimated recruitment tended to be high with more spawners, but tended to decline with more spawners at high spawner population size.

3.2.5 Discussion

The previously established minimum size limit of five inches (127 mm) for North Carolina blue crabs was maintained in the 1998 Fishery Management Plan (FMP), with mature females, soft, and peeler crabs exempted from this size limit. The Blue Crab FMP was amended in 2004 by adopting a spawning stock trigger meant to protect the spawning stock. The 2004 Amendment implemented a seasonal maximum size limit for mature females (6.75 inch for hard crabs and 5.25 inch for peeler crabs) from September 1 through April 30 when the spawning trigger was met. The seasonal maximum size limit was enacted in 2006 and remained in effect through April 2014. This may have contributed to the large reduction in fishing mortality estimates and the rebound in population size estimates, especially for fully recruited female crabs and the boost in SPR estimates since 2007, although industry compliance with this measure is uncertain.

Blue crab is sensitive to flow and salinity, larval and juvenile crabs depends on flow to distribute spatially before settling down (Etherington and Eggleston 2000). North Carolina experienced three sequential destructive hurricanes in 1999, namely Dennis (end of August), Floyd (mid-September) and Irene (mid-October). Heavy rainfall during the first two hurricanes caused massive flooding, reduced salinity, and anoxic conditions in the Pamlico and Neuse River systems, which forced blue crabs out of the rivers and aggregate in Pamlico Sound where the harvest of crabs was high in 1999 (Paerl et al. 2001; Burgess et al. 2007). Statewide catch of fully recruited crabs and female recruits in 1999 was among the highest of the study time period. Low recruitment estimates during 2000-2001 in this assessment may represent a recruitment failure due to the low spawning stock size caused by intense harvest of spawners after the 1999

hurricane season and the potential disruption in larval dispersal and initial settlement caused by the hurricanes (Etherington and Eggleston 2000; Eggleston et al. 2004).

The models fit to index data not as well as to catch data, which reflects the quality of these different types of index datasets. For example, in the SEAMAP spawner data, all samples in certain years (e.g., 1992, 2015) were collected in July, samples in certain years (e.g., 2014, 2016) were collected in both July and August, and samples in certain years such as 2014 were not well balanced among month or location, e.g., in 2014, 27 samples were collected in July versus only four samples were collected in August; all these July samples were from Raleigh Bay and Onslow Bay, and these August samples were from Long Bay. Thus, a sampling scheme that is consistent and well-balanced across year and region would provide better-quality data to improve the model fit to index data.

This assessment did not include discards due to a lack of data. However, discards of blue crabs in North Carolina waters could be a significant source of mortality, especially in the commercial gill net fishery. This assessment, without discards considered, could be overestimating population size. Thus, it is important to establish data collection programs for fishery discards to help improve future stock assessments.

4 STATUS DETERMINATION

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 Statutes define overfishing as "fishing that causes a level of mortality that prevents a fishery from producing a sustainable harvest."

The 2004 FMP for blue crab defined the overfished condition for the blue crab stock based on commercial landings trends (NCDMF 2004). The blue crab resource was considered overfished when annual commercial landings declined for five consecutive years. No overfishing definition was developed.

The 2011 FMP for blue crab defined the overfished condition based on the blue crab production characteristic of the Traffic Light such that when the proportion of red for the production characteristic is greater than or equal to the third quartile (>=0.75) for three consecutive years, the blue crab stock is considered overfished. No overfishing definition was developed.

In this assessment, the working group evaluated blue crab stock status based on maximum sustainable yield (MSY). The MSY-based biological reference points (BRPs) have been widely used in fishery stock assessments including blue crabs, e.g., Chesapeake Bay 2001 (Miller et al. 2011), Florida 2007 (Murphy et al. 2007) and Gulf of Mexico 2013 assessments (VanderKooy 2013). In this assessment, the MSY-based BRPs were developed by estimating a Ricker spawner-recruit relationship outside the two-stage model (Shepherd 1982). Specifically,

Spawner-per-recruit (SPR) (Quinn and Deriso 1999)

$$SPR = v_{s=female}\left(w_R + w_N \frac{\exp\left(-Fg_{R,\ s=female} - M_{R,\ s=female}\right)}{1-\exp\left(-Fg_{N,\ s=female} - M_{N,\ s=female}\right)}\right),$$

Yield-per-recruit (YPR)

$$YPR = \sum_s \left(\frac{v_s Fg_{R,s}}{Fg_{R,s} + M_{R,s}} \left(1 - \exp\left(-Fg_{R,s} - M_{R,s}\right)\right) \right) + \sum_s \left(\frac{v_s Fg_{N,s}}{Fg_{N,s} + M_{N,s}} \exp\left(-Fg_{R,s} - M_{R,s}\right) \right),$$

Equilibrium spawner abundance

$$N_{sp}^{*} = \frac{\ln(\alpha) + \ln(SPR)}{\beta},$$

Equilibrium recruitment

$$R^{*} = \frac{N_{sp}^{*}}{SPR},$$

Total yield

$$Total\ \ yield = R^{*} \times YPR\ .$$

The fishing mortality that maximizes the total yield (F_{MSY}) was set to be the threshold for overfishing, and $0.75F_{MSY}$ was set to be the target fishing mortality. The spawner abundance at F_{MSY} (SP_{MSY}) and 0.75 F_{MSY} was set to be the threshold and target for overfished population, respectively. In the current stock assessment, the populaion is determined being overfished if the average spawner abundance in 2016 falls below SP_{MSY}, and is determined to be undergoing overfishing if the average F in 2016 remains above F_{MSY}.

For the current assessment (2016), determination of the current population status is based on the baseline model (Figure 3.6). In the baseline model, the threshold SP_{MSY} was estimated to be 64 million on average, and the target spawner abundance was estimated to be 73 million on average. The average spawner abundance of the year 2016 was estimated to be 50 million (< the threshold) with a 95%CI of 37-68 million, which determines the population in 2016 is overfished with a probability of 0.98. In the baseline model, the F threshold F_{MSY} and F target $0.75F_{MSY}$ was estimated to be 1.46 and 1.22 on average respectively, and the fishing mortality of 2016 was averaged 1.48 (> F threshold) with a 95%CI of 0.86-2.42, which determines overfishing is occurring in 2016 with a probability of 0.52.

In this assessment, the working group did not use spawning potential ratio (SPR/SPR at virgin level) based BRPs that compare with the virgin level, e.g., North Carolina 2004 assessment (Eggleston et al. 2004) and Louisiana 2016 assessment (West et al. 2016). This assessment spans from 1995 to 2016 due to data limitation, and the fishery began in the 1950s. The model may not sufficiently capture the population dynamics back to the virgin level due to such a short time series of data relative to history of the fishery, which makes it difficult to obtain reliable BRP estimates that compare with the virgin level.

5 SUITABILITY FOR MANAGEMENT

Stocks assessments performed by the NCDMF in support of fishery management plans are subject to an extensive review process. Internal reviews are conducted by various groups within the NCDMF including the species plan development team and the Management Review Team. 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 external peer reviewer panel accepted the baseline two-stage model as appropriate for management use for the next five years, and agree the determination of North Carolina blue crab stock status concurs with professional opinion and observations. The reviewers also agree 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 baseline two-stage model is a significant improvement over the traffic light approach used previously, and is robust to assumptions that have been explored in sensitivity analysis, such as assumptions regarding natural mortality and growth; (4) determination of stock status is robust to model assumptions; (5) although reviewers expressed concerns regarding spatial coverage of abundance indices and model complexity, sensitivity analysis indicates model results and stock status determination are robust to the reviewers' primary areas of concerns. Detailed comments from the external peer reviewers are provided in Appendix B, and results of additional sensitivity analyses requested by the reviewers are provided in Appendix C.

6 RESEARCH RECOMMENDATIONS

This assessment successfully applied a comprehensive stock assessment method, however, the performance of the assessment model could be improved with additional data. To address this, the following research recommendations are offered. Those research recommendations denoted with an asterisk (*) were suggested (and ranked) by the external peer reviewers.

<u>High</u>

- Develop statewide fishery-independent survey(s) to monitor the abundance of all blue crab life stages
- Expand time and area coverage of existing fishery-independent surveys
- Better characterize the magnitude of recreational harvest *
- Develop better estimates of life-history parameters, especially growth and natural mortality *
- Explore alternative biological reference points *

<u>Medium</u>

- Identify key environmental factors that significantly impact North Carolina's blue crab stock and investigate assessment methods that can account for these environmental factors
- Implement monitoring of hazardous events (e.g., hurricane, extreme heat or cold weather) affecting blue crab population dynamics and harvest
- Explore alternative model types *

<u>Low</u>

- Investigate and support research on promising methods to age blue crabs
- Evaluate the genetic stock structure of blue crabs within North Carolina and the magnitude of mixing between populations
- Identify programs outside the NCDMF that collect data of potential use to the stock assessment of North Carolina's blue crabs

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8 TABLES

Table 1.1. Water quality parameters required by and habitats associated with different life stages of blue crab. No documented data where blank (Funderburk et al.1991; Pattilo et al. 1997; Wannamaker and Rice (2000); NOAA 2001).

Life Stage	Salinity (ppt)	Temperature (C)	DO (mg/l)	Associated Habitats
Adult	0-30	5-39	>3	Entire estuary
Spawning Female	23-28	19-29		Inlet and Ocean
Larvae	>20	16-30		Inlet and Ocean
Juveniles	2-21	16-30		Wetlands, SAV, Shell Bottom, Soft Bottom

Table 1.2. Number of fishermen (excluding crew) that reported landings of blue crabs in North Carolina, associated number of trips, average crew size, and estimated total number of participants (fishermen + crew), 1994–2016.

Year	Number of Fishermen	Number of Trips	Average Crew Size	Total Participants
1994	2,059	121,833		
1995	2,211	125,974		
1996	2,287	123,900		
1997	2,284	132,493		
1998	2,004	143,055		
1999	1,916	124,378	1.40	2,690
2000	1,756	111,213	1.39	2,442
2001	1,787	113,571	1.41	2,526
2002	1,681	93,620	1.47	2,473
2003	1,578	91,730	1.45	2,292
2004	1,489	80,828	1.46	2,169
2005	1,216	64,029	1.43	1,735
2006	1,010	52,886	1.42	1,437
2007	952	53,833	1.46	1,387
2008	914	52,654	1.54	1,409
2009	990	59,313	1.60	1,587
2010	984	54,977	1.52	1,498
2011	925	52,406	1.59	1,472
2012	895	52,696	1.57	1,403
2013	863	52,630	1.55	1,340
2014	923	56,217	1.54	1,425
2015	923	57,603	1.58	1,454
2016	884	51,707	1.61	1,424

Table 1.3. Estimated number of blue crab directed recreational fishing trips compared to estimated total number of recreational fishing trips, and estimated number of blue crabs harvested and discarded by RCGL license holders in North Carolina, 2002–2008.

Year	Number of Trips		Percent of total trips	Harvest	Discards
	Total	Directed			
2002	80,159	28,324	35%	346,550	185,939
2003	55,787	27,907	50%	354,425	124,196
2004	53,488	28,021	52%	329,478	138,316
2005	47,120	26,278	56%	323,531	152,905
2006	43,384	24,401	56%	297,875	123,787
2007	41,617	25,153	60%	286,856	102,695
2008	40,556	24,732	61%	311,690	132,519

Table 1.4. Total effort and catch (in numbers of crabs) estimates based on CAP shellfish mail survey, 2011-2016.

Year	Wave	Total Effort	Total Harvest	Total Release	Total Catch
2011	Jan/Feb	658	2,253	1,287	3,540
	Mar/Apr	1,570	5,472	4,725	10,197
	May/Jun	8,253	36,477	19,310	55,786
	Jul/Aug	7,416	33,159	32,266	65,426
	Sep/Oct	5,333	29,034	20,718	49,752
	Nov/Dec	1,588	8,031	3,457	11,488
	Total	24,818	114,426	81,763	196,189
2012	Jan/Feb	781	1,215	330	1,545
	Mar/Apr	2,196	8,230	5,504	13,734
	May/Jun	7,311	23,564	14,762	38,326
	Jul/Aug	11,262	61,648	40,210	101,858
	Sep/Oct	3,625	19,563	13,405	32,968
	Nov/Dec	1,688	6,759	4,861	11,620
	Total	26,863	120,979	79,072	200,051
2013	Jan/Feb	161	0	0	0
	Mar/Apr	1,784	1,528	1,162	2,690
	May/Jun	6,225	23,150	11,528	34,678
	Jul/Aug	9,555	40,004	20,143	60,147
	Sep/Oct	10,599	25,976	25,872	51,848
	Nov/Dec	2,408	3,516	2,747	6,263
	Total	30,732	94,174	61,452	155,626
2014	Jan/Feb	335	0	0	0
	Mar/Apr	1,222	2,872	2,322	5,195
	May/Jun	8,477	25,749	18,019	43,768
	Jul/Aug	5,584	35,911	23,067	58,978
	Sep/Oct	7,282	35,882	23,975	59,856
	Nov/Dec	481	183	30	213
	Total	23,381	100,597	67,413	168,010
2015	Jan/Feb	760	0	0	0
	Mar/Apr	2,993	4,648	5,897	10,546
	May/Jun	5,182	22,461	14,429	36,890
	Jul/Aug	10,880	31,483	28,123	59,605
	Sep/Oct	5,743	12,309	8,925	21,234
	Nov/Dec	2,405	686	2,761	3,415
	Total	27,963	71,587	60,135	131,690
2016	Jan/Feb	1,218	0	0	0
	Mar/Apr	1,111	4,696	3,351	8,047
	May/Jun	5,192	16,720	18,446	35,166
	Jul/Aug	7,435	21,722	41,521	63,243
	Sep/Oct	7,537	40,047	19,157	59,204
	Nov/Dec	832	1,694	305	1,999
	Total	23,325	84,879	82,780	167,659

Table 1.5. Management measures in N.C. Blue Crab Fishery Management Plan Amendment 2 that may be implemented by proclamation as described in the blue crab adaptive management framework when a stock characteristic exceeds a designated management threshold.

Characteristic	Moderate management level	Elevated management level
Adult abundance	A1. Increase in minimum size limit for male and immature female crabs	A4. Closure of the fishery (season and/or gear)
	A2. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 5%) and/or implement gear modifications to reduce sublegal catch	A5. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 1%) and/or implement gear modifications to reduce sublegal catch
	A3. Eliminate harvest of v-apron immature hard crab females	A6. Time restrictions
Recruit abundance	R1. Establish a seasonal size limit on peeler crabs	R4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas
	R2. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	R5. Expand existing and/or designate new crab spawning sanctuaries
	R3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	R6. Closure of the fishery (season and/or gear)
		R7. Gear modifications in the crab trawl fishery
Production	P1. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	P4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots for specific areas
	P2. Minimum and/or maximum size limit for mature female crabs	P5. Reduce peeler harvest (no white line peelers and/or peeler size limit)
	P3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	P6. Expand existing and/or designate new crab spawning sanctuaries
		P7. Closure of the fishery (season and/or gear)

Table 2.1. Frequency of occurrence, number of samples, CPUE, standard error, minimum number caught in a sample, maximum number caught in a sample, and total number caught by year for all blue crab from Program 120 core stations, 1971-2016.

Year	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crab
1971	100	3	6.00	1.53	3	8	18
1972*	.	.	.	.	.	.	.
1973	61.5	26	2.46	0.92	0	23	64
1974	79.2	24	20.42	6.55	0	120	490
1975	64.1	39	4.69	1.31	0	30	183
1976	66.7	14	15.21	5.37	0	52	213
1977	76.9	13	14.54	8.52	0	113	189
1978	64.4	87	3.09	0.60	0	39	269
1979	71.3	136	3.79	0.41	0	29	516
1980	77.2	145	4.42	0.49	0	34	641
1981	87.0	146	8.92	1.15	0	106	1,302
1982	85.7	154	8.44	1.03	0	102	1,299
1983	83.6	183	7.33	0.91	0	83	1,342
1984	86.6	186	8.64	0.92	0	114	1,607
1985	87.7	195	8.97	0.73	0	70	1,750
1986	74.5	204	5.33	0.67	0	92	1,087
1987	83.0	206	9.38	2.03	0	396	1,933
1988	80.4	209	10.23	1.30	0	124	2,139
1989	70.0	207	4.49	0.64	0	73	930
1990	78.2	206	7.57	0.80	0	64	1,559
1991	70.5	207	5.25	0.56	0	53	1,086
1992	66.3	208	4.36	0.53	0	71	907
1993	71.7	204	7.70	1.25	0	163	1,570
1994	77.6	205	8.12	1.39	0	237	1,665
1995	75.5	208	8.05	0.89	0	92	1,674
1996	83.6	207	13.50	1.37	0	107	2,794
1997	74.9	207	9.29	0.97	0	66	1,922
1998	69.2	208	6.51	0.86	0	115	1,354
1999	79.1	206	10.68	1.16	0	120	2,200
2000	77.9	208	4.40	0.45	0	47	915

Year	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crab
2001	67.3	208	7.55	1.54	0	285	1,571
2002	80.8	208	9.44	1.05	0	107	1,963
2003	70.2	208	5.75	0.74	0	90	1,197
2004	83.7	208	9.98	1.09	0	105	2,076
2005	75.0	208	6.49	0.84	0	122	1,350
2006	69.2	208	6.30	0.80	0	61	1,310
2007	68.8	208	5.52	0.75	0	95	1,149
2008	76.0	208	8.12	0.84	0	79	1,688
2009	65.9	208	7.80	1.52	0	202	1,622
2010	74.0	208	7.80	0.88	0	124	1,622
2011	74.0	208	7.43	0.76	0	78	1,546
2012	73.6	208	8.81	0.97	0	106	1,832
2013	65.4	208	3.58	0.46	0	51	744
2014	59.1	208	3.64	0.61	0	89	758
2015	69.7	208	5.85	0.83	0	126	1,216
2016	61.5	208	3.04	0.37	0	49	632

* No samples from core stations in 1972

Table 2.2. Frequency of occurrence, number of samples, CPUE, standard error, minimum number caught in a sample, maximum number caught in a sample, and total number caught by year for all blue crab from Program 100 core stations, 1972-2016.

Year	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crabs
1972	25.0	12	0.67	0.40	0	4	8
1973	25.0	28	0.39	0.15	0	3	11
1974	46.9	49	4.49	1.92	0	86	220
1975	62.5	24	2.67	0.90	0	16	64
1976	60.0	20	2.05	0.63	0	9	41
1977	66.7	18	1.72	0.46	0	7	31
1978	15.0	60	0.23	0.09	0	4	14
1979	10.8	37	0.16	0.09	0	3	6
1980	2.7	37	0.08	0.08	0	3	3
1981	34.2	38	0.74	0.22	0	6	28
1982	6.9	101	0.07	0.03	0	1	7
1983	11.7	137	0.15	0.04	0	3	21
1984	7.1	126	0.08	0.03	0	2	10
1985	47.6	147	1.04	0.13	0	7	153
1986	70.6	119	6.43	0.99	0	61	765
1987	48.8	162	1.57	0.27	0	22	254
1988	59.3	140	4.44	0.59	0	34	621
1989	43.6	140	2.90	0.70	0	49	406
1990	24.3	140	0.53	0.13	0	13	74
1991	36.4	140	0.73	0.13	0	12	102
1992	47.9	140	1.57	0.28	0	22	220
1993	32.9	140	0.63	0.10	0	6	88
1994	60.7	140	3.37	0.52	0	46	472
1995	81.4	140	5.78	0.79	0	62	809
1996	45.0	140	1.24	0.28	0	34	174
1997	7.9	140	0.11	0.04	0	4	15
1998	40.0	140	3.46	2.19	0	305	484
1999	58.6	140	4.89	1.37	0	180	684
2000	40.7	140	1.71	0.30	0	21	240
2001	25.0	140	0.46	0.09	0	9	65
2002	72.9	140	4.47	0.74	0	85	626
2003	68.6	140	6.71	0.89	0	51	940
2004	31.4	140	0.76	0.15	0	13	107
2005	62.5	128	2.23	0.32	0	25	286
2006	77.1	140	4.76	0.57	0	45	667
2007	74.3	140	4.34	0.59	0	51	607
2008	92.9	140	25.66	3.75	0	346	3593

Year	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crabs
2009	96.4	140	20.04	1.99	0	173	2806
2010	97.1	140	24.29	2.35	0	157	3401
2011	79.3	140	10.09	1.23	0	64	1413
2012	84.3	140	10.56	2.64	0	352	1479
2013	76.4	140	4.21	0.70	0	65	589
2014	55.0	140	3.67	0.64	0	40	514
2015	93.6	140	19.29	3.10	0	294	2700
2016	85.7	140	11.68	1.27	0	96	1635

Table 2.3. Number of sample grids per strata used as weighting factors for catch-per-unit-effort calculations for Program 195.

Strata	Strata Abbreviation	Number of Grids
Neuse River	NR	93
Pamlico River	PR	64
Pungo River	PUR	18
Pamlico Sound Deep East	PDE	554
Pamlico Sound Shallow East	PSE	206
Pamlico Sound Deep West	PDW	312
Pamlico Sound Shallow West	PSW	135

Table 2.4. Frequency of occurrence, number of samples, weighted CPUE, standard error, minimum number caught in a sample, maximum number caught in a sample, and total number caught by year for all blue crabs from Program 195, 1987 – 2016.

Year	Percent Frequency of Occurrence	Total Number of Samples	Weighted CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crabs
1987	92.7	96	68.83	12.33	0	769	6,806
1988	92.6	95	33.42	5.39	0	323	3,316
1989	90.0	90	45.13	8.52	0	551	3,890
1990	100	105	155.64	26.86	1	1,706	15,475
1991	86.8	106	138.04	21.07	0	1,521	14,967
1992	94.3	105	63.39	9.79	0	557	6,448
1993	97.2	107	62.27	9.72	0	508	6,416
1994	93.1	102	53.54	6.34	0	394	5,359
1995	100	105	31.70	4.16	1	193	3,607
1996	97.1	105	63.41	8.58	0	401	6,589
1997	96.2	106	71.39	10.21	0	430	7,467
1998	93.4	106	55.82	11.96	0	1,052	6,027
1999	93.4	106	76.24	8.28	0	374	8,207
2000	93.4	106	28.93	3.69	0	451	3,598
2001	69.8	106	31.25	5.95	0	277	3,111
2002	81.0	105	49.73	8.08	0	387	5,528
2003	85.8	106	56.51	12.25	0	800	5,817
2004	84.1	107	52.22	10.62	0	682	7,208
2005	88.5	104	27.05	3.78	0	217	3,213
2006	73.1	108	18.03	3.14	0	575	3,007
2007	77.1	105	12.54	2.73	0	156	1,590
2008	72.2	108	20.13	4.12	0	229	2,508
2009	66.7	108	6.53	1.45	0	152	952
2010	82.4	108	58.69	11.62	0	732	6,831
2011	76.9	108	15.72	4.15	0	337	2,557
2012	73.1	108	17.09	3.02	0	269	2,128
2013	72.2	108	25.04	5.17	0	334	2,578
2014	68.5	108	11.09	1.82	0	106	1,215
2015	66.7	108	9.16	2.64	0	515	1,656
2016	82.4	108	17.19	2.75	0	526	2,807

Table 2.5. Frequency of occurrence, number of samples, CPUE, standard error, minimum number caught in a sample, maximum number caught in a sample, and total number caught by year for all blue crabs from the SEAMAP Coastal Survey by season, 1989 – 2016.

	Spring							Summer							Fall						
Year	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crab	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crab	Percent Frequency of Occurrence	Total Number of Samples	CPUE	Standard Error	Minimum Number per Sample	Maximum Number per Sample	Total Number of Blue Crab
1989	0.0	13	0	.	.	.	0	46.2	13	2.38	0.78	0	7	31	61.5	13	2.23	0.66	0	7	29
1990	11.1	18	0.11	0.07	0	1	2	94.4	18	22.78	7.11	0	99	410	82.4	17	6.00	3.90	0	70	102
1991	22.2	18	0.22	0.10	0	1	4	61.1	18	4.00	2.45	0	46	72	29.4	17	0.82	0.57	0	10	14
1992	5.6	18	0.44	0.43	0	8	8	50.0	18	3.06	1.38	0	22	55	44.4	18	1.17	0.43	0	7	21
1993	11.1	18	0.17	0.12	0	2	3	61.1	18	16.72	6.14	0	83	301	33.3	18	1.89	1.02	0	18	34
1994	11.1	18	0.28	0.22	0	4	5	66.7	18	5.17	2.23	0	39	93	38.9	18	1.06	0.43	0	7	19
1995	0.0	18	0	.	.	.	0	50.0	18	4.50	1.87	0	32	81	11.1	18	0.11	0.07	0	1	2
1996	5.6	18	0.11	0.11	0	2	2	77.8	18	17.94	6.76	0	118	323	33.3	18	0.50	0.23	0	4	9
1997	22.2	18	0.33	0.16	0	2	6	50.0	18	2.06	0.71	0	10	37	5.6	18	0.22	0.22	0	4	4
1998	11.1	18	0.11	0.07	0	1	2	66.7	18	7.83	2.92	0	46	141	16.7	18	0.67	0.54	0	10	12
1999	5.6	18	0.06	0.05	0	1	1	38.9	18	1.00	0.36	0	5	18	38.9	18	2.39	1.27	0	23	43
2000	0.0	18	0	.	.	.	0	66.7	18	2.83	0.95	0	17	51	5.6	18	0.06	0.05	0	1	1
2001	6.5	31	0.10	0.07	0	2	3	54.8	31	8.52	4.73	0	145	264	29.0	31	0.58	0.24	0	6	18
2002	6.7	30	0.20	0.14	0	3	6	56.7	30	1.73	0.59	0	17	52	13.3	30	0.23	0.12	0	3	7
2003	6.7	30	0.23	0.20	0	6	7	43.3	30	1.97	0.57	0	11	59	46.7	30	0.77	0.19	0	4	23
2004	6.1	33	0.67	0.47	0	14	22	66.7	33	18.45	6.42	0	197	609	24.2	33	2.55	1.25	0	38	84
2005	12.1	33	0.21	0.13	0	4	7	39.4	33	3.97	1.28	0	31	131	9.1	33	0.12	0.07	0	2	4
2006	0.0	30	0	.	.	.	0	48.3	29	4.66	1.20	0	21	135	20.0	30	1.67	0.77	0	16	50
2007	0.0	28	0	.	.	.	0	25.0	28	1.54	0.87	0	21	43	0.0	28	0	.	.	.	0
2008	0.0	27	0	.	.	.	0	14.8	27	0.26	0.15	0	4	7	11.1	27	0.56	0.31	0	6	15
2009	0.0	30	0	.	.	.	0	36.7	30	2.23	1.36	0	41	67	3.3	30	0.03	0.03	0	1	1
2010	9.7	31	0.13	0.08	0	2	4	32.3	31	0.97	0.36	0	10	30	9.7	31	0.10	0.05	0	1	3
2011	36.4	33	1.06	0.57	0	19	35	30.3	33	1.82	0.66	0	17	60	33.3	33	0.76	0.24	0	5	25
2012	45.5	33	1.76	0.68	0	21	58	36.4	33	1.00	0.34	0	9	33	12.1	33	0.15	0.08	0	2	5
2013	21.1	19	0.21	0.09	0	1	4	40.0	30	1.13	0.34	0	7	34	23.3	30	0.50	0.20	0	4	15
2014	12.9	31	0.13	0.06	0	1	4	29.0	31	2.23	0.79	0	20	69	12.9	31	0.13	0.06	0	1	4
2015	3.2	31	0.03	0.03	0	1	1	23.5	34	1.74	0.74	0	16	59	9.7	31	0.52	0.34	0	9	16
2016	5.9	34	0.06	0.04	0	1	2	29.4	34	1.06	0.39	0	9	36	17.6	34	1.15	0.51	0	13	39

Table 3.1. Parameters and priors. U denotes uniform distribution.

Parameters	Values	Reference
Input parameters		
Sex ratio	1:1	
Selectivity for fully recruited	$g_{N,\,s}$ =1	Rudershausen and Hightower 2016
Proportion of mature females	w_N =0.9; w_R =0.044	Eggleston et al. 2004
Natural mortality (Model 3)	M=0.55	Eggleston et al. 2004
Priors		
Initial population size (10^6)	$N_{y=1997,\,s=male}$ ~ U(58, 5800) $N_{y=1997,\,s=female}$ ~ U(58, 5800)	Derived from catch data in initial year (1995)[a]
Average recruitment (10^6)	$\bar{R}$ ~ U(10, 1000)	Derived from catch data[b]
Initial recruitment (10^6; Model 4)	$R_{y=1997}$ ~ U(10, 1000)	
Natural mortality (yr^{-1})	$\bar{M}$ ~ U(0.5, 2)	Miller et al. 2011; Murphy et al. 2007
Fishing mortality (yr^{-1})	F_y ~ U(0.001, 3)	Eggleston et al. 2004
Selectivity for recruits	$g_{R,\,s}$ ~ U(0, 0.6)	Rudershausen and Hightower 2016
Ricker productivity parameter (#offspring per spawner; Model 4)	α ~ U(1, 15)	Eggleston et al. 2004; VanderKooy 2013
Ricker density-dependence parameter (Model 4)	β = 0.005	Eggleston et al. 2004; VanderKooy 2013
Standard deviation of process errors	σ_N, σ_R ~ U(0.001, 10)	
Standard deviation of observation errors	$\sigma_{CN,\,s}$, $\sigma_{CR,s}$ ~ U(0.001, 10) $\sigma_{sp,\,j}$, $\sigma_{IN,\,s,\,j}$, $\sigma_{IR,\,s,\,j}$ ~ U(0.001, 10)	
Standard deviation of natural mortality error	σ_{MM}, σ_M ~ U(0.001, 1)	

Table 3.2. Priors for catchability (q; 10^{-6}). U denotes uniform distribution. Derived from catch and abundance index data by assuming catch is the lower bound for population size and 100 x catch is the upper bound. Set minimum index /(100 x maximum catch) as lower bound, and maximum index /minimum catch as upper bound.

Abundance index	Priors
P120 male recruits	U(0.0001, 4)
P195 male recruits June	U(0.0001, 58)
P195 male recruits September	U(0.0001, 13)
P120 female recruits	U(0.0001, 8)
P195 female recruits June	U(0.0001, 202)
P195 female recruits September	U(0.0001, 32)
P100 male fully recruited summer	U(0.0001, 0.5)
P100 male fully recruited fall	U(0.0001, 0.5)
P195 male fully recruited June	U(0.0001, 0.5)
P195 male fully recruited September	U(0.0001, 0.5)
P100 female fully recruited summer	U(0.0001, 0.1)
P100 female fully recruited fall	U(0.0001, 1)
P195 female fully recruited June	U(0.0001, 1)
P195 female fully recruited September	U(0.0001, 0.5)
P195 spawner	U(0.0001, 1)
SEAMAP spawner	U(0.0001, 1.5)

Table 3.3. Candidate models.

Model	Features
Model 1 (baseline)	Sex- and stage-specific natural mortality Recruitment free parameter to estimate (lognormal distribution) Time-constant catchability All abundance indices Initial year when catch data start (1995) Sex-specific recruits selectivity to estimate
Model 2	Same as Model 1 except a constant natural mortality to estimate
Model 3	Same as Model 1 except a constant natural mortality to input
Model 4	Same as Model 1 except recruitment follows a Ricker model

9 FIGURES

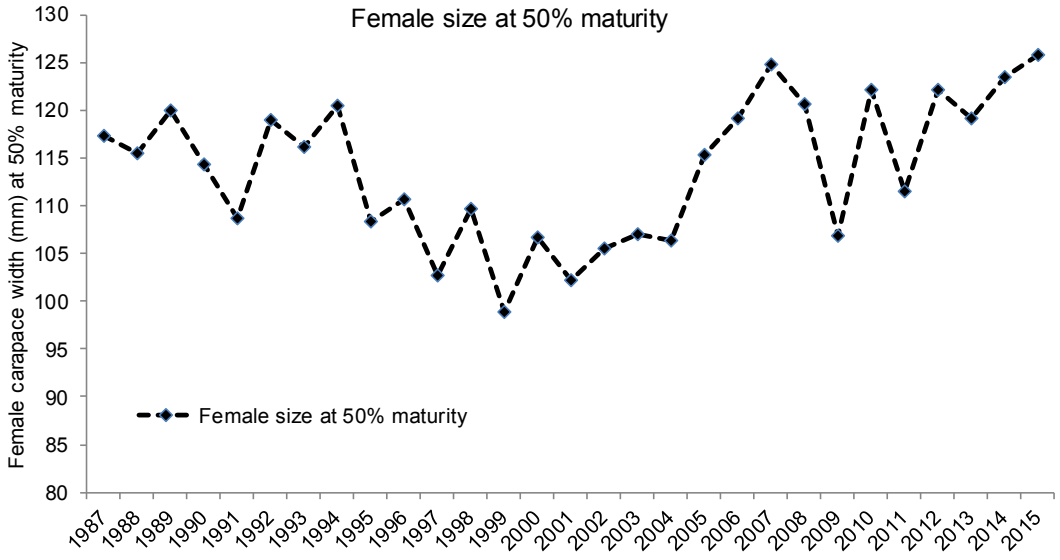

Figure 1.1. Annual carapace width at 50% maturity for female blue crabs collected in several NCDMF sampling programs and North Carolina water bodies, 1987-2015.

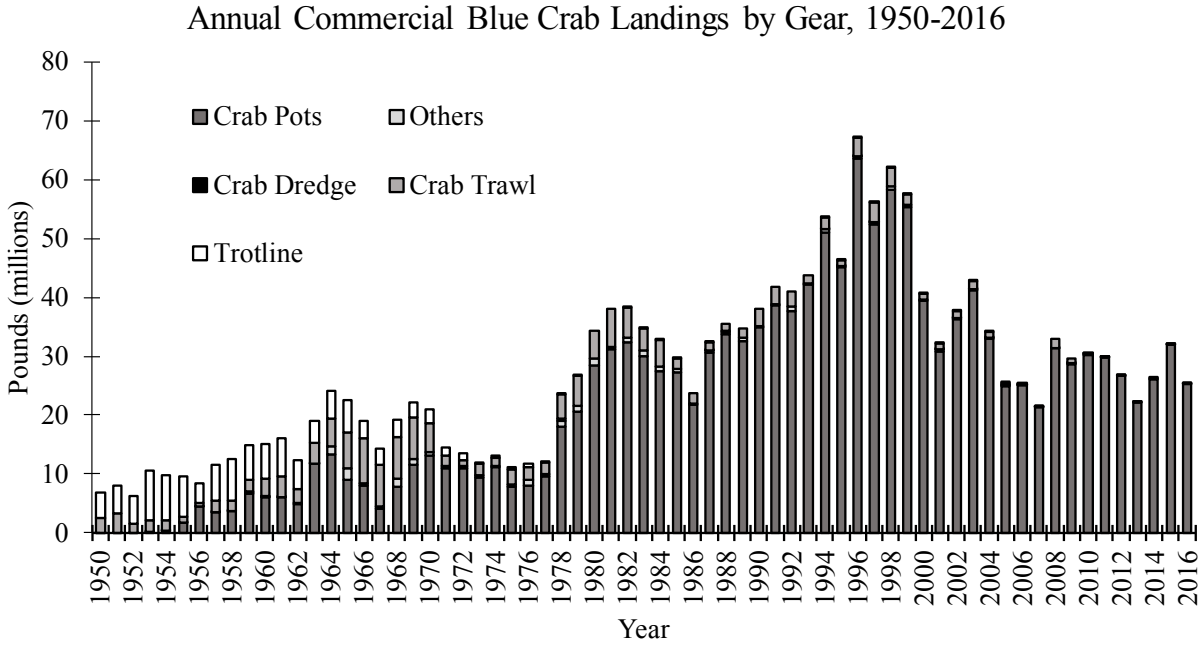

Figure 1.2. Annual commercial fishery landings of blue crabs in North Carolina, by major gear, 1950–2016.

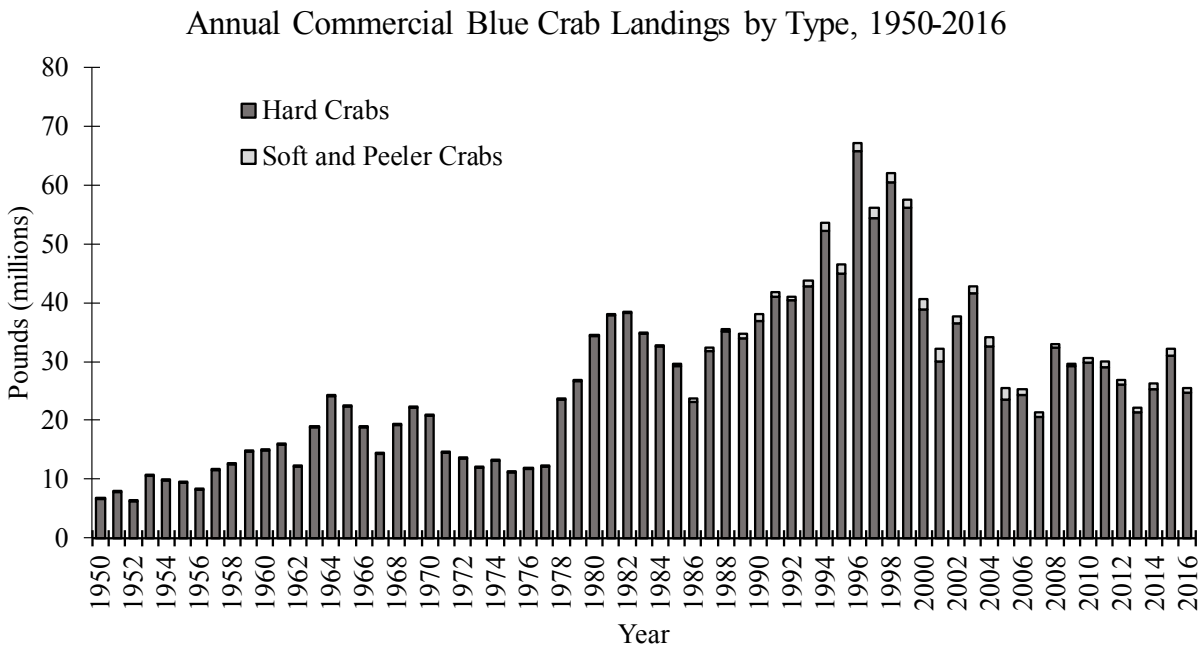

Figure 1.3. Annual commercial fishery landings of blue crabs in North Carolina, by crab type, 1950–2016.

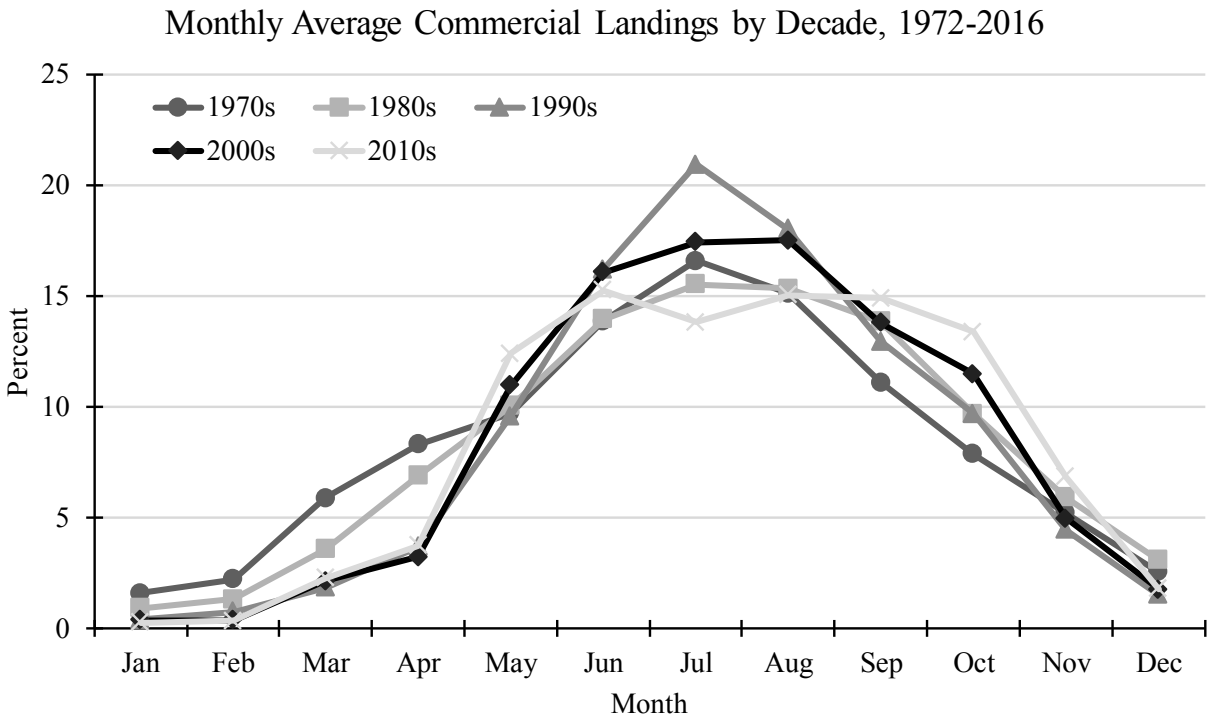

Figure 1.4. Average percent of blue crab commercial landings among months, by decade, 1972–2016.

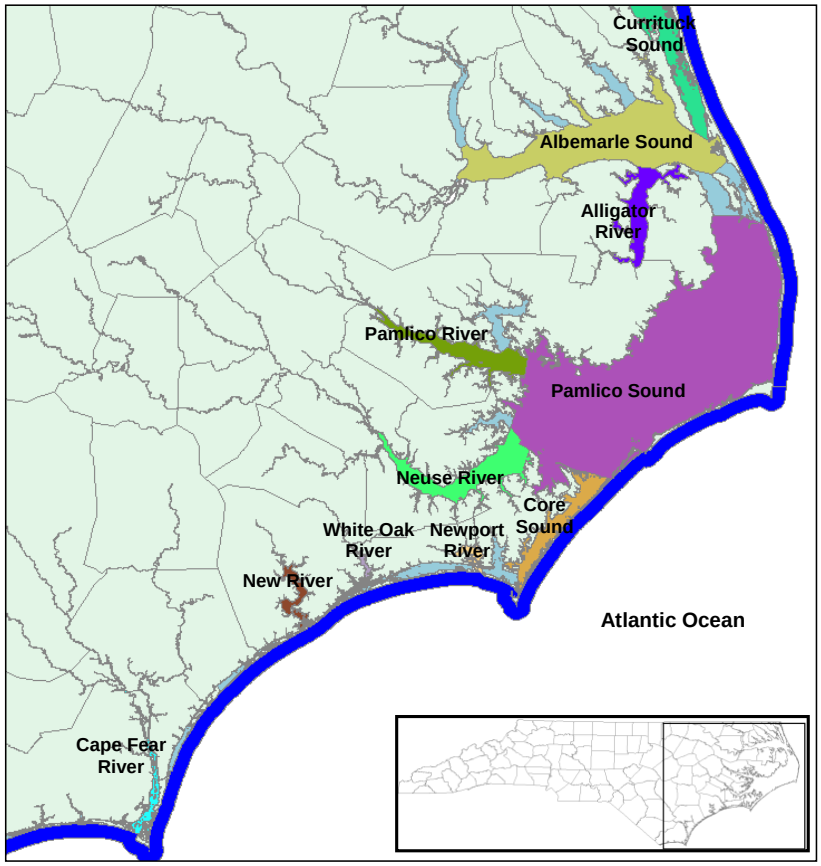

Figure 1.5. Major water bodies within and around North Carolina. The dark blue area represents the extent of the state's coastal fishing waters, which extend to three miles offshore.

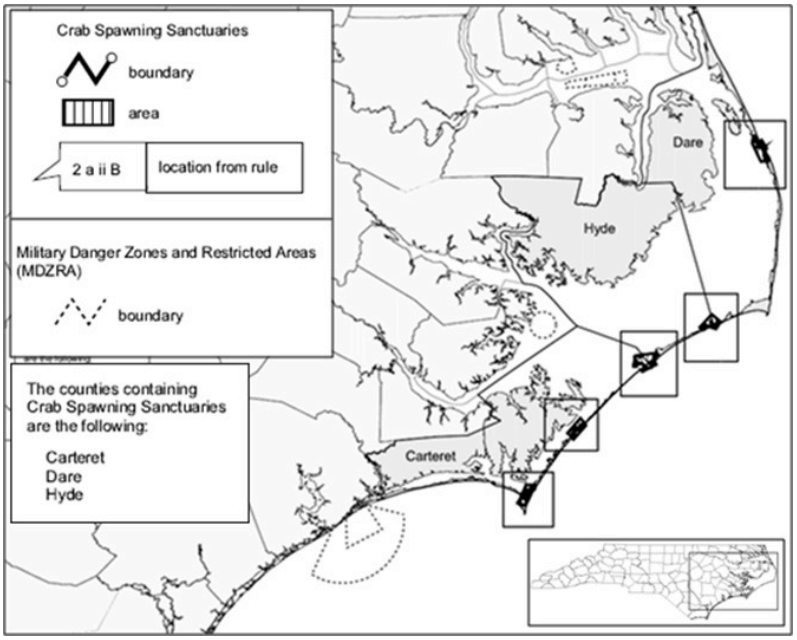

Figure 1.6. General location of blue crab spawning sanctuary areas for the protection of mature female crabs (NCMFC rules 15 NCAC 03L .0205 and 03R .0110).

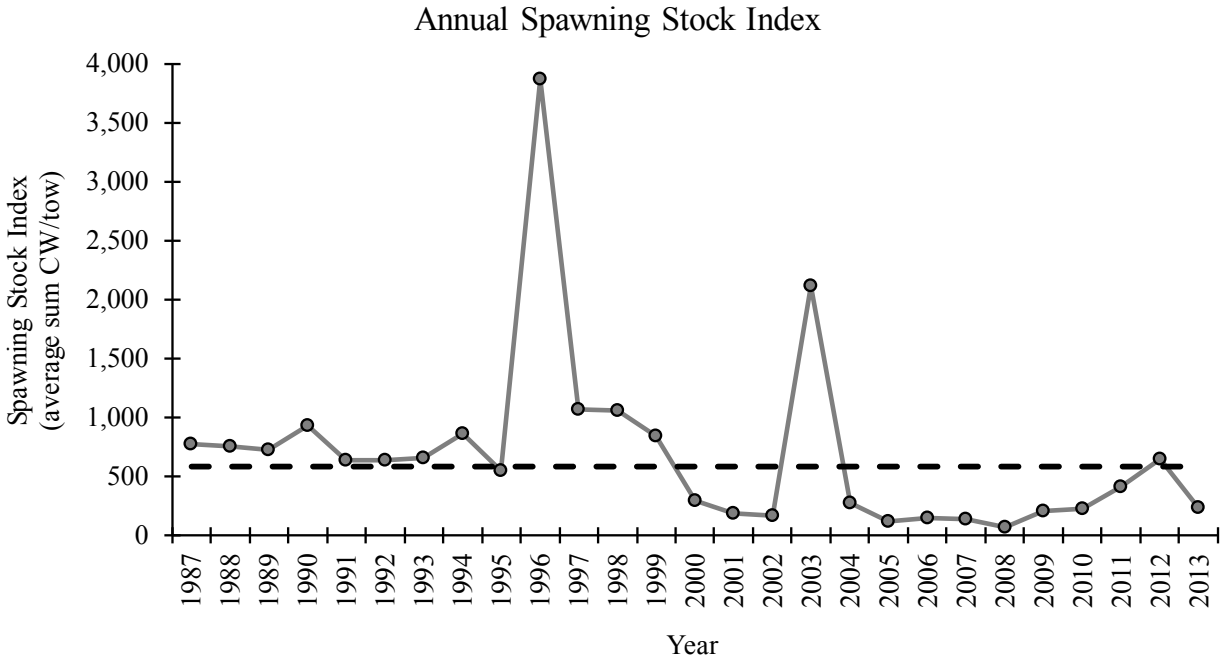

Figure 1.7. Spawning stock index adopted as the management trigger in the 2004 amendment to the North Carolina Blue Crab FMP, 1987-2013. The dashed line represents the lower 90% confidence limit of the reference baseline average (1987–2003). When the spawning stock index falls below this line for two consecutive years, the NCDMF had the proclamation authority to implement spawning stock protection measures.

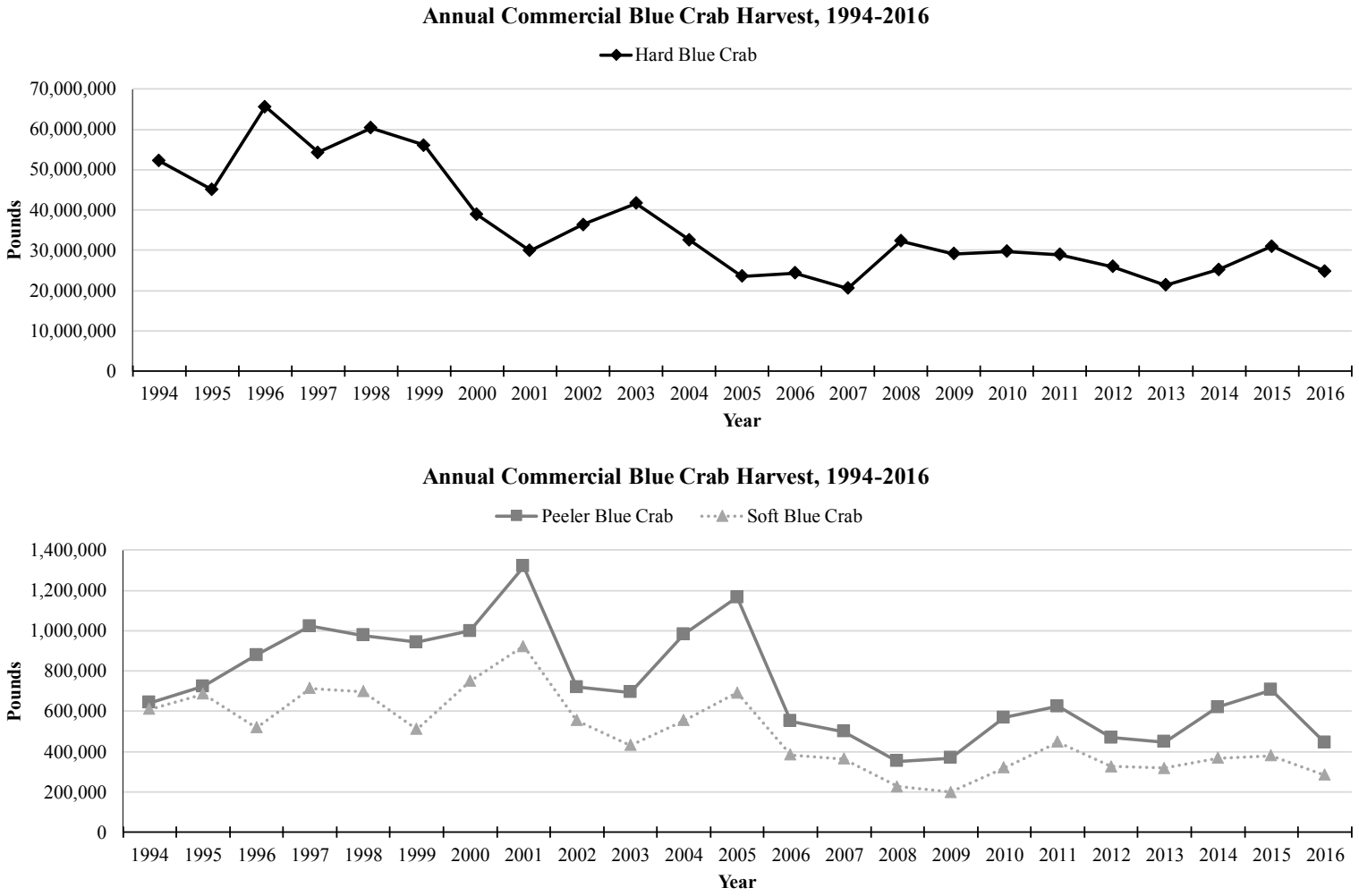

Figure 2.1. Commercial hard, peeler and soft blue crab landings, 1994–2016.

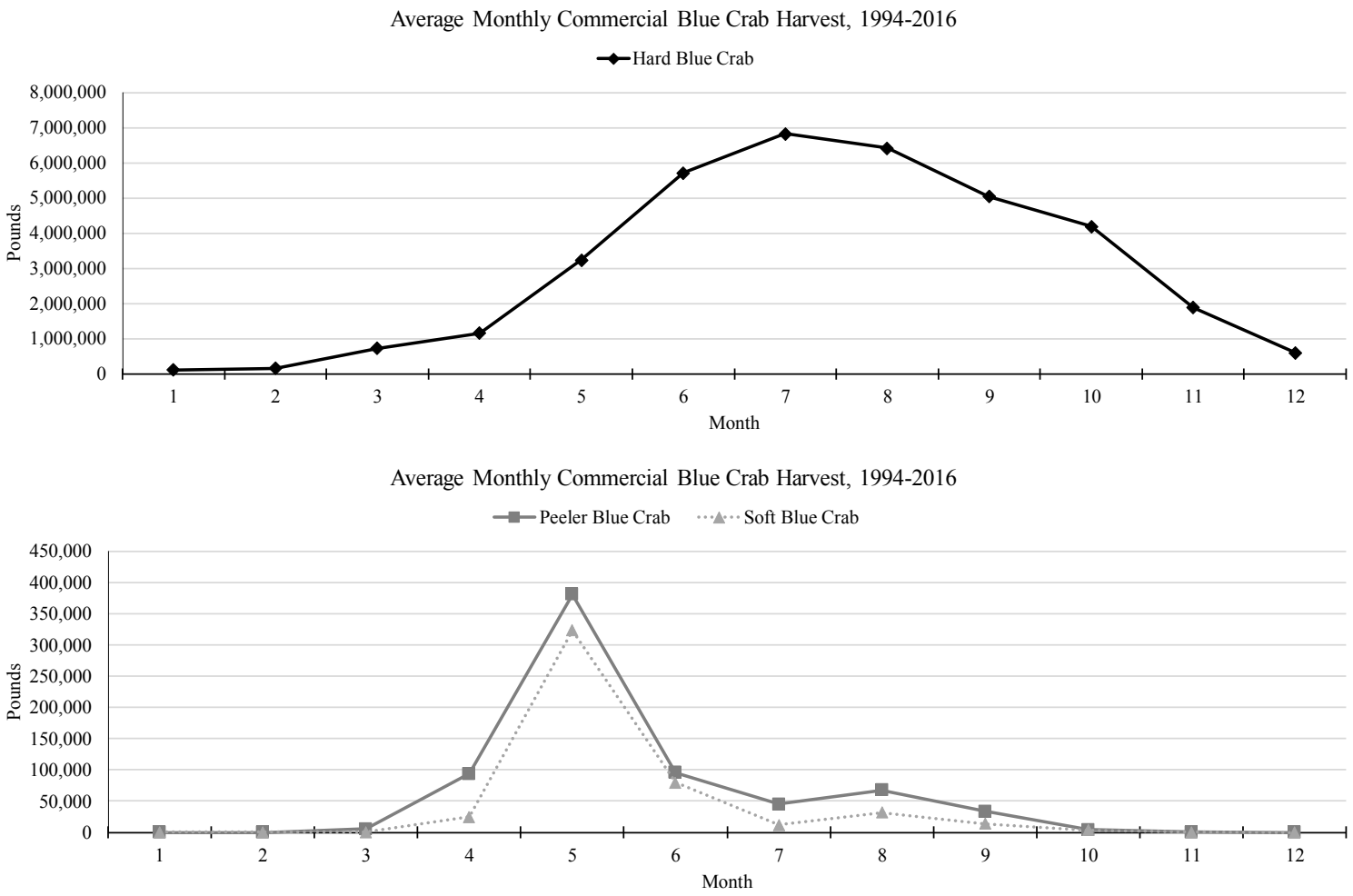

Figure 2.2. Average annual commercial landings of blue crab by type and by month, 1994-2016.

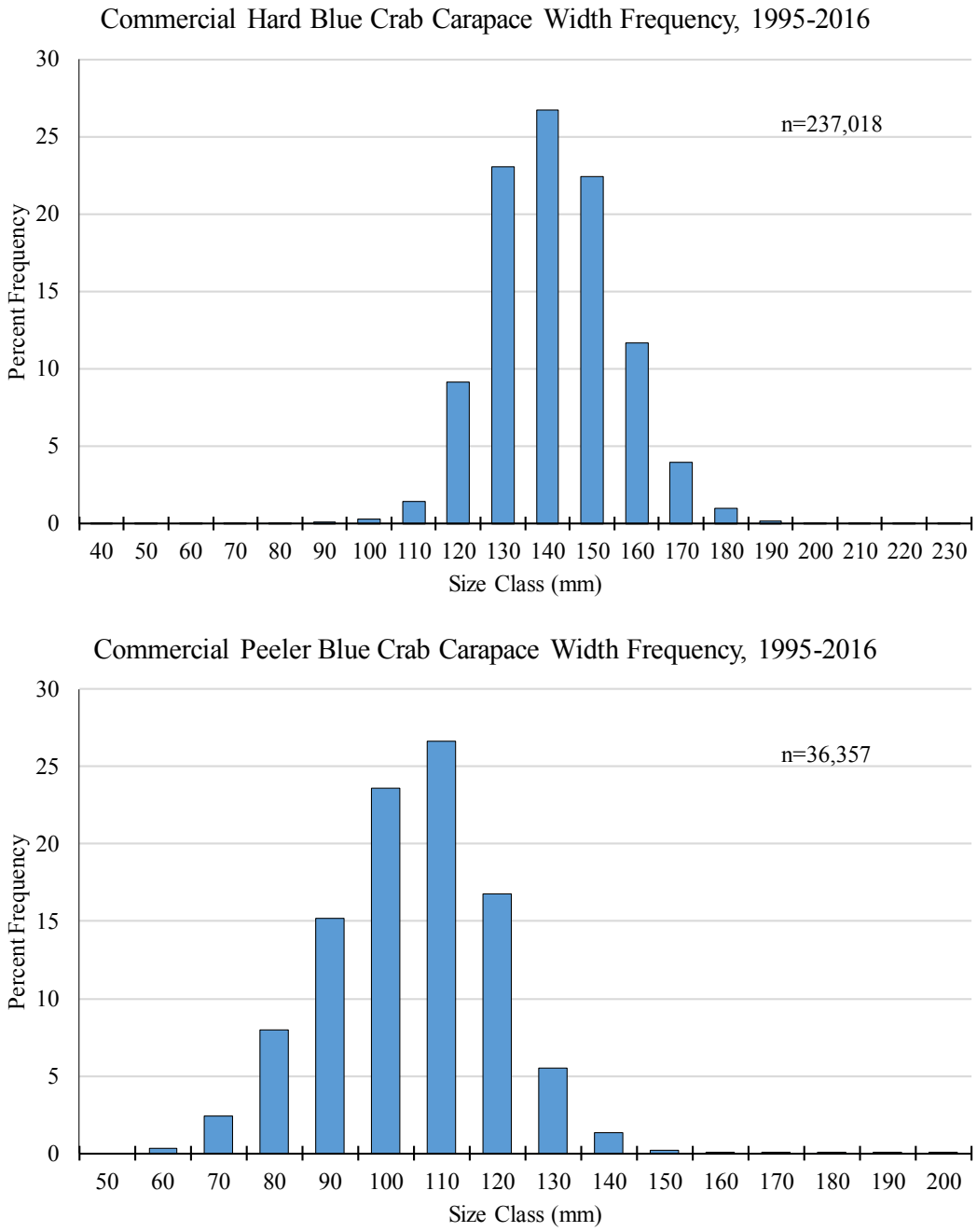

Figure 2.3. Carapace width frequency (10 mm bins) of hard and peeler blue crabs landed by commercial fisheries in North Carolina, 1995-2016. Note: no measurements taken for soft blue crabs.

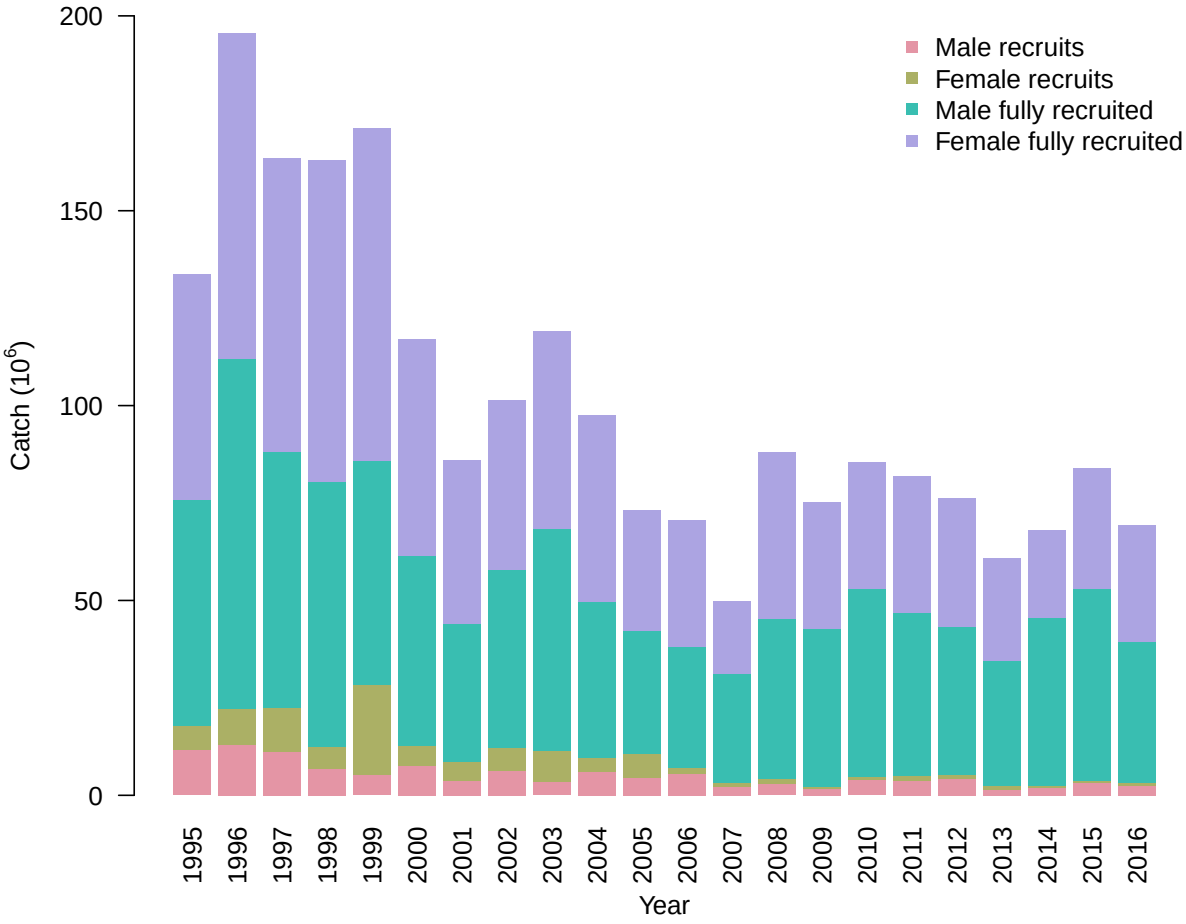

Figure 2.4. Commercial catch data of North Carolina blue crab by sex and stage (< 127 mm CW as recruits and ≥ 127 mm CW as fully recruited crabs) during 1995-2016.

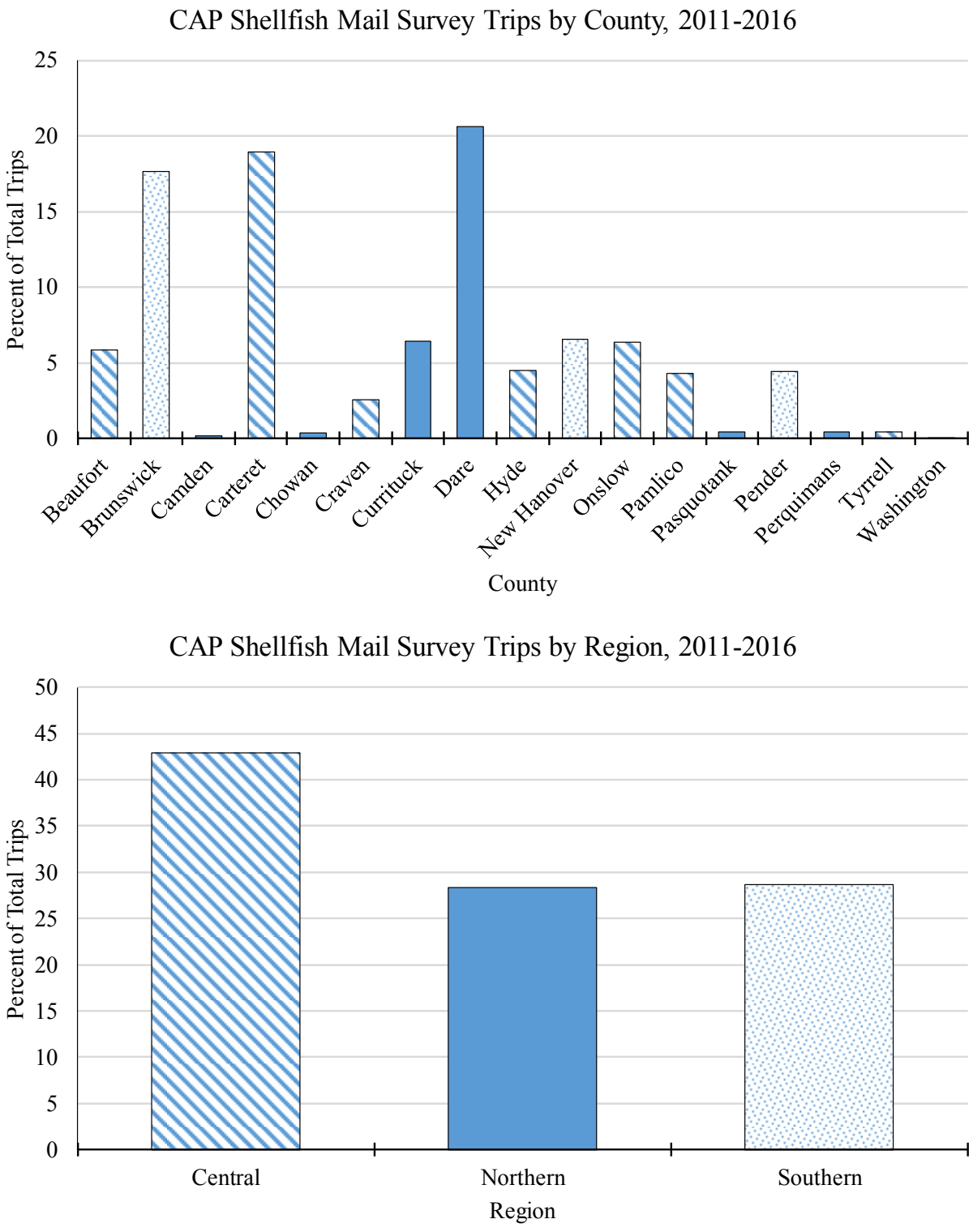

Figure 2.5. Percent crab trips by county and region from CAP shellfish mail survey, 2011-2016.

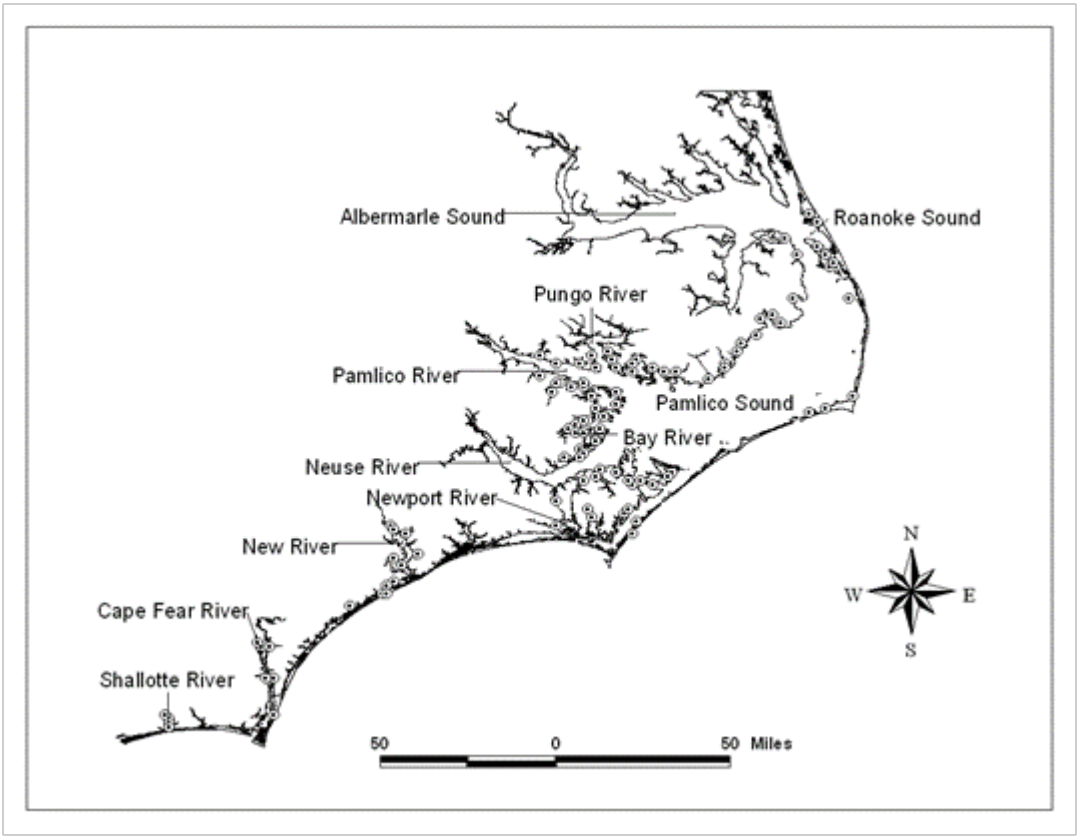

Figure 2.6. Location of all core sample stations in Program 120.

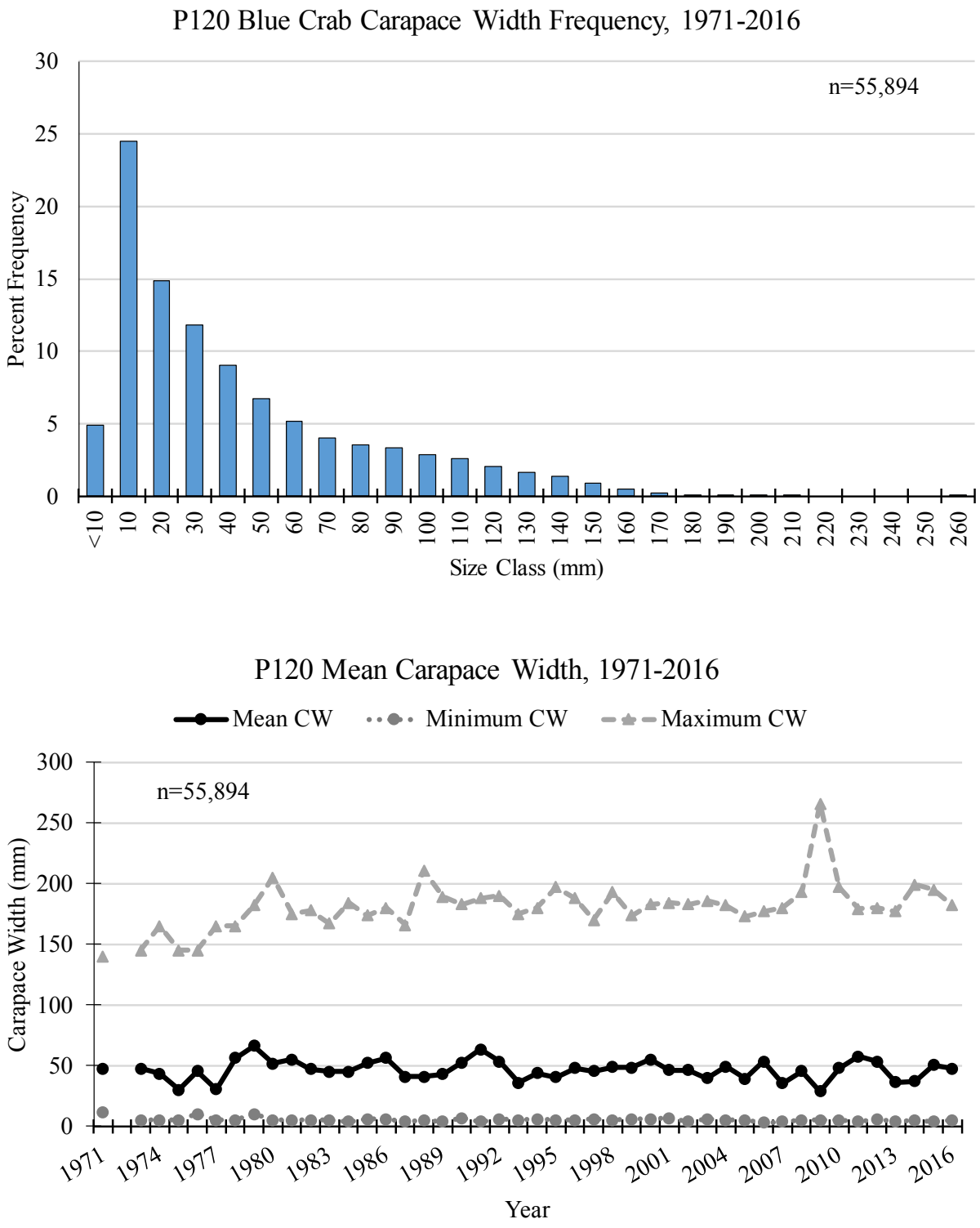

Figure 2.7. Carapace width frequency (10 mm bins), annual mean, minimum, and maximum carapace width (mm) of all blue crab captured in Program 120 core stations in May and June, 1971 – 2016.

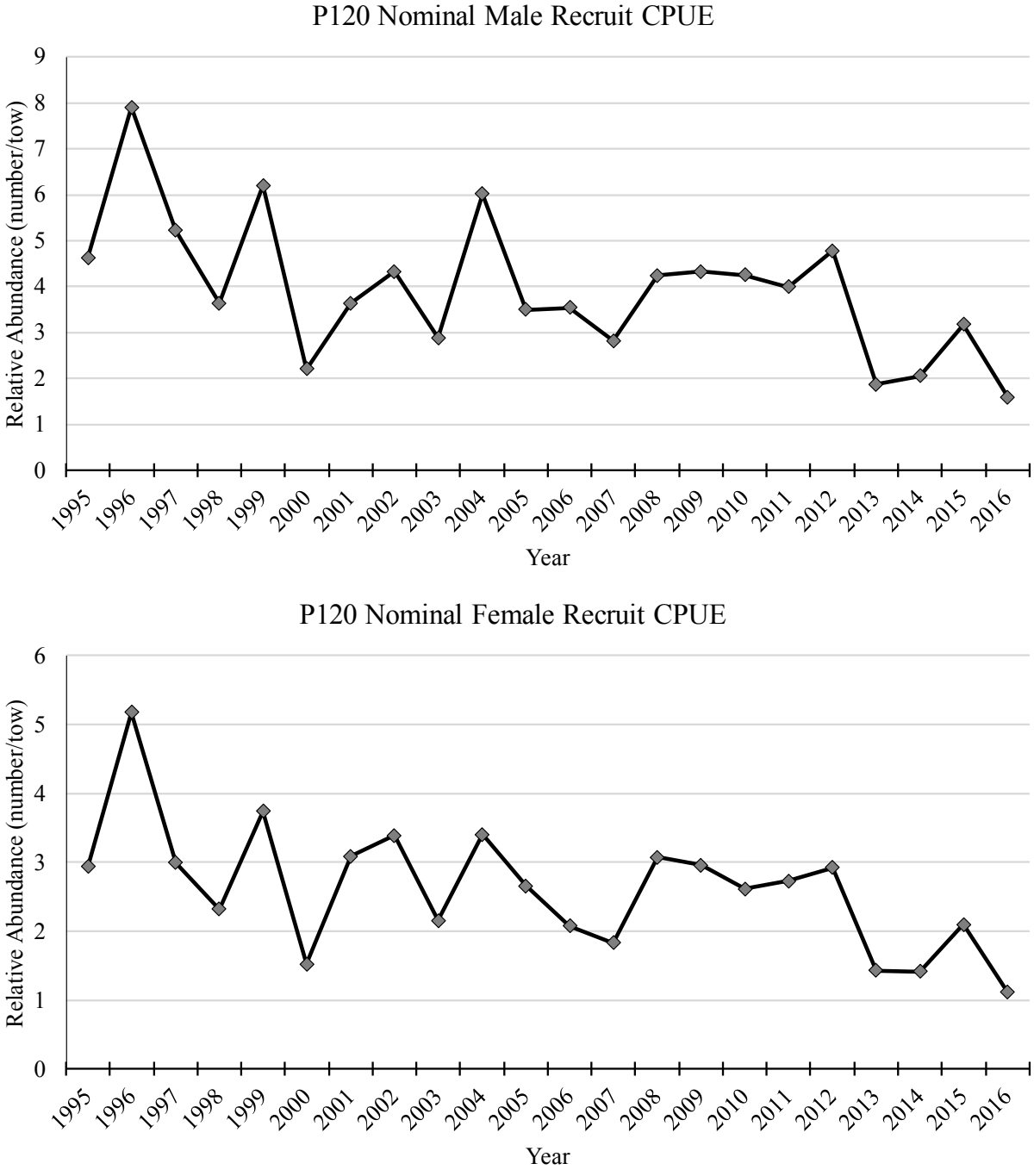

Figure 2.8. Annual nominal catch-per-unit effort (CPUE; number of crab per sample) of recruit (<127 mm CW) blue crabs captured in Program 120 in May and June by sex, 1995 – 2016.

Figure 2.9. Annual standardized catch-per-unit effort (CPUE; number of crab per sample) of recruit (<127 mm CW) blue crabs captured in Program 120 in May and June by sex, 1995 – 2016.

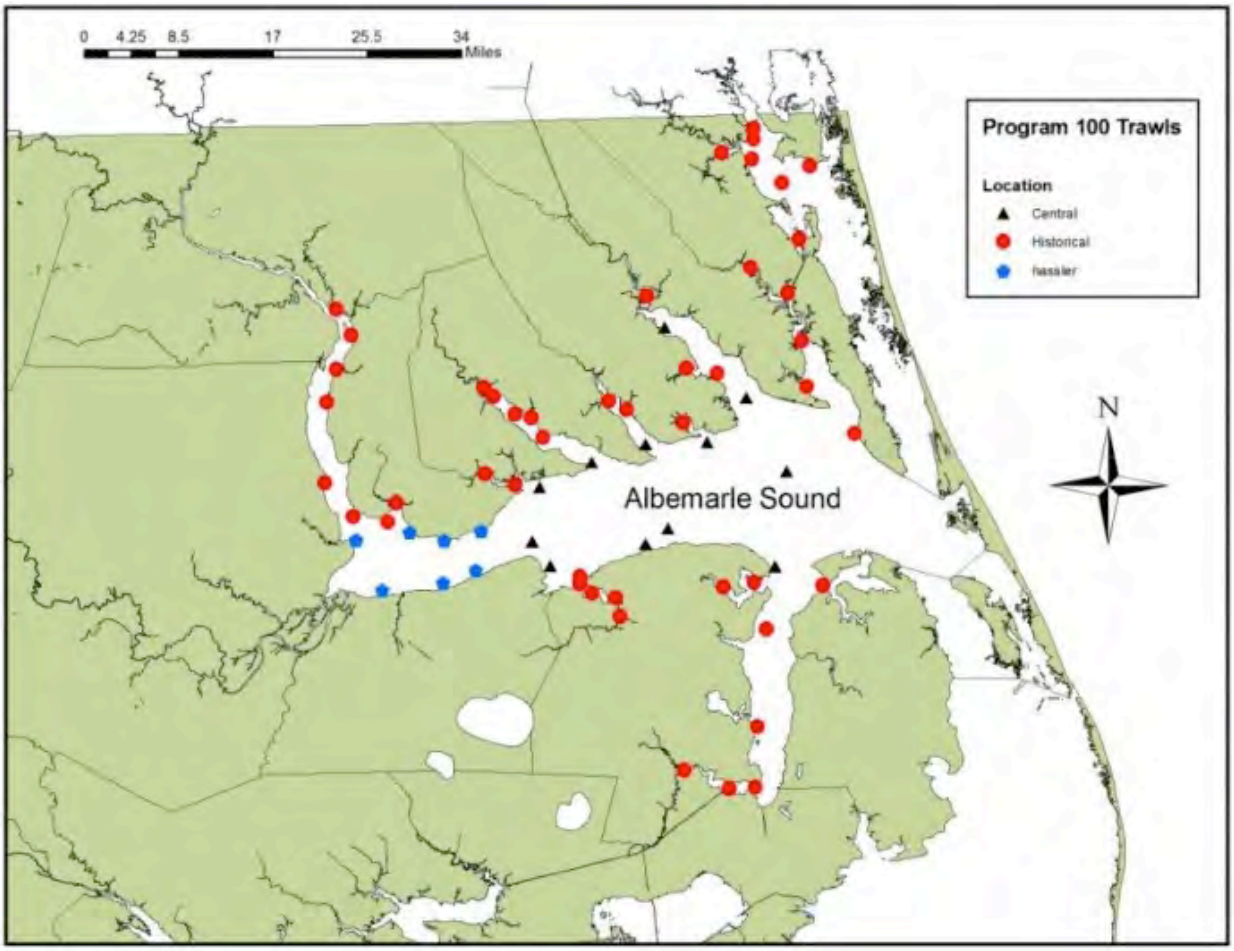

Figure 2.10. Location of all trawl stations in Program 100 by type.

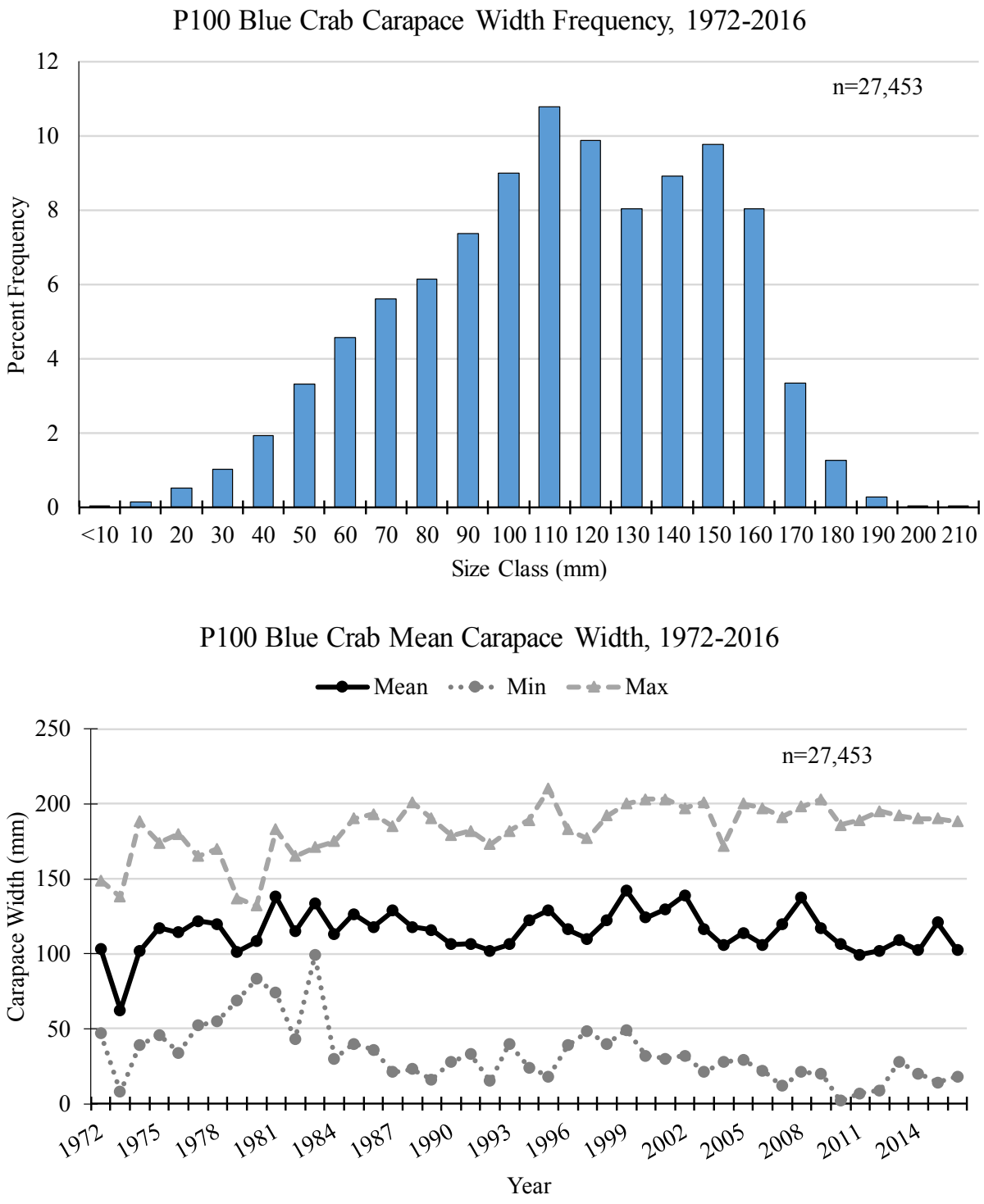

Figure 2.11. Carapace width frequency (10 mm bins), annual mean, minimum, and maximum carapace width (mm) of all blue crabs captured in Program 100 trawl stations, 1972 – 2016.

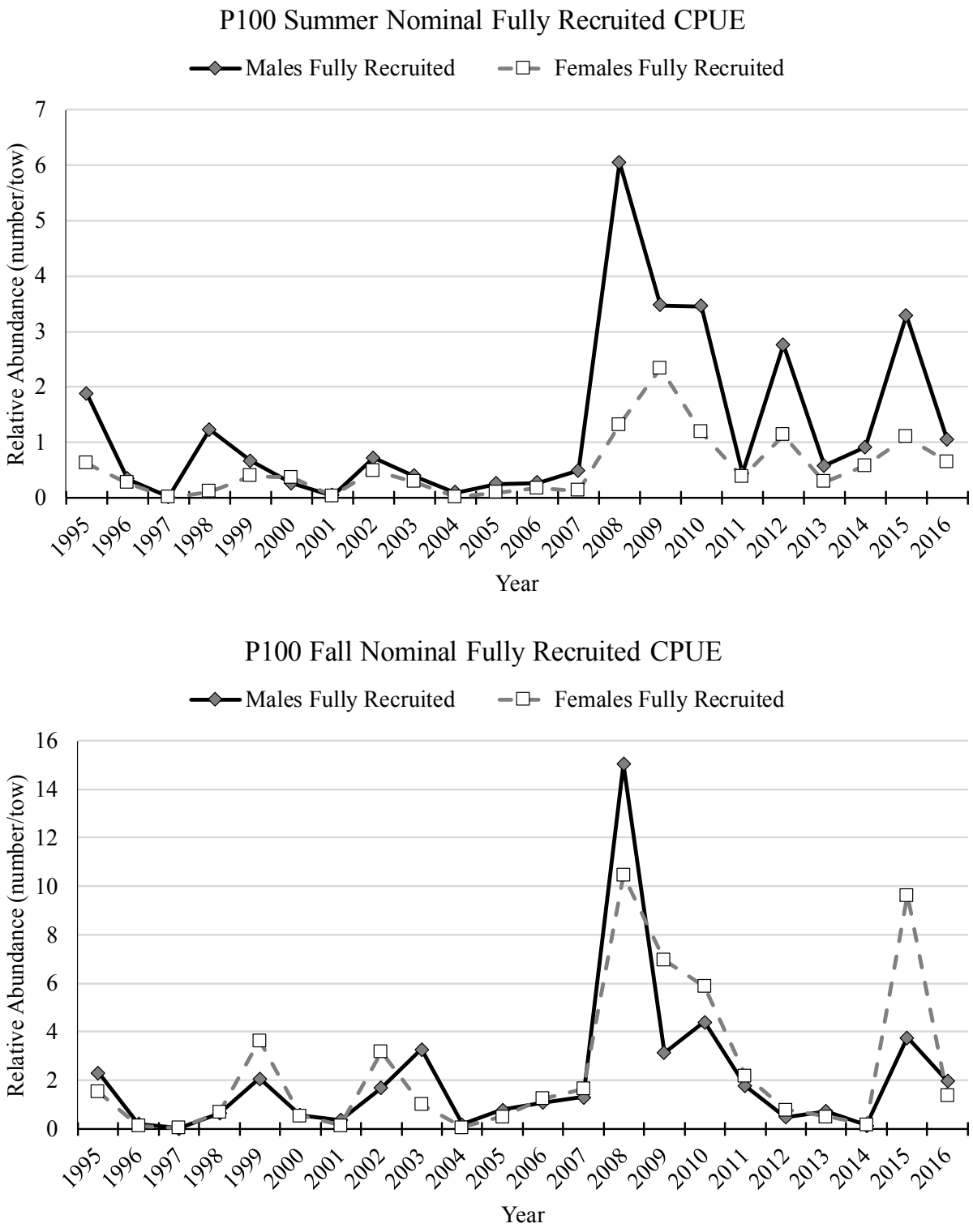

Figure 2.12. Nominal catch-per-unit effort (CPUE; number of crabs per sample) of fully recruited crabs (≥127 mm CW) captured in Program 100 by season and sex, 1995 – 2016.

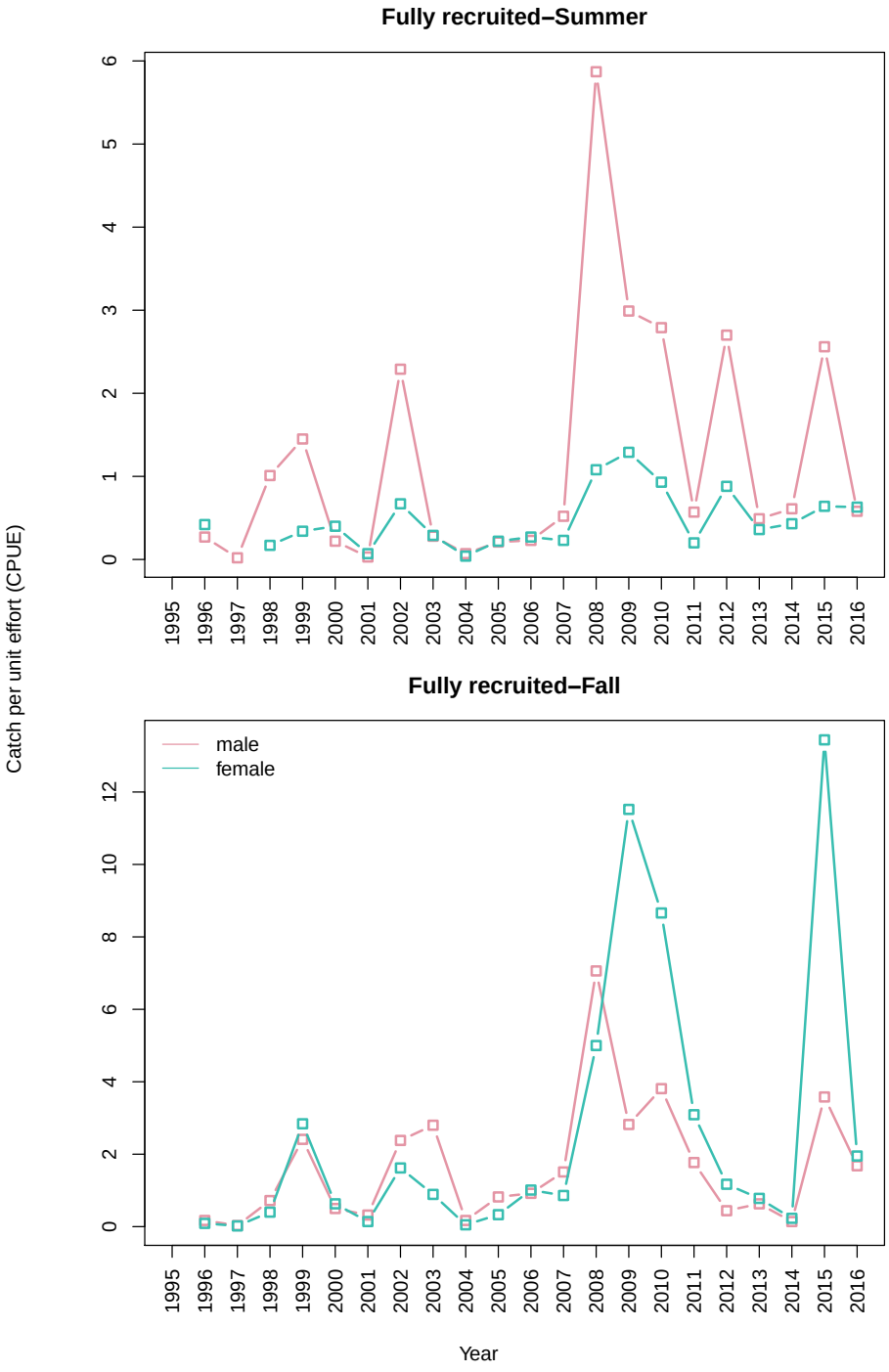

Figure 2.13. Annual standardized catch-per-unit effort (CPUE; number of crabs per sample) of fully recruited crabs (≥127 mm CW) captured in Program 100 by season and sex, 1995 – 2016. Estimated standardized CPUE for female summer indices in 1997 was removed due to large estimated variation.

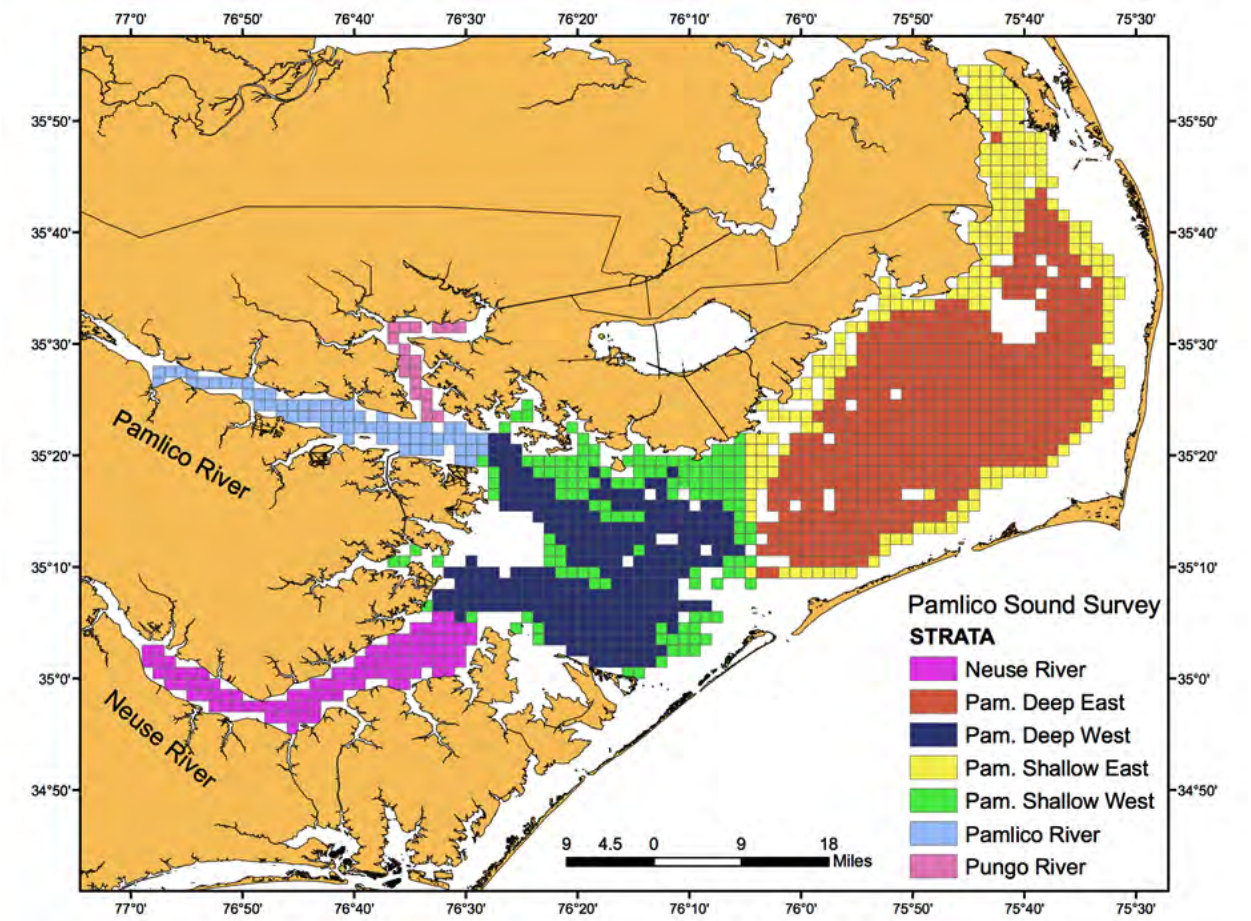

Figure 2.14. Location of all potential sample grids by stratum for the Pamlico Sound Survey (Program 195).

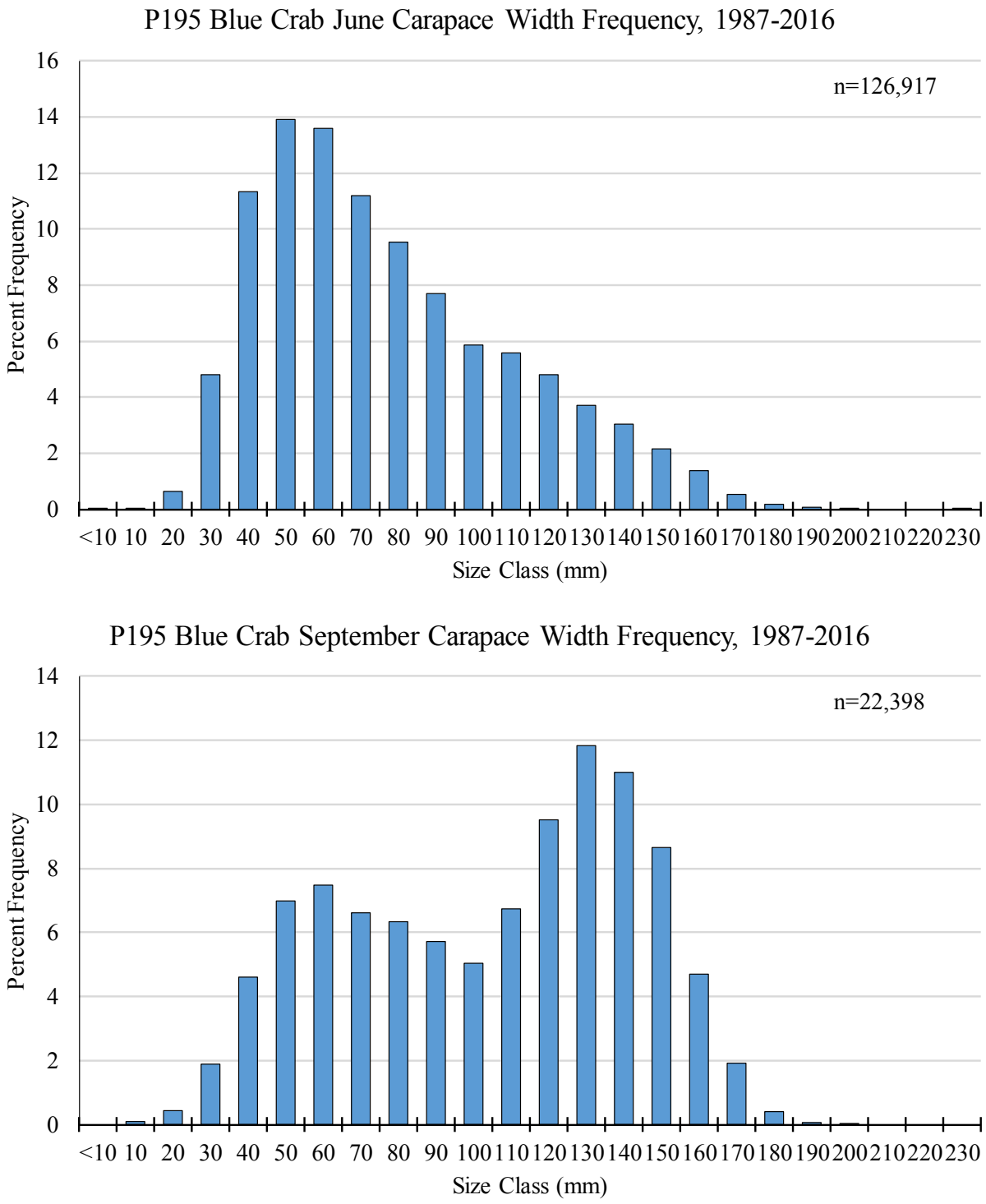

Figure 2.15. Carapace width frequency (10 mm bins) of blue crab captured in program 195 by month, 1987 – 2016 all strata combined.

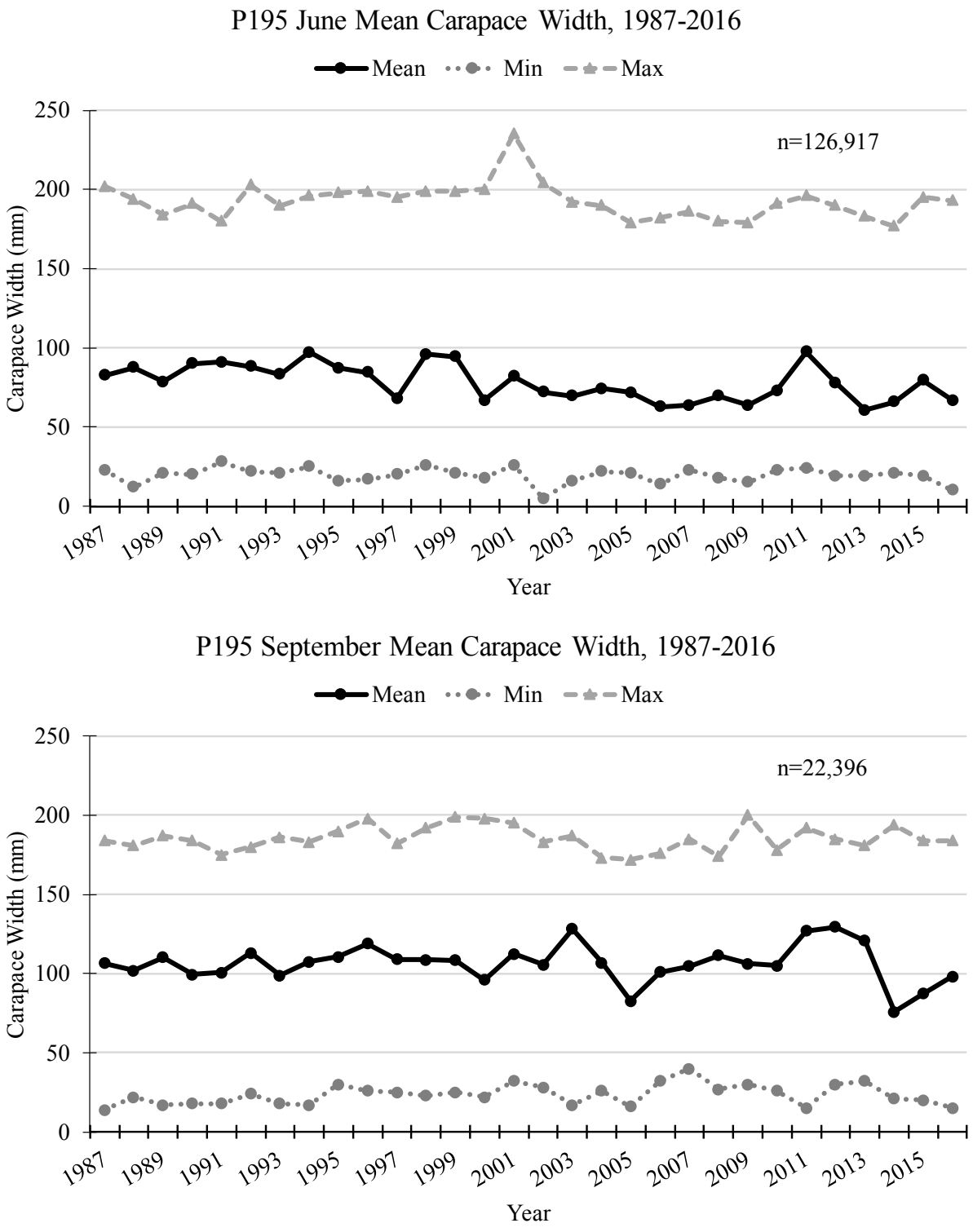

Figure 2.16. Annual mean, minimum, and maximum carapace width (mm) of blue crab captured in Program 195, 1987 – 2016.

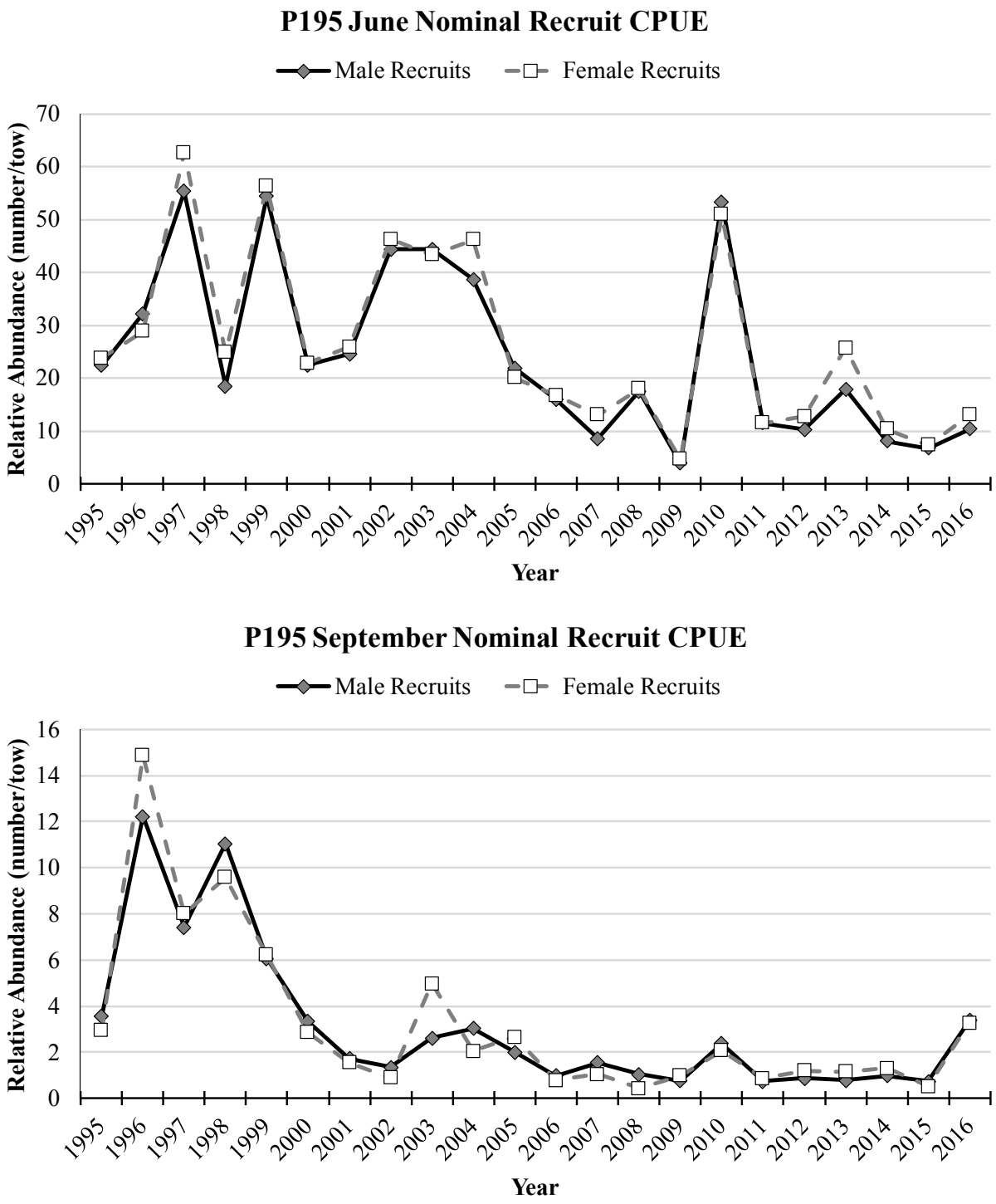

Figure 2.17. Weighted nominal catch-per-unit effort (CPUE; number of crabs per sample) of recruit crabs (<127 mm CW) captured in Program 195 by month and sex, 1995 – 2016 for all strata combined.

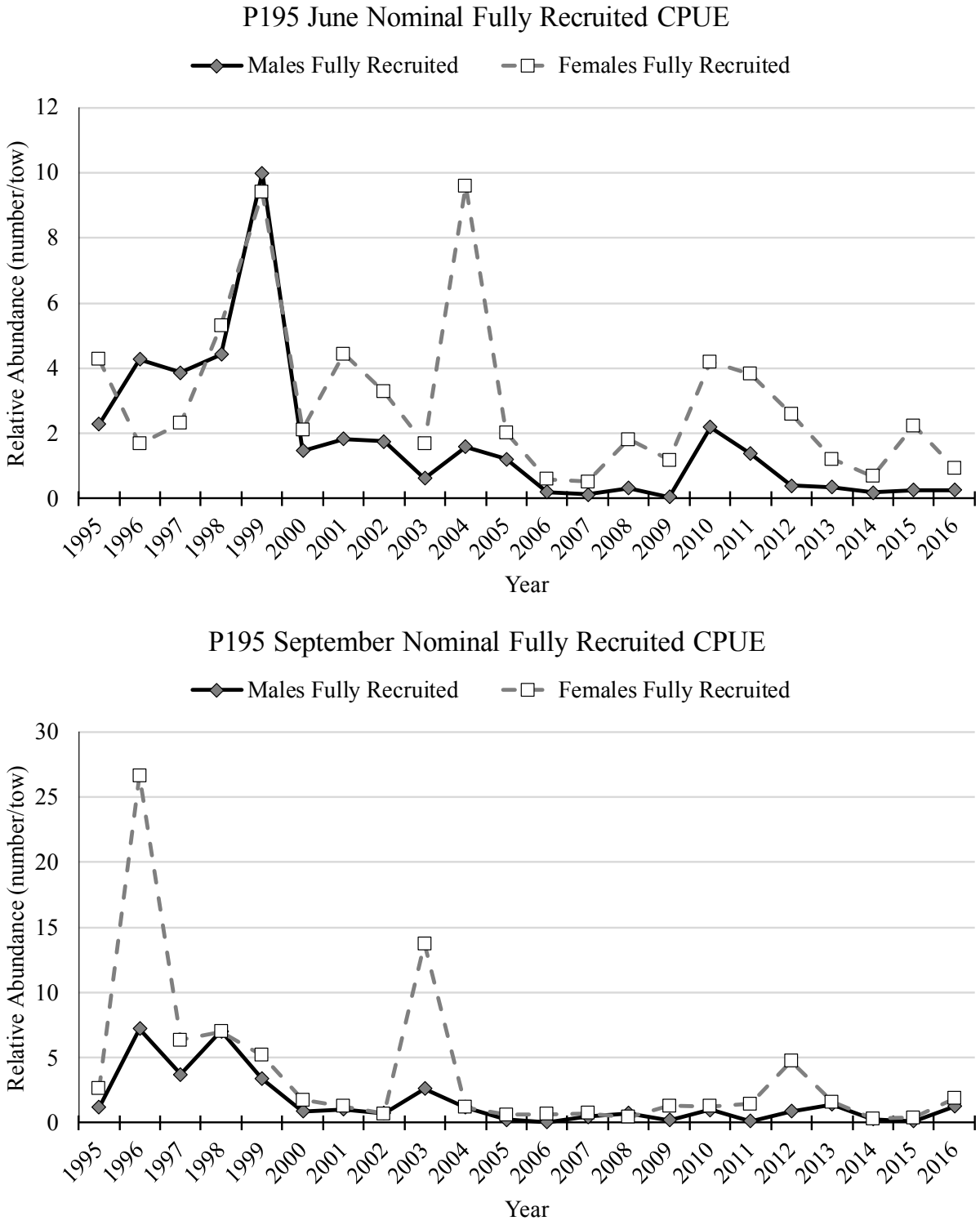

Figure 2.18. Weighted nominal catch-per-unit effort (CPUE; number of crabs per sample) of fully recruited crabs (≥127 mm CW) captured in Program 195 by month and sex, 1995 – 2016 for all strata combined.

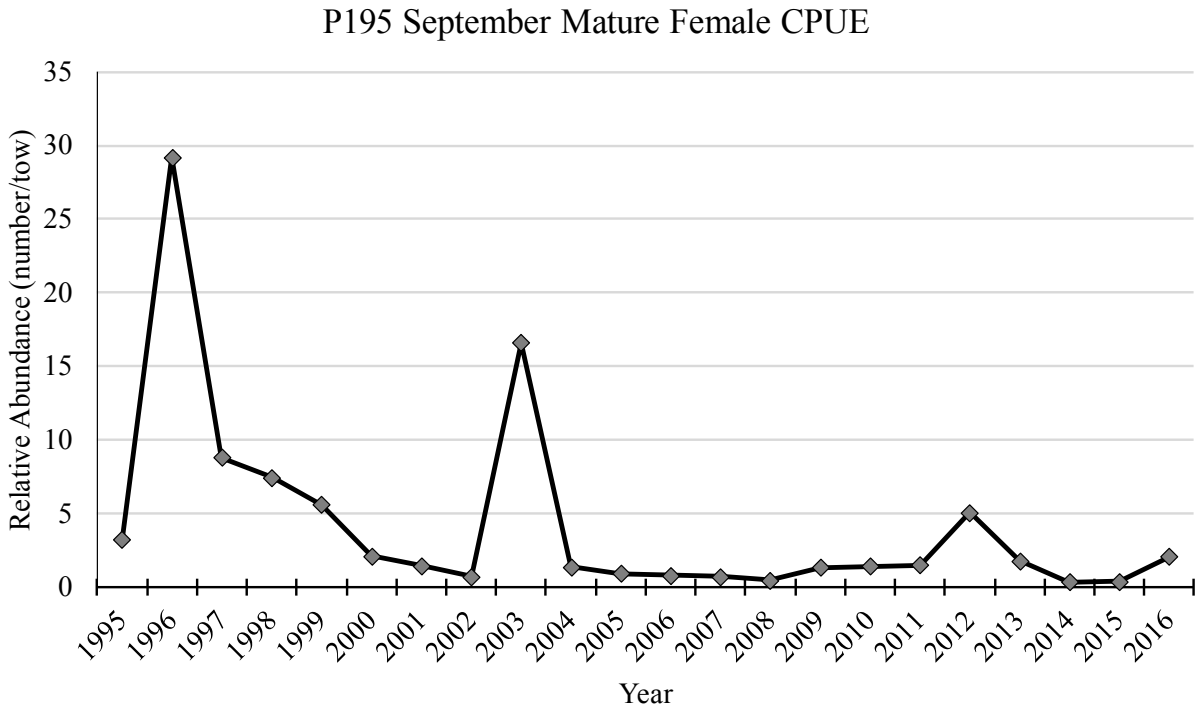

Figure 2.19. Weighted nominal catch-per-unit effort (CPUE; number of crabs per sample) of mature female crabs captured in September in Program 195, 1995 – 2016 for all strata combined.

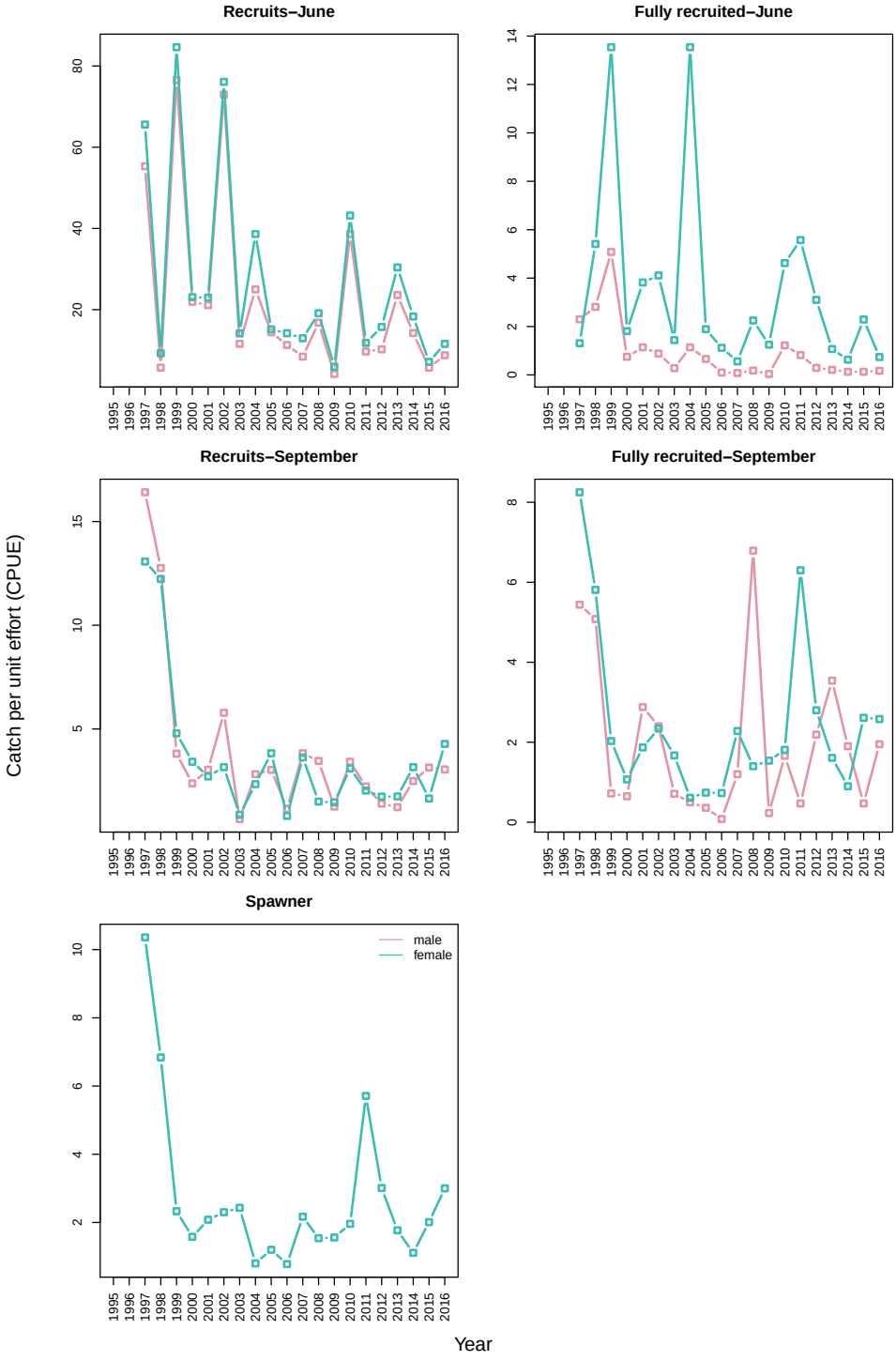

Figure 2.20. Standardized catch-per-unit effort (CPUE; number of crabs per sample) of recruit crabs (<127 mm CW), fully recruited crabs (≥127 mm CW) and mature female crabs (September) captured in Program 195 by month and sex, 1995 – 2016 for all strata combined.

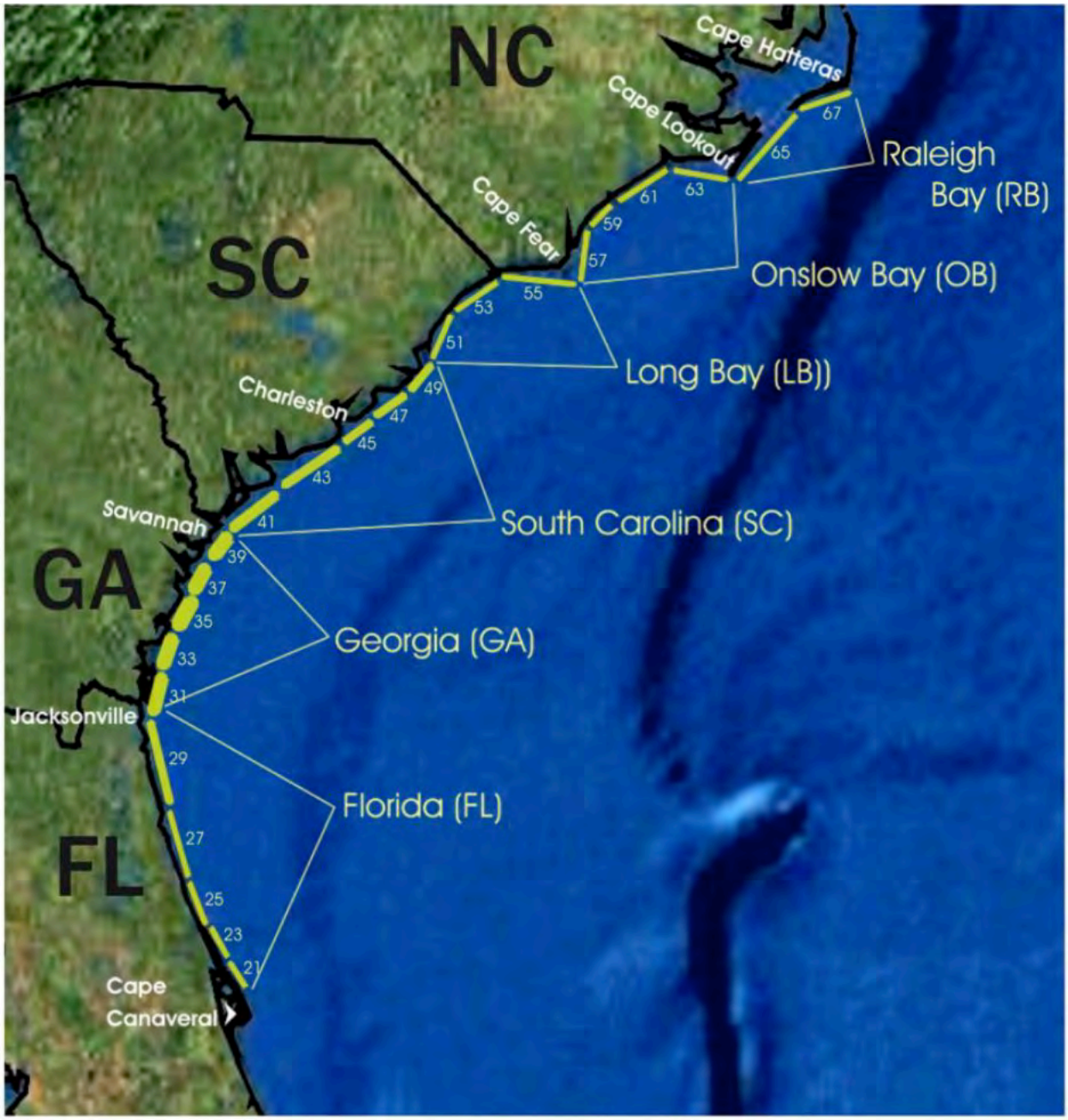

Figure 2.21. Sampling area of the SEAMAP Coastal Survey.

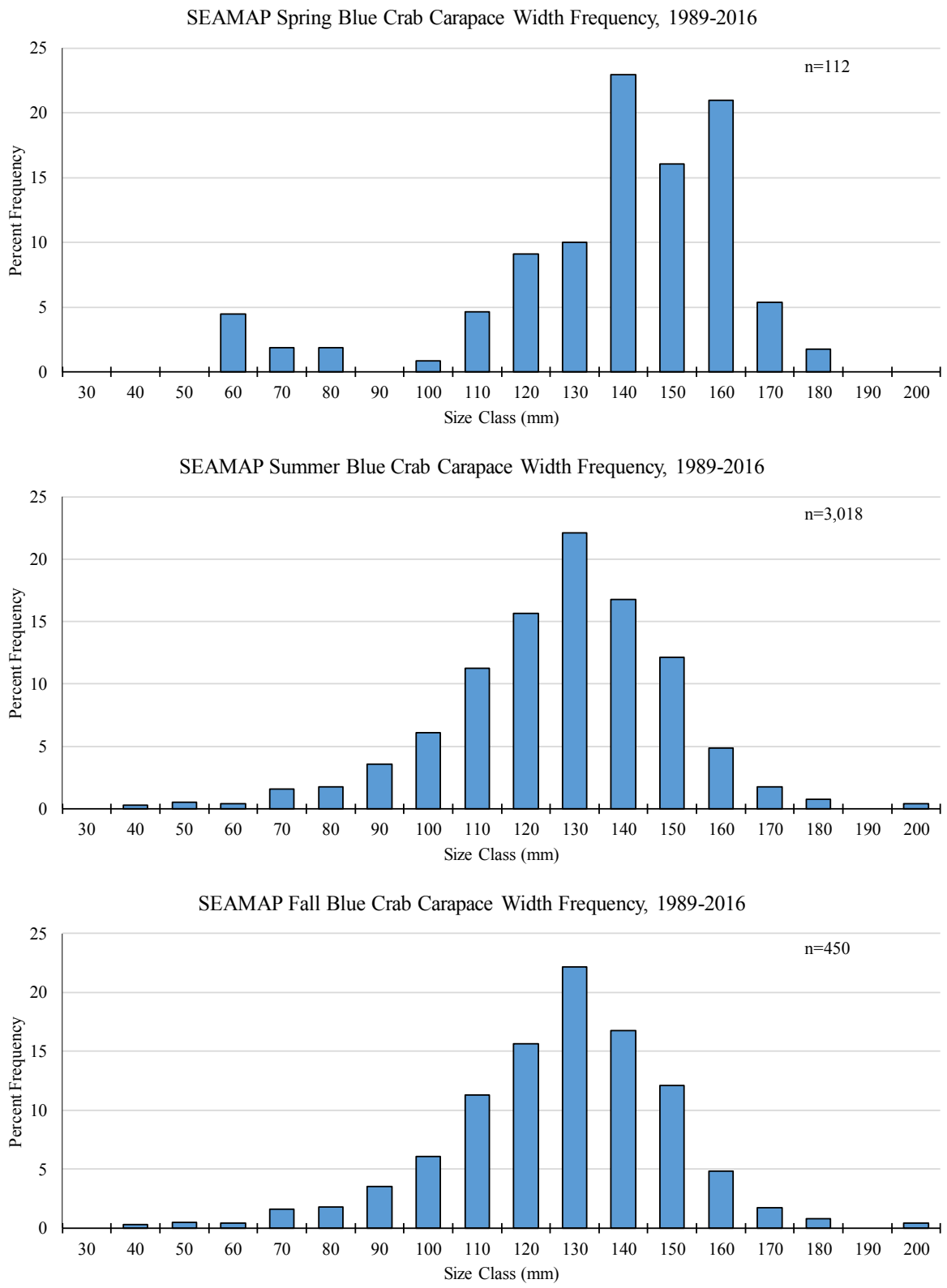

Figure 2.22. Carapace width frequency by season from the SEAMAP Coastal Survey in North Carolina waters, 1989-2016.

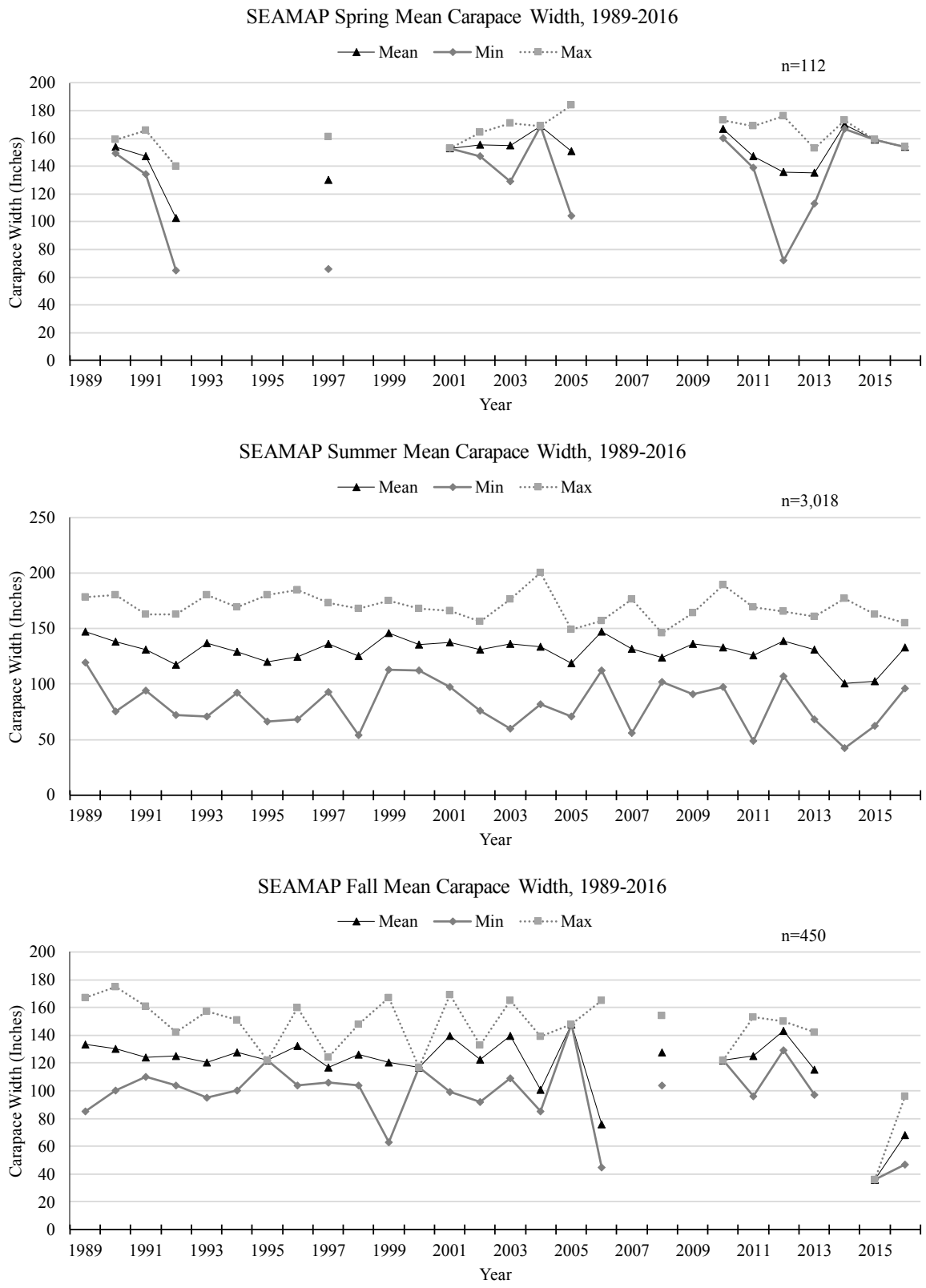

Figure 2.23. Median, minimum, and maximum carapace width by season from the SEAMAP Coastal Survey in North Carolina waters, 1989-2016.

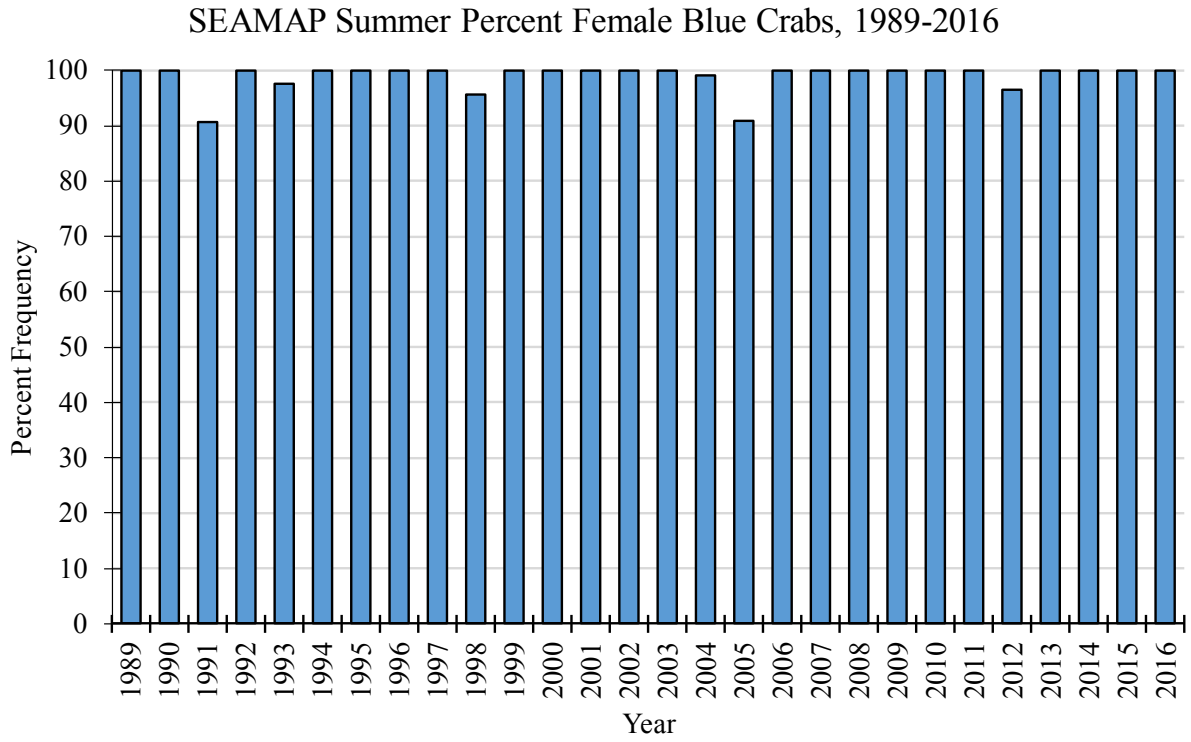

Figure 2.24. Percent of mature female blue crabs in the catch from the summer cruise of the SEAMAP Coastal Survey in North Carolina waters, 1989-2016.

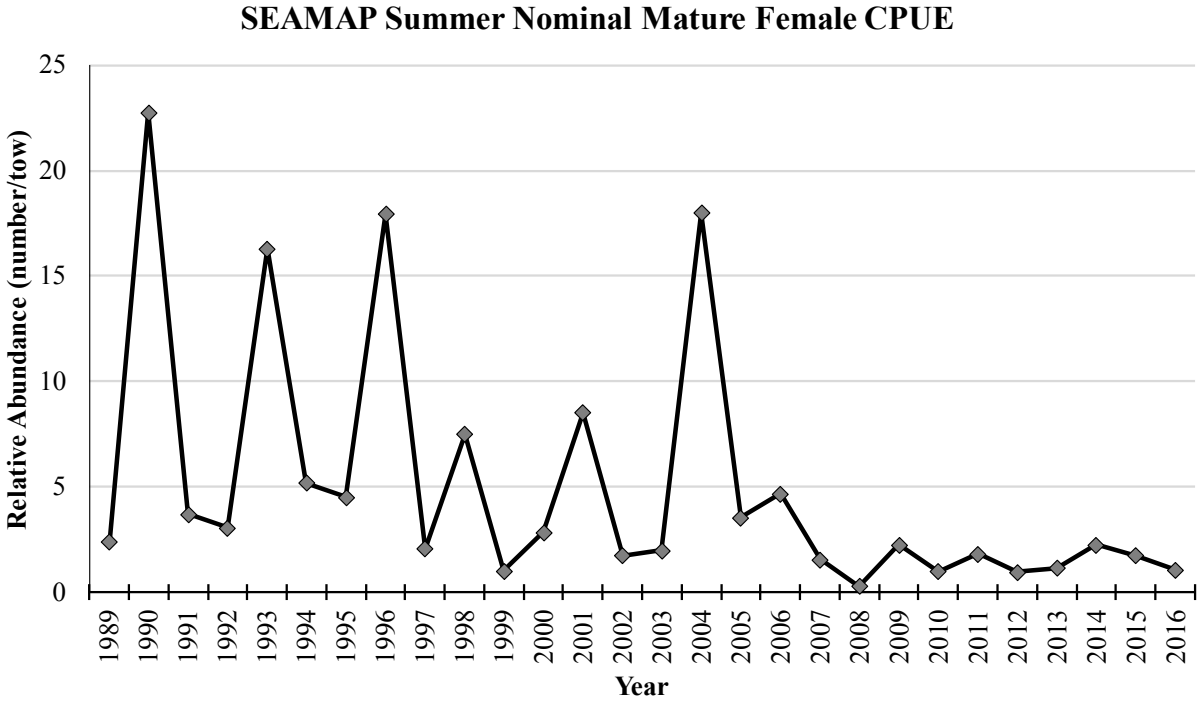

Figure 2.25. Nominal summer CPUE from the SEAMAP Coastal Survey in North Carolina waters, 1989-2016.

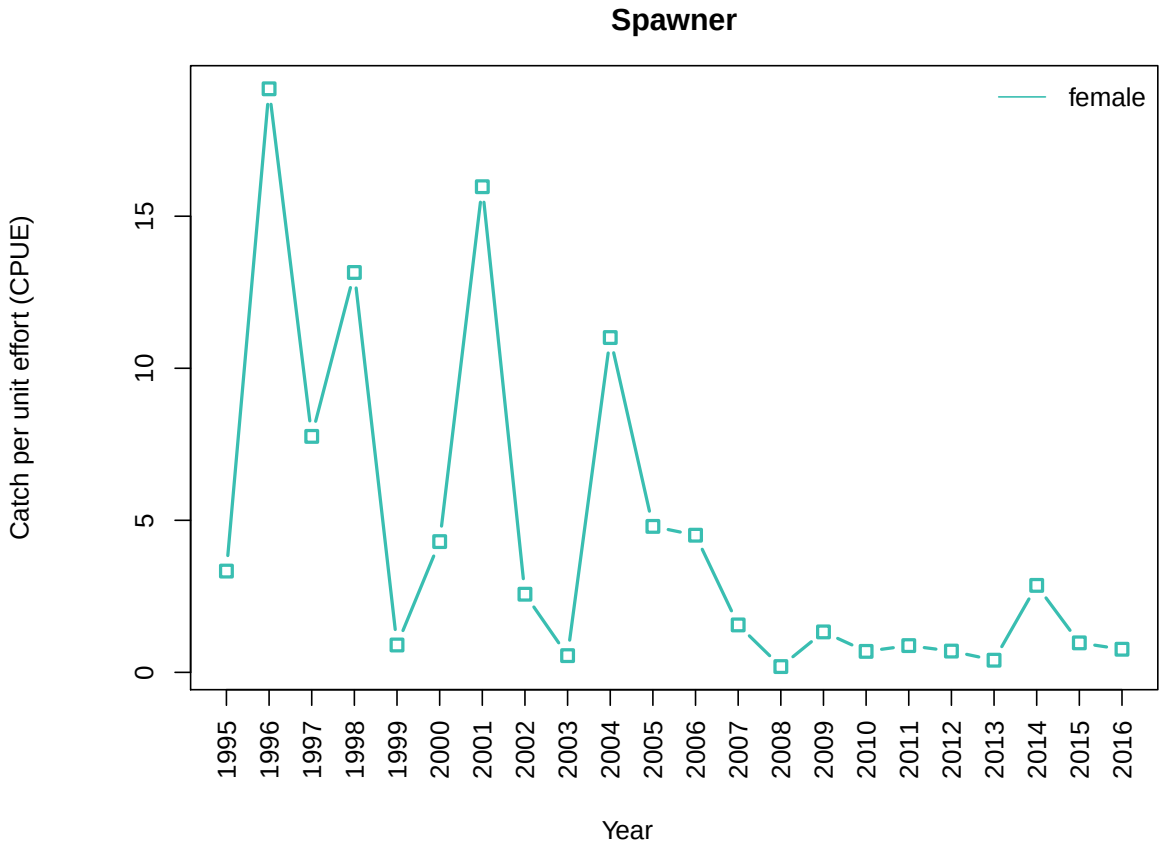

Figure 2.26. Standardized Summer CPUE from the SEAMAP Coastal Survey in North Carolina waters, 1995-2016.

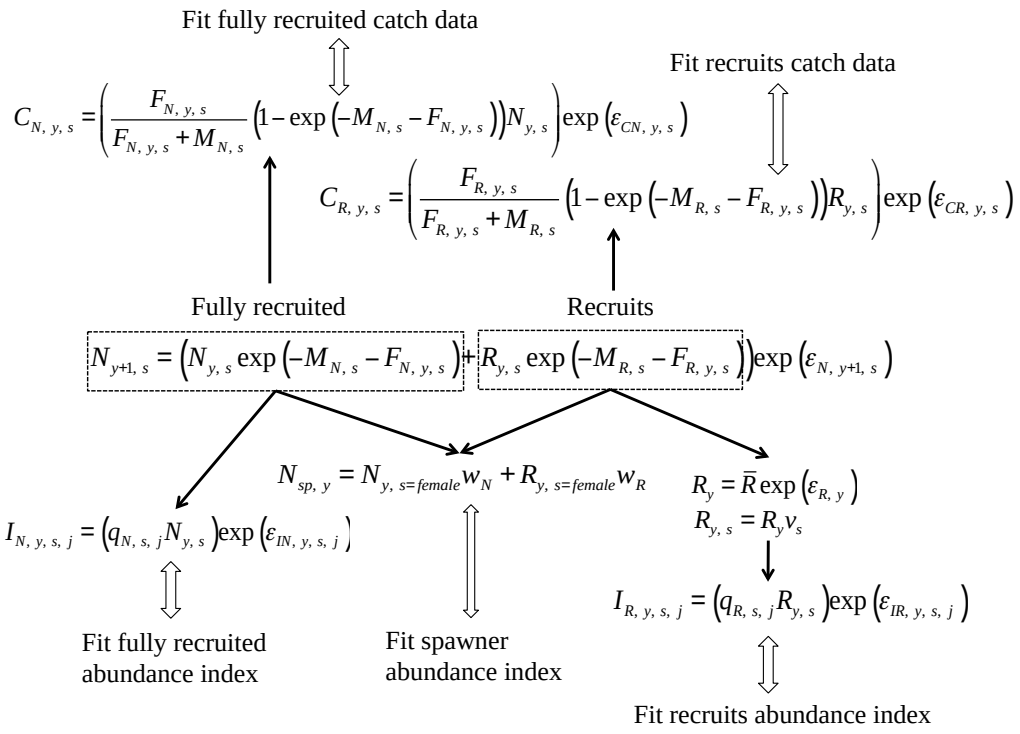

Figure 3.1. Schematic diagram of the two-stage model for North Carolina blue crab stock assessment. Refer to text for symbol explanation.

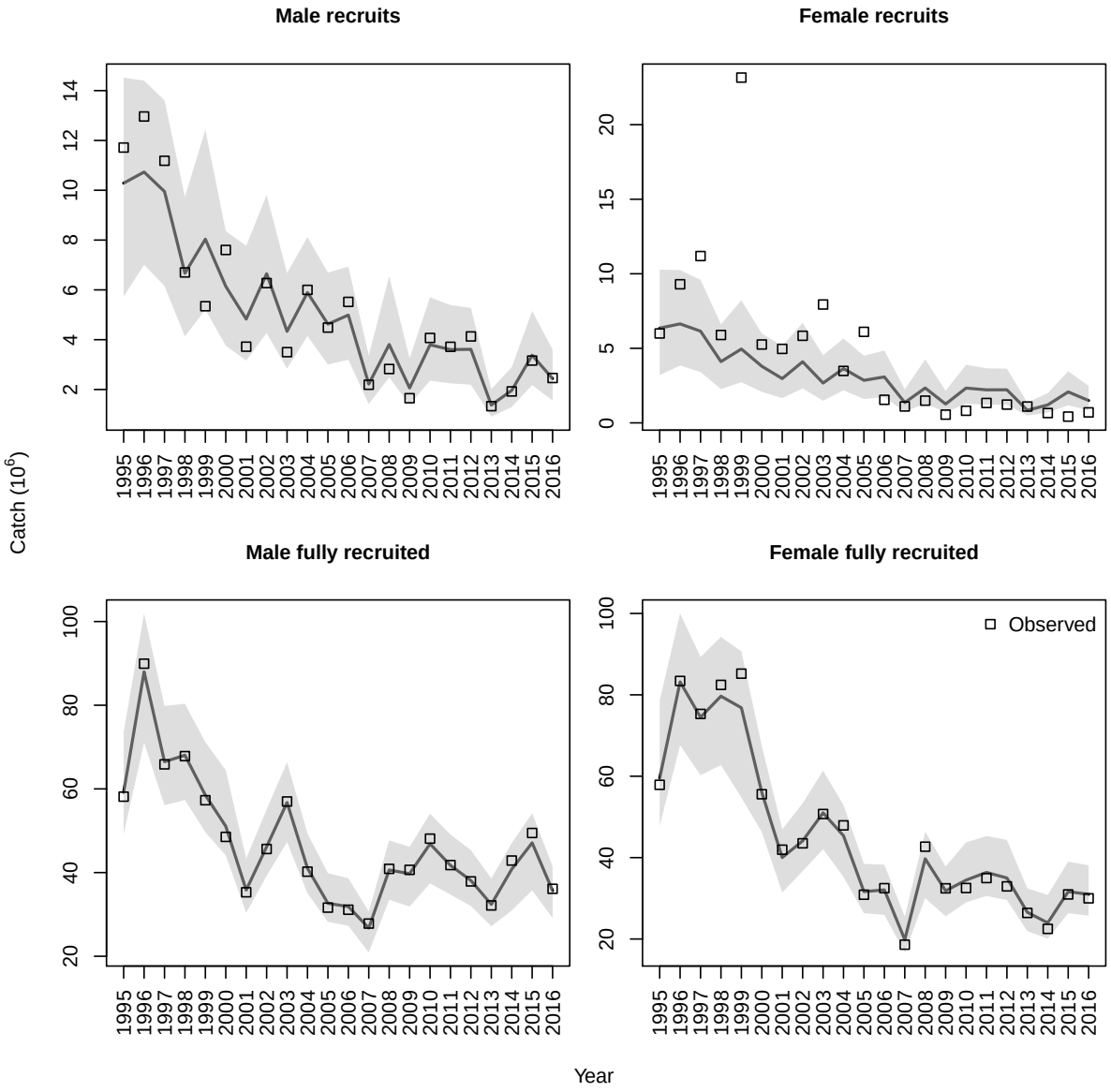

Figure 3.2. Estimated commercial catch of North Carolina blue crab from the baseline model (Model 1), with lines representing posterior mean and shaded area representing 95% credible interval.

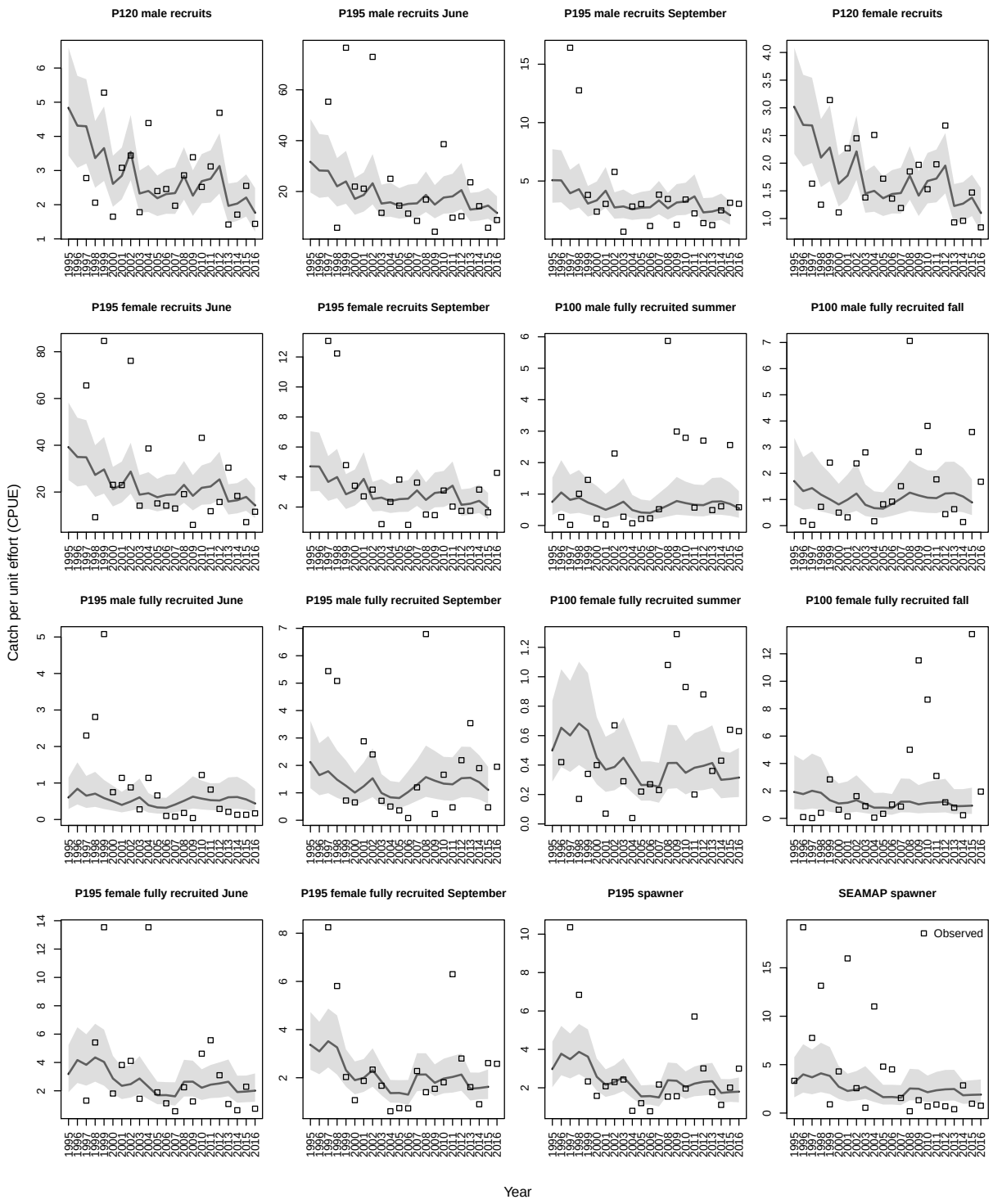

Figure 3.3. Estimated abundance indices of North Carolina blue crab from the baseline model (Model 1), with lines representing posterior mean and shaded area representing 95% credible interval.

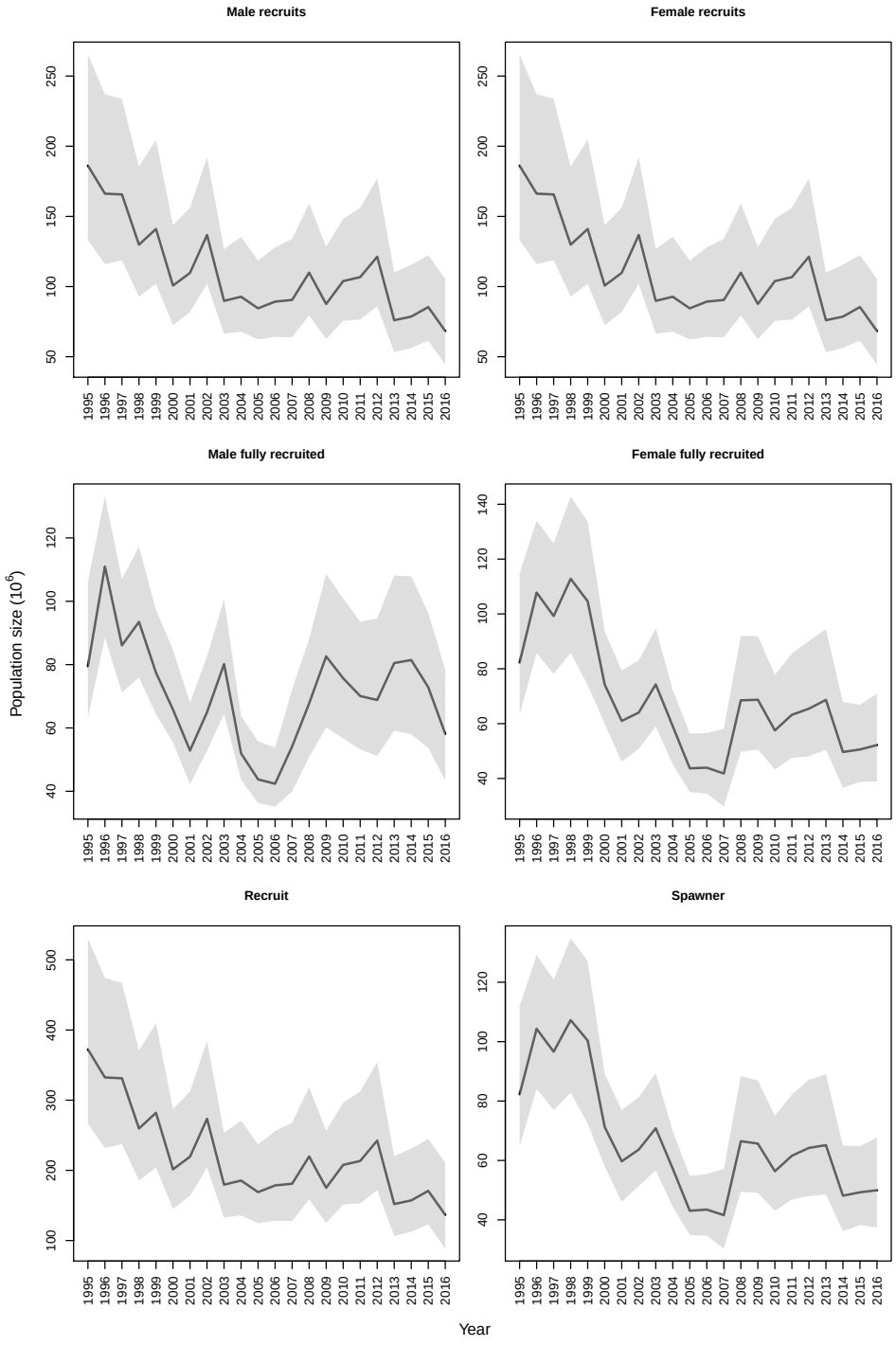

Figure 3.4. Estimated population size of North Carolina blue crab from the baseline model (Model 1), with lines representing posterior mean and shaded area representing 95% credible interval.

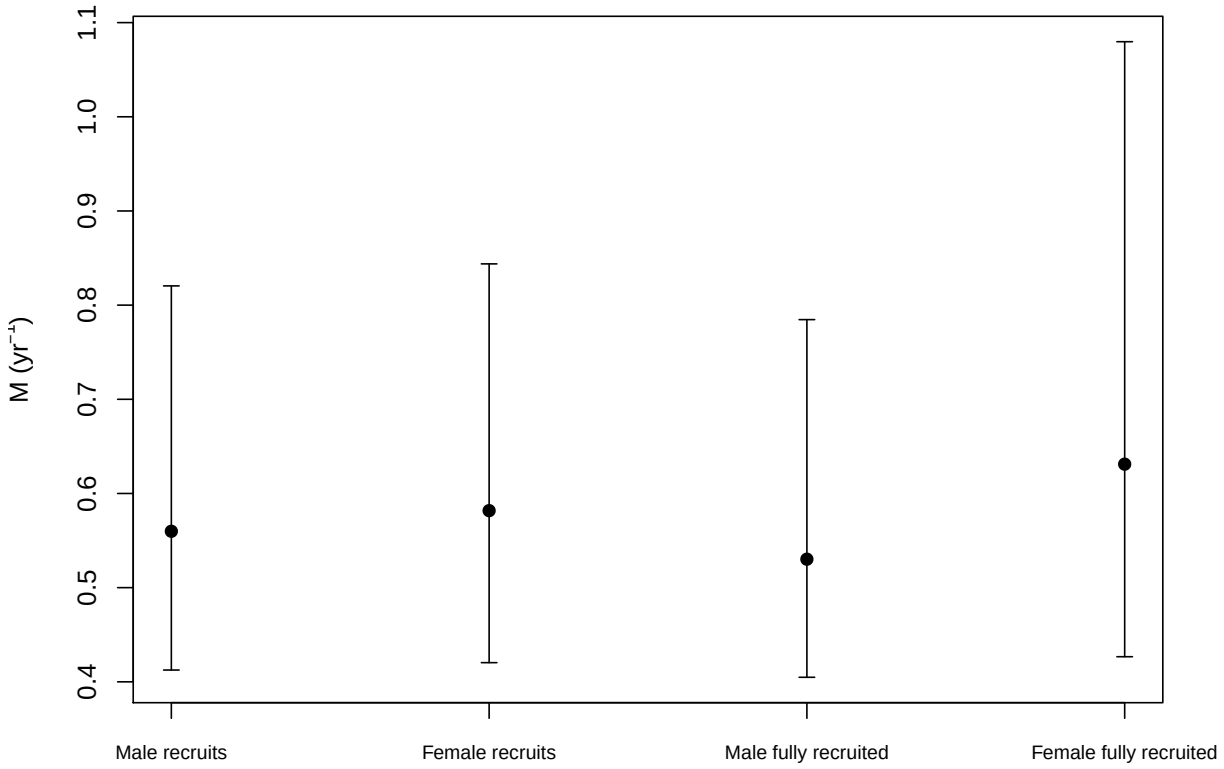

Figure 3.5. Estimated natural mortality (*M*) from the baseline model (Model 1), with dots representing posterior mean and wiskers representing 95% credible interval.

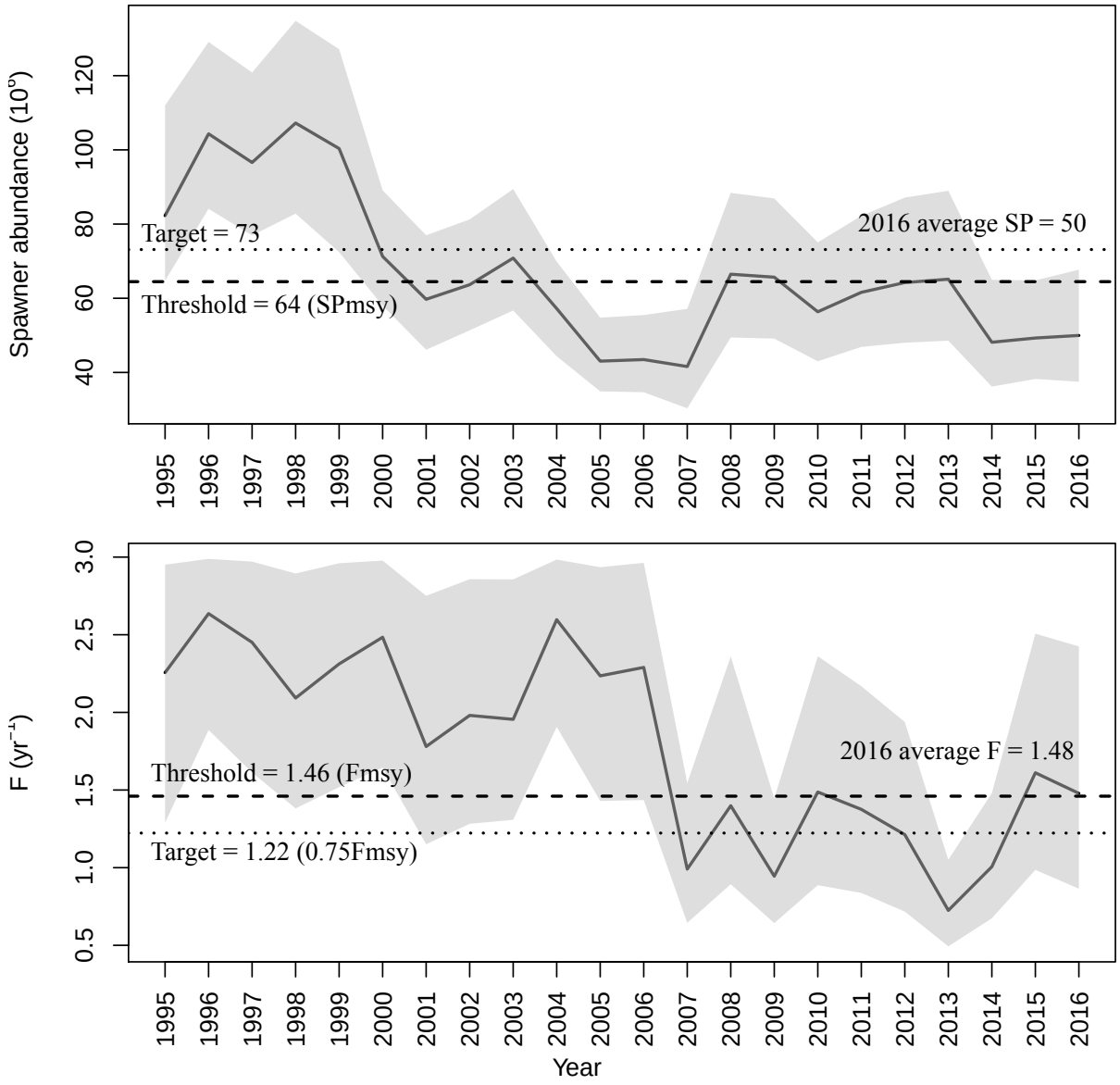

Figure 3.6. Estimated spawner abundance and fishing mortality (*F*) of North Carolina blue crab from the baseline model (Model 1), with lines representing posterior mean and shaded area representing 95% credible interval from the baseline model, Model 1. The threshold and target values are the posterior means.

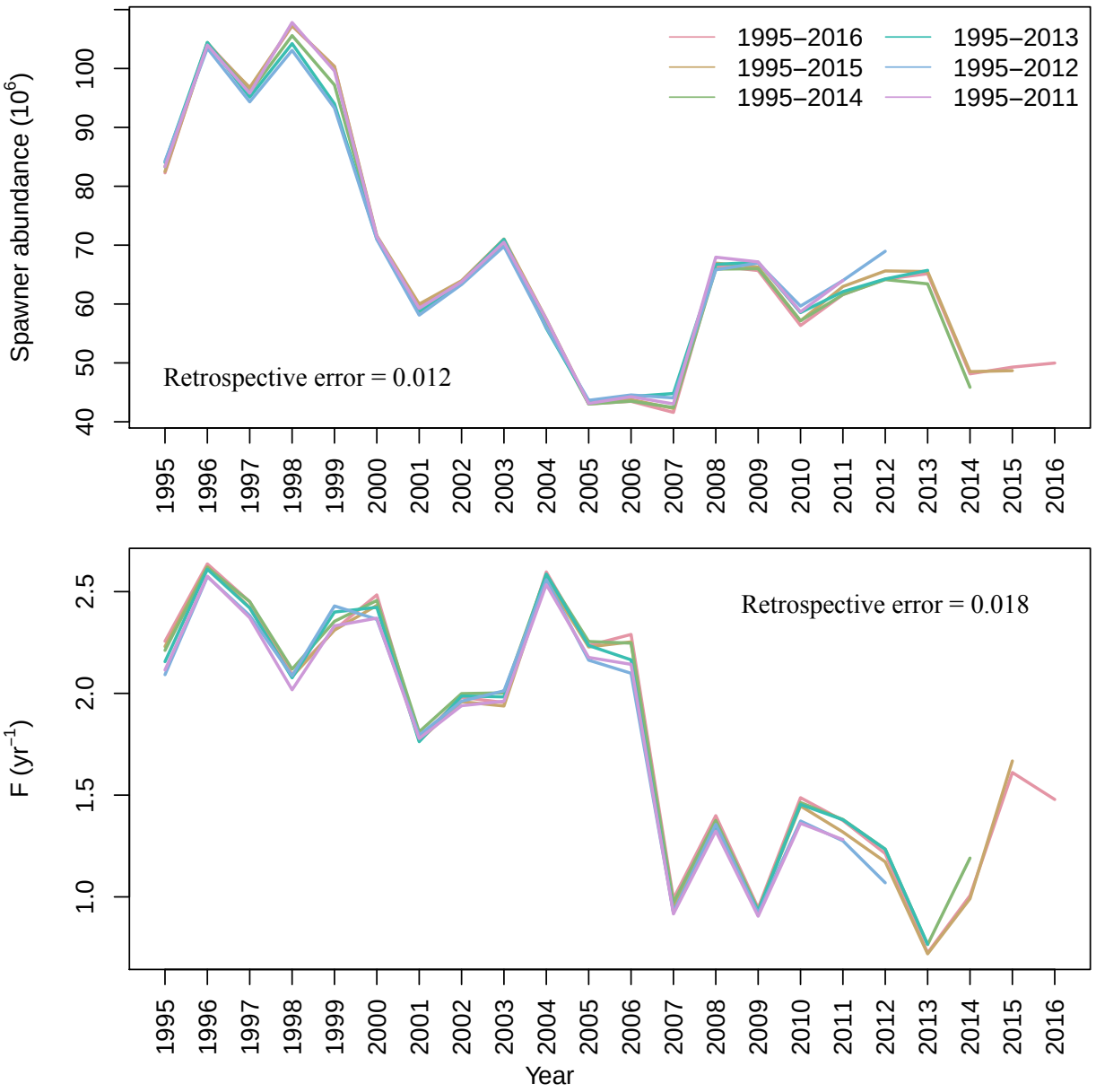

Figure 3.7. Estimated spawner abundance and fishing mortality (F) of North Carolina blue crab from a retrospective analysis with additional one year of data added at a time for five years in the baseline model, Model 1. Lines represent posterior mean.

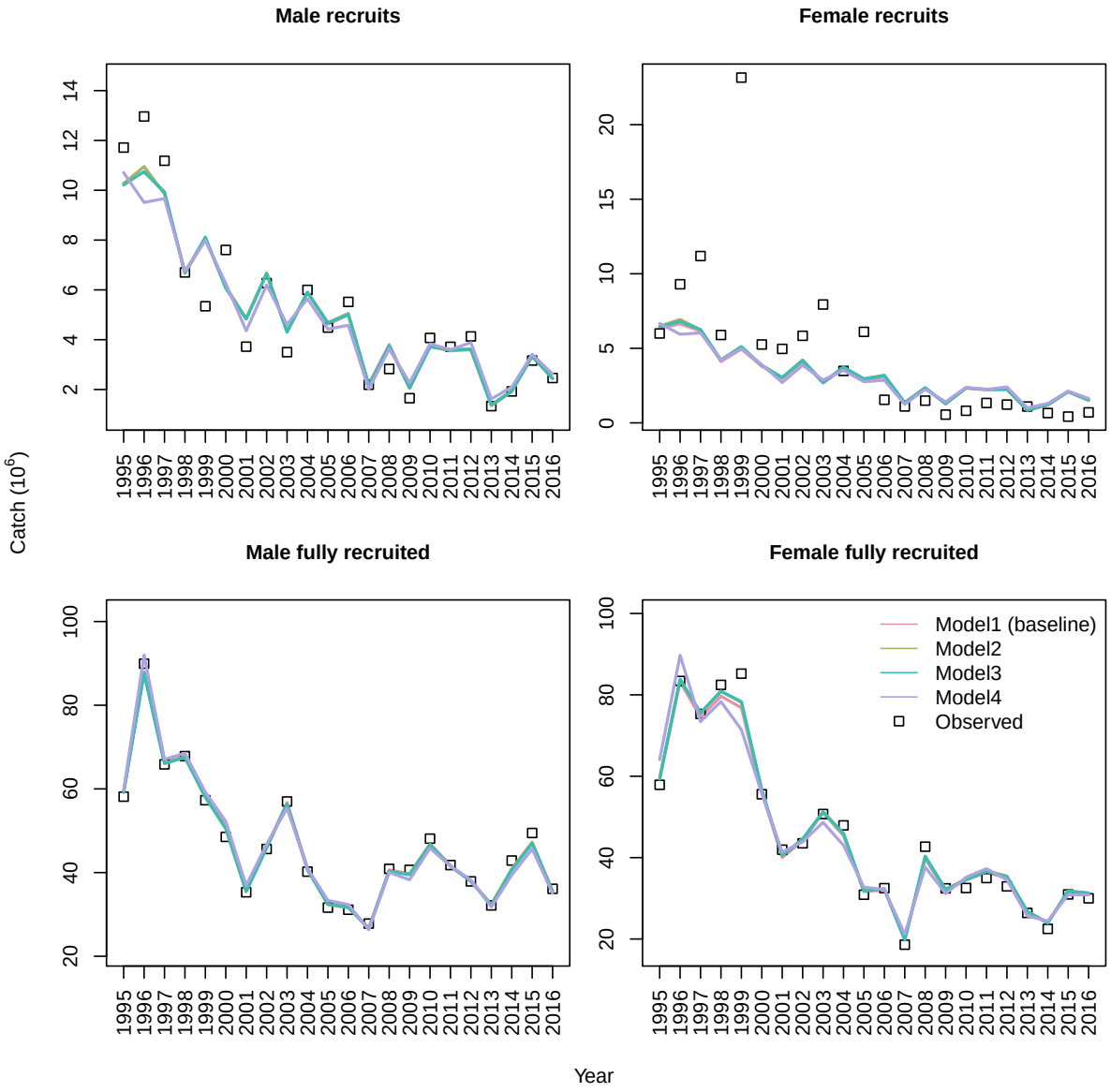

Figure 3.8. Estimated commercial catch of North Carolina blue crab from candidate models, with lines representing posterior mean. The Please refer to Table 3.3 for the explanation of candidate models.

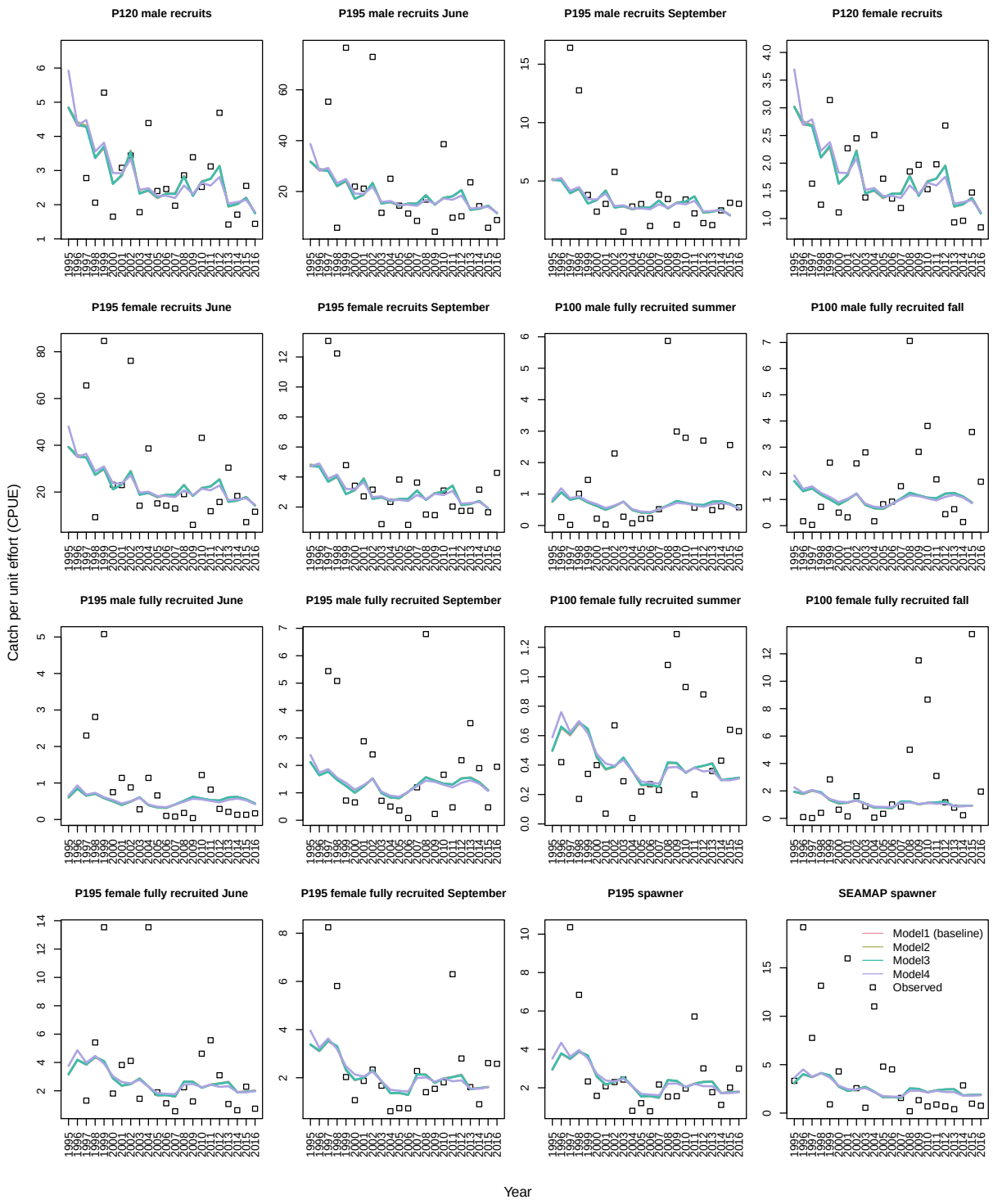

Figure 3.9. Estimated abundance indices of North Carolina blue crab from candidate models, with lines representing posterior mean. Please refer to Table 3.3 for the explanation of candidate models.

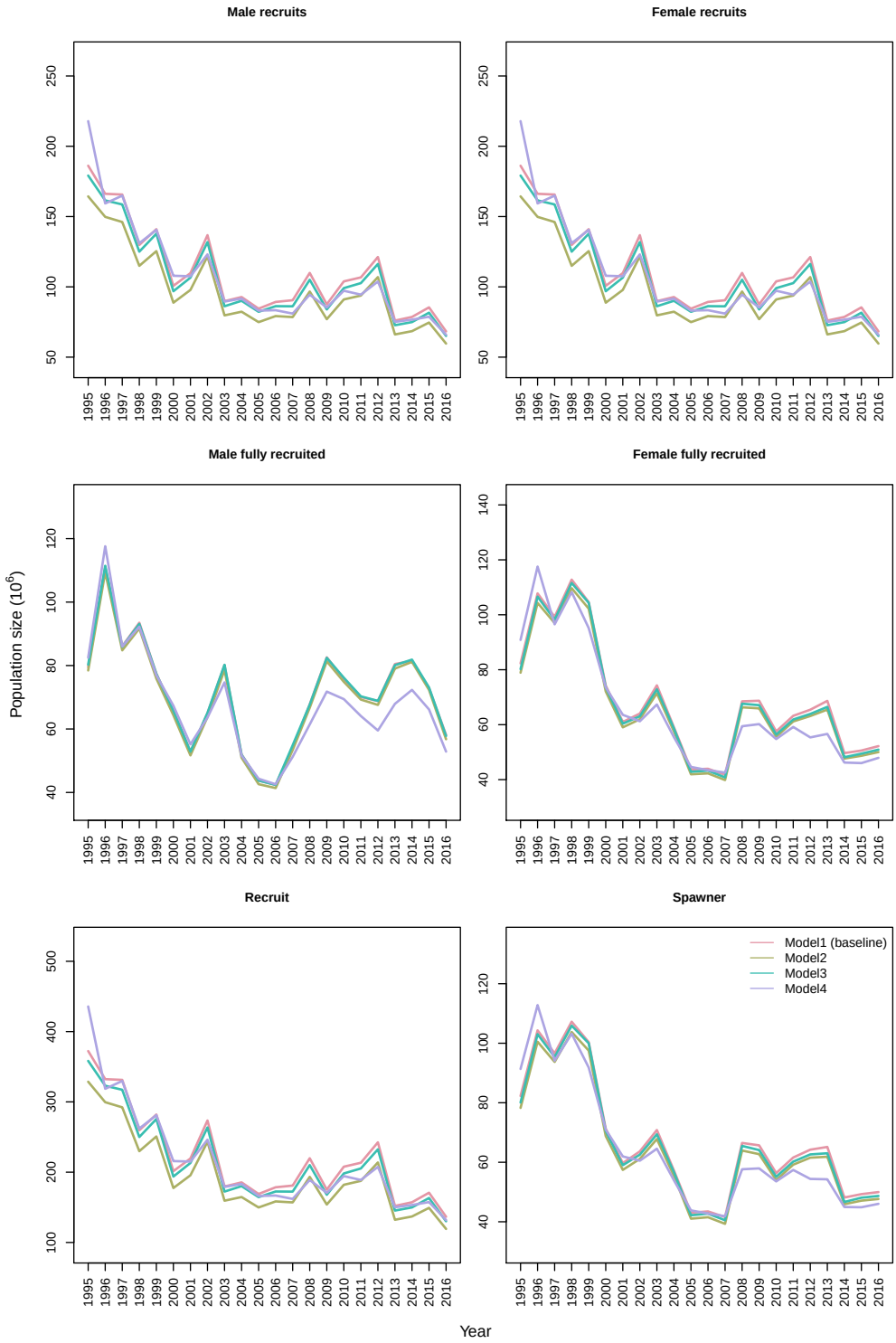

Figure 3.10. Estimated population size of North Carolina blue crab from candidate models, with lines representing posterior mean. Please refer to Table 3.3 for the explanation of candidate models.

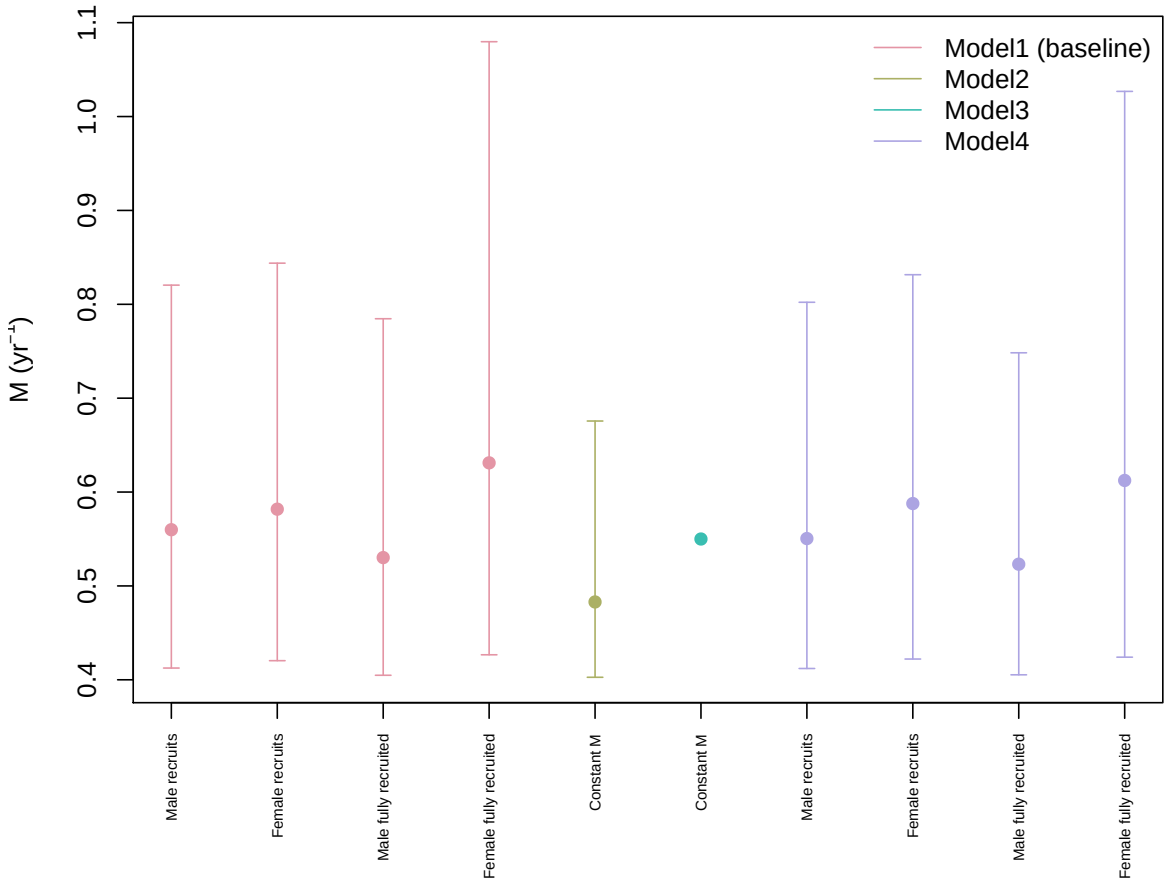

Figure 3.11. Estimated natural mortality (*M*) from candidate models, with dots representing posterior mean and wiskers representing 95% credible interval. Please refer to Table 3.3 for the explanation of candidate models.

Figure 3.12. Estimated fishing mortality (*F*) of North Carolina blue crab from candidate models, with lines representing posterior mean. Please refer to Table 3.3 for the explanation of candidate models.

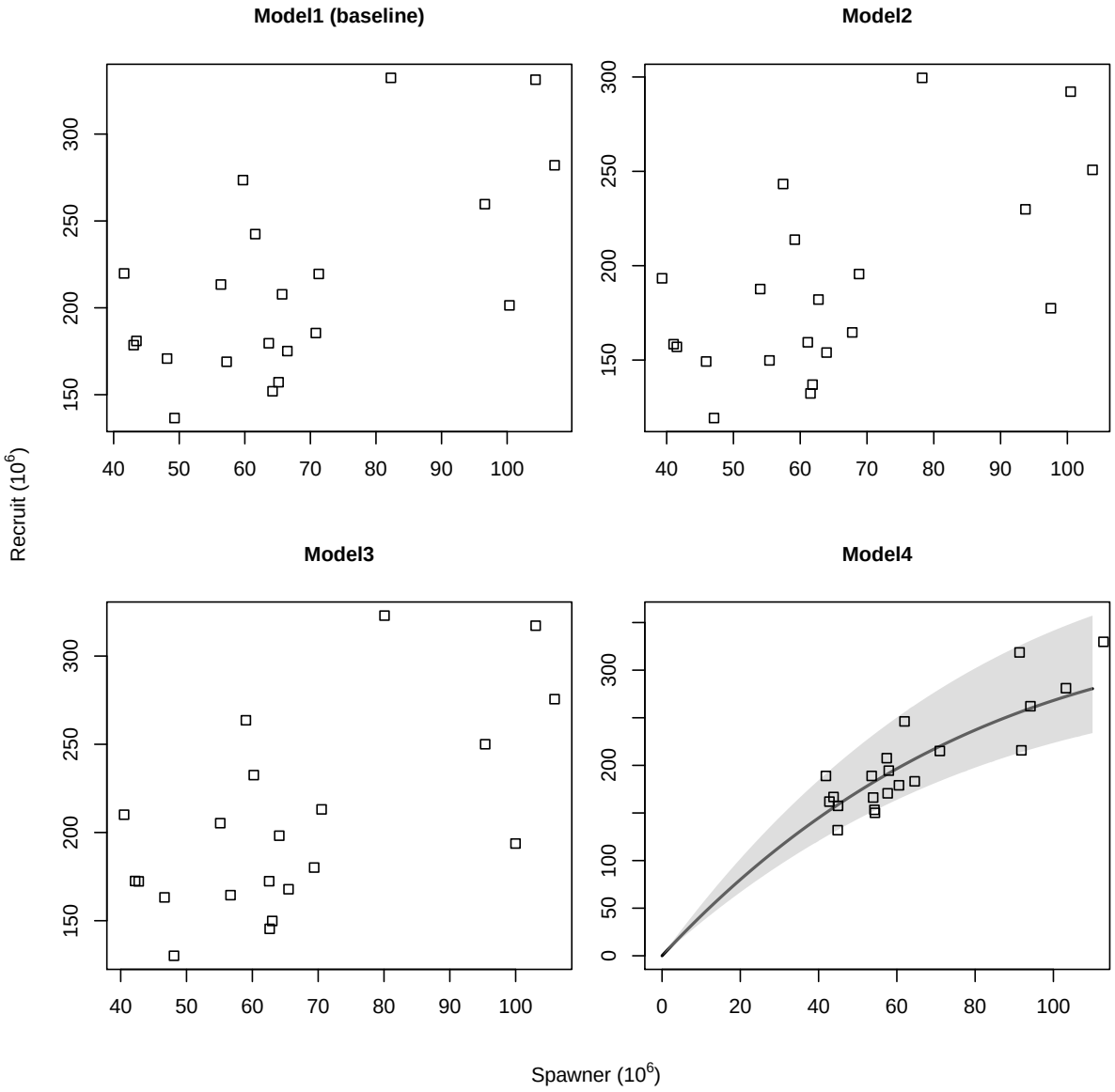

Figure 3.13. Estimated recruitment and spawner relationships from candidate models. Models 1-3 show the estimated annual average of recruits and spawner stock size; Model 4 shows the estimated recruits given a spawner stock size assuming a Ricker curve, with lines representing posterior mean and shaded area representing 95% credible interval. Please refer to Table 3.3 for the explanation of candidate models.

10 APPENDIX

10.1 APPENDIX A: Traffic Light Approach

The blue crab Traffic Light is divided into three separate characteristics: 1) adult abundance, 2) recruit abundance, and 3) production. Each characteristic uses data from several division biological surveys and sampling programs to determine the relative abundance of adult and recruit blue crabs in the population and various production indictors for the stock each year. Under the plan, management measures will be implemented in the blue crab fishery if certain biological triggers are met. To trigger management action, either the adult abundance or production characteristic of the Traffic Light must be at or above the 50% red threshold for three consecutive years to trigger moderate management action and must be at or above the 75% red threshold for two of three consecutive years to trigger elevated management action as established in the plan (Table A1). The recruit abundance indicator, while not used to trigger initial management action, may be used to supplement any management action taken if an adult abundance or production trigger is activated. The three-year period was chosen to prevent taking management action due to annual variability in the blue crab stock and instead base any management response on the observation of a short, but continued declining trend in the population.

As a result of the update with data through 2015, a revision to the Blue Crab Fishery Management Plan was adopted in May 2016 to improve the condition of the blue crab stock. Since management measures were implemented in June 2016, it is too early to tell what effect, if any, they have had on the condition of the blue crab stock.

The most recent update, including data through 2016, indicates the adult abundance characteristic continues to exceed the moderate threshold of 50% red (adult=66% red; Figure A1). This serves as the fourth consecutive year at or above the 50% red threshold for the adult abundance characteristic. The recruit abundance characteristic has exceeded the 75% red threshold for fourth consecutive year (2016=88% red). The production characteristic has met the 50% red threshold (2016=50% red) for the first of three years required before management action must be taken due to the condition of this characteristic.

Table A1. Moderate and elevated management measures under the adaptive management framework for the Blue Crab Traffic Light in Amendment 2 to the Blue Crab Fishery Management Plan.

Characteristic	Moderate management level	Elevated management level
Adult abundance	A1. Increase in minimum size limit for male and immature female crabs	A4. Closure of the fishery (season and/or gear)
	A2. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 5%) and/or implement gear modifications to reduce sublegal catch	A5. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 1%) and/or implement gear modifications to reduce sublegal catch
	A3. Eliminate harvest of v-apron immature hard crab females	A6. Time restrictions
Recruit abundance	R1. Establish a seasonal size limit on peeler crabs	R4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas
	R2. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	R5. Expand existing and/or designate new crab spawning sanctuaries
	R3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	R6. Closure of the fishery (season and/or gear)
		R7. Gear modifications in the crab trawl fishery
Production	P1. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color)	P4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots for specific areas
	P2. Minimum and/or maximum size limit for mature female crabs	P5. Reduce peeler harvest (no white line peelers and/or peeler size limit)
	P3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	P6. Expand existing and/or designate new crab spawning sanctuaries
		P7. Closure of the fishery (season and/or gear)

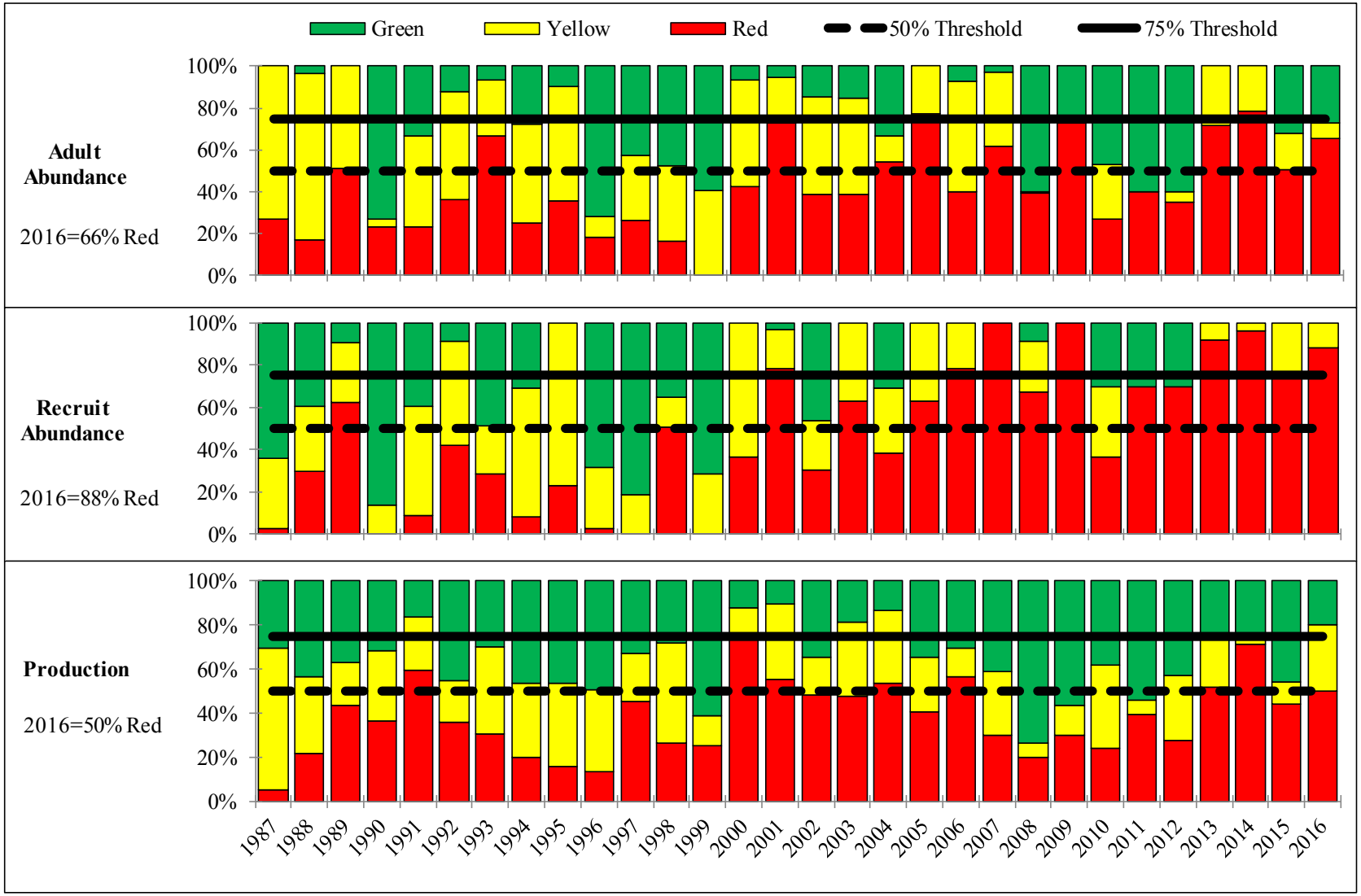

Figure A1. Adult abundance, recruit abundance, and production characteristics for the 2016 Blue Crab Traffic Light update.

10.2 APPENDIX B: External Peer Review Report

External Peer Review Report
for the
2018 Stock Assessment
of
Blue Crab in the North Carolina

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Dr. Edward Hale, Delaware Department of Natural Resources and Environmental Control

Dr. Robert Leaf, University of Southern Mississippi

Genine McClair, Maryland Department of Natural Resources

April 16, 2018

EXECUTIVE SUMMARY

A peer review of the North Carolina blue crab (*Callinectes sapidus*) stock assessment was conducted in New Bern, North Carolina on March 27-29, 2018. The Peer Review Panel (RP) evaluated the data sources and model relative to a set of Terms of Reference provided by the Stock Assessment Team. Based on the information provided in the assessment report and during the peer review workshop, the RP accepts the stage- and sex-structured Catch Survey Analysis model as appropriate for management use.

The fishery dependent and independent data sources, including potential biases in each one, were well described. The data sources used in the model were determined to be appropriate, but the RP suggests additional analyses to further evaluate potential data sources and better justify their inclusion or exclusion. The index standardization process was also well documented, and is consistent with best practices. The panel would have liked to see a list of all covariates available for each index, rather than just those selected. We also recommend further investigation into development of regional indices, and exploration of environmental events or indices to help explain trends in abundance.

The RP is in agreement that the CSA model used in this assessment is a significant improvement over the qualitative traffic light approach used previously. The stage-based structure is appropriate given the life history of blue crabs. We express some concerns about possible overparameterization, inconsistencies between survey and fishing time steps, and model assumptions about life history characteristics (M, growth). Sensitivity runs indicate the model is robust to these uncertainties, but recommendations are provided to address the RP's concerns.

Reference points selected are based on historical performance of spawner per recruit to prevent a "worst case scenario" (*i.e.* falling below a previously observed low point). The RP recognizes the difficulty establishing more quantitative reference points given the available data, but expresses concern over the utility of the reference points selected. It was noted that there was little variability in SPR over time, and the degree of risk in the SPR values selected is unknown (*i.e.* they could be ultra-conservative or ultra-liberal). The RP provides guidance into development of other reference points, such as those used for blue crabs in other areas, or species with similar life histories.

Stock status was determined as overfished and overfishing. This is consistent with the Assessment Team's professional opinion and observations about stock dynamics in recent years, and sensitivity runs indicate that this determination is robust to model assumptions. The RP concurs with this determination, but again encourages investigation into other reference points, which may affect status determination.

The Assessment Team provided a list of research recommendations that address data gaps and other uncertainties. The RP concluded that the list is relevant, but provides guidance on prioritization of the different items.

Overall, the RP is impressed with the amount of research and analysis conducted by the Assessment Team. Prior to and during the review workshop the Assessment Team was very responsive to the RP's questions and request. Further, an external peer review for a state level stock assessment is recognized as being above and beyond the capacity of most states. Staff of the NC Division of Marine Fisheries are commended for their efforts.

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1 INTRODUCTION

The North Carolina Division of Marine Fisheries (NC DMF) held an external peer review workshop on March 27-29, 2018 in New Bern, NC to evaluate the 2018 North Carolina blue crab (*Callinectes sapidus*) stock assessment. Members of the review panel (RP) included fishery biologists and natural resource managers from other state agencies and academia. This assessment of the North Carolina blue crab stock is the second to undergo an in-person peer review workshop; previous assessments had been reviewed through a desk audit process. Overall, the RP is impressed with the State's commitment to treating local assessments with the same level of scrutiny as regional, national and international assessments. In this respect, North Carolina sets a high bar for other states to follow in order to promote science-based management of its marine resources.

The assessment team (AT) provided a draft of the stock assessment report to the RP approximately three weeks prior to the review workshop. At the time, the AT requested that potential sensitivity run suggestions be provided prior to the review workshop since the model took approximately 4-6 hours to run, limiting the number of sensitivity runs that could be performed during the workshop. The RP submitted several ideas, as well as identified some topics that needed additional clarification or discussion during the review workshop.

Prior to the workshop, the AT also provided a set of Terms of Reference (ToR) for the RP to address in order to focus the review and deliberations on relevant aspects of the assessment, including data sources, model choice and parameterization, reference points, stock status, and research recommendations. The RP concludes that the AT addressed each of the ToR adequately, and that the model and model results are suitable for management use. Additional comments on each of the ToR are provided through the remainder of this report.

2 TERMS OF REFERENCE

2.1 Evaluate the thoroughness of data evaluation and presentation including:

Overall, the RP found that the AT adequately addressed this ToR. The individual biological monitoring programs, both fishery dependent and fishery independent, were well documented. Further, the AT acknowledged survey specific limitations and potential biases after a description of each survey, and the application of GLMs to standardize indices was well described. However, the RP did identify several potential strategies that may have helped clarify the data sources used, justify inclusion of data sources, and explain the process for index and model selection. These are described in detail below.

2.1.1 Justification for inclusion or elimination of available data sources

The AT provided thorough descriptions of the multiple monitoring programs considered, including fishery-dependent (Commercial Monitoring-Trip Ticket Program[TTP], Biological Characterization [P436]; Recreational Monitoring-Telephone and Mail-in surveys) and fishery independent surveys (Estuarine Trawl Survey[P120]; Juvenile Anadromous Survey[P100]; Pamlico Sound Survey[P195]; Southeast Area Monitoring and Assessment Program[SEAMAP]). The AT acknowledged survey specific limitations and potential biases after a description of each survey. For example, the AT acknowledged that the TTP fails to capture information on unsuccessful trips, recording only positive catch events. However, the RP notes that the survey

response rate was not characterized by region of the recreational monitoring survey despite stratifying the survey design. Also, the AT limited survey participation to recreationally licensed individuals. The P120 survey was reported to potentially inflate the abundance of mature female crabs in Pamlico Sound by including transient females in abundance estimation. Further, the survey has the potential to report fewer crabs than are actually present because of a failure to sample waters deeper than 2 m. Similarly, P100 was described as potentially biased due to a failure to sample a broader depth range, as well as potentially limited in spatial scope which could significantly misrepresent the presence of mature female crabs. Conversely, P195 was described as potentially biased because of an inability to sample shallower waters and navigate complex habitat structure which may act as refugia. SEAMAP was accepted for use by the AT, and it is the only survey that samples the entire stock distribution, but it was largely recognized by the RP to potentially misrepresent trends in statewide or smaller regional patterns in abundance given the offshore sampling design.

The AT described the monitoring programs excellently; however, the RP did identify a few issues that may help clarify the available data sources, index standardization and model parametrization. First, a conceptual presentation of life history dynamics used to inform model input would have been helpful to the RP in order to document significant biological milestones encapsulated within the model parameters. For example, further detail on molt frequency and timing with respect to the model assumption that all crabs would enter the fully recruited stage after one year would help to evaluate the merits of this assumption. Similar discussion on the links between the model and natural mortality (*e.g.* pre- and post-recruitment rates), predation, and environmental tolerances (*e.g.* effects of storm events on recruitment, mortality, and availability to survey gear) would prove useful to justify model structure and parameterization.

The description of the standardization process included in the explanation of the P120 survey was excellent. However, the RP recommends the AT document all available individual covariates (not just those selected) and error structure listed for each standardized survey within the report. This information was provided upon request at the peer review by the AT. Overall, the RP felt that a series of more comprehensive tables and figures, including those developed/presented at the peer review documenting a comprehensive list of the indices considered, model type and error structure of selected standardized indices, a quantitative comparison of surveys (e.g. correlation matrix), as well as corresponding figures (e.g. GLM fit and residual plots) would have helped the RP consider more fully the surveys chosen and methods used to standardize indices prior to the review. Further, both trace plots and marginal density plots would have been helpful in order to consider diagnostics of model convergence and parameter estimation. Similarly, Gelman diagnostics would have been helpful to the RP in assessing differences among chains (Gelman and Rubin, 1992), and plots of the posterior distributions would have helped the RP assess model differences. Finally, the RP would have appreciated the presentation of a continuity run of the traffic light approach within the assessment to compare the preferred model with an updated result from a previously approved management strategy.

The RP found the overall presentation of monitoring programs well documented in the stock assessment. However, several recommendations should be considered to improve the next benchmark stock assessment. In particular, the RP recommends providing additional information and justification on the data sources evaluated, and additional types of data sources should be considered. The RP feels that, although the data sources used in the assessment were appropriate,

the assessment report itself lacked sufficient justification for inclusion of specific data sources beyond listing the available monitoring programs. The potential exclusion of data sources from the assessment (e.g. recreational survey, commercial CPUE, total number of commercial licenses sold) should have been made available within the body of the stock assessment report to comparatively assess all available data streams. The RP also recommends that additional evaluation of the data sources with respect to each other should be performed. For example, available surveys, particularly fishery-dependent monitoring programs, should have been examined to determine if significant correlations were present with commercial landings. Correlation matrices of the difference indices (with appropriate time lags) are instrumental in looking for consistent signals. These were provided at the RP's request during the assessment workshop, but should be included in the draft assessment report. Finally, environmental information, including fresh water input, river flow, frequency and intensity of environmental perturbations (*i.e.* hurricanes), as well as large scale climatic indices (*e.g.* AMO/NAO/ENSO) should be explored to determine if any mechanistic physical parameters affecting recruitment or abundance could be identified and potentially included within the assessment model. However, the AT did present a number of comparisons including commercial landings relative to large hurricane events to the RP at the peer review for further consideration.

2.1.2 Consideration of survey and data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, sample size)

The RP found the description of data bias following each monitoring program helpful in assessing potential weaknesses of individual surveys. However, several recommendations should be considered to improve the next benchmark stock assessment. In particular, the RP recommends that a discussion on comprehensive issues with current sampling methodologies, including the lack of larger-scale, regional information, and whether or not surveys were tracking population abundance. Also, a proportion of positive tows for individual monitoring programs would be helpful in assessing the utility of individual sampling programs within the assessment model. Finally, appropriate comparisons of the different data sources with each other are very useful for evaluating the information content of the different sources. Much of this information was supplied to the RP upon request during the peer review workshop, but should be included in the assessment report.

2.1.3 Calculation and standardization of indices and other statistics

The RP found the calculation and standardization of indices and other statistics consistent with current best scientific practices. Specifically, the RP appreciated the incorporation of environmental variables into index standardizations given the historical information regarding environmental consideration within the assessment report. The application of GLMs to standardize indices was well documented in P120. However, a table of covariates and error structures for individual standardized indices is recommended for all indices in future assessments within the assessment report. Also, environmental indices, including those described in Section 2.1.1 of this report should be considered to examine potential relationships affecting recruitment and/or abundance. Finally, other diagnostics of index and model performance would have helped the RP better understand model parameter selection and comparative performance among models (e.g. GLM fit and residual plots, trace plots and marginal density plots, Gelman diagnostics and posterior distributions).

2.2 Evaluate the adequacy, appropriateness, and application of data used in the assessment.

Multiple data sets from throughout the stock range in North Carolina were used as inputs into the Catch Survey Analysis model broken out by stage (recruit < 127mm and fully recruited > 127mm) and sex, including commercial landings and several fishery-independent indices. The commercial landings data were appropriately characterized using biological samples from Program 436, which ran for most of the assessment time-frame. The development and use of standardized indices for the fishery-independent surveys as input for the model was a significant improvement from previous assessments, as a means to address the influence of environmental variability. The GLM approach used was appropriate and well documented, however a list of all available covariates for each index, as well as presentation of additional diagnostics of standardization (e.g. deviance explained, AIC, etc.) would improve the RP's understanding of the effects of standardization.

A limitation for the indices utilized (with the exception of SEAMAP) is that they each cover a small spatial and temporal component of the unit stock. As such, while some of the indices showed similar patterns for the same stage and sex, others did not. There also appeared to be very real differences in regional trends between Pamlico and Albemarle sounds. Since assessment models typically have difficulty reconciling conflicting indices, the RP discussed the merit of developing combined indices by sex and stage outside the model rather than treating each survey as an independent index. Upon request by the RP, the AT ran a sensitivity analysis that incorporated combined indices to provide a more comprehensive stock-wide signal by stage and sex for model input. This model run had minimal impacts on biomass trends, and no effect on stock status. However, the RP recommends further exploration of a means to fully capture stock-wide changes in abundance for future assessments. Combining indices may also benefit the model implementation by reducing the number of parameters that must be fit.

A temporal change in abundance is reflected in some of the datasets after 2007, and it was unclear what caused this drastic change and whether it was explored by the AT. Therefore, the RP requested a sensitivity run that explored a time-block to allow for differences in catchability after 2007. While, this run had better fits to some of the indices, it increased the number of estimated parameters and did not change stock status. This sensitivity run supports the use of a single time-block, but further exploration into the data sets to investigate this temporal change will provide further justification for inclusion/exclusion of these data sets for future assessments.

To evaluate the contribution of each index to the model the RP suggested sensitivity runs that serially removed indices. As time did not allow for this process, the AT ran a sensitivity run that dropped Program 100, the Albemarle Sound juvenile trawl survey, which had the most pronounced change in abundance after 2007, and a run that dropped Program 120, the Estuarine Trawl Survey, which samples south of Albemarle Sound. Both of these sensitivity runs had negligible effects on the results compared to the base model, suggesting the model is robust to these data inputs.

The RP also discussed the appropriateness of SEAMAP as an index of abundance for the model considering the habitat sampled by the survey and unknown coastal mixing of nearby stocks (e.g. Chesapeake Bay). While SEAMAP is the only survey that samples the entire stock range within NC, the RP is concerned that there is limited connectivity between the component of the stock sampled in the ocean and the remainder of the stock in the estuaries.

The start date for the assessment was 1995. While harvest of blue crabs from North Carolina has been occurring for much longer than the assessed timeframe, the start date was adequately justified by reliable commercial landings following the implementation of the TripTicket Program in 1994 and survey data with associated environmental data becoming available in 1997. However, the RP recommends future reports consider the effect of historic harvest levels on starting biomass and evaluation of stock status.

A large data gap for this assessment is unknown recreational harvest. Expert opinion from the AT is that recreational harvest is minimal compared to commercial harvest, and available data are not considered reliable enough to estimate harvest accurately, so recreational harvest was assumed to be zero. However, it is known that recreational harvest is not zero, and data from other states suggest that it may be substantial. A sensitivity run conducted during the review workshop indicated the model results and stock status are robust to this uncertainty. Further, the RP acknowledges the difficulty in estimating recreational harvest based on the available mail surveys and no license requirement to recreationally crab in the state. Regardless, we highly recommend inclusion of recreational harvest in future assessments.

The annual time-step of this model assumes recruits grow to be fully recruited within one year. Some discussion of the accuracy of this growth assumption for all crabs < 127 mm is needed. The RP recommends exploration of a narrower recruit criteria (e.g. 80mm – 127mm) applied to survey data sets. As discussed in Section 2.1.1, a detailed review of the species life history and its implications for the model set up and parameterization would be useful.

2.3 Evaluate the adequacy, appropriateness, and application of method(s) used to assess the stock.

The assessment integrated three sources of information (life history, fishery-dependent and fishery-independent) into a Catch-Survey Analysis (CSA), specifically catch-multisurvey analysis, that was implemented using a Bayesian parameter estimation method. The use of CSA was initially applied to four groundfish stocks in New England - Georges Bank and Southern New England yellowtail flounder and Georges Bank and NAFO SA 4X haddock stocks (Collie and Sissenwine, 1983). The approach is a stage-based population dynamics model that divides the population into pre- and post-recruits. The population model, involves fitting the time series of observed abundances of pre-recruit and post-recruit individuals to obtain estimates of stage-specific population estimates and fishing mortality rates. The approach has been reviewed and the method is robust to variation in input parameters; however, absolute estimates are sensitive to the ratio of catchabilities for each stage (Mesnil, 2003). CSA has been applied to a variety of crustacean species including northern shrimp in the northwest Atlantic, king crab in Alaska, and blue crab in Delaware Bay, Chesapeake Bay, and the eastern and western Gulf of Mexico (Miller et al., 2011, 2005; VanderKooy, 2013; Wong, 2010; Zheng et al., 2002). Miller et al. (2005, 2011) refined the model to include multiple surveys and relaxed the assumption that catch is known without error.

The RP concluded that the Catch-Multiple Survey Analysis presented in the Stock Assessment of the North Carolina Blue Crab 1995-2016 is appropriate to understand this stock's fishery and biological dynamics. The stage-based modeling approach is necessary given the difficulty of age determination of crustaceans. Stage-based methods are often used for management and conservation when the length-at-age relationship is not well understood (Rogers-Bennett and Leaf, 2006). The sensitivity runs in the assessment report, and those requested by the RP, further

indicate that the model is robust to the assumptions used in the model. The use of quantitative stock assessment methods is an improvement over those such as the traffic light methods used previously for this stock.

Although the RP believes the model configuration is adequate, we believe that three aspects of the temporal dynamics of the model should be addressed. The RP advises that each of the input time series included in the model should be on the same temporal scale. Particularly, the commercial harvest should coincide temporally with the life-history of the blue crab stock in North Carolina and coincide with the indices of abundance – August 31 to September 1. The RP agrees with the decision to lag the fall fully recruited indices forward to the next year, but with up to 30% of the harvest occurring after the index is developed, this could create inconsistencies between the index and population. Adjusting the fishing year to be consistent with the index year will alleviate this concern.

Another structural issue in the model that we recommend the AT review and discuss is the time span of the assessment. The stock has been exploited by both the recreational and commercial sectors for a very long time, and identification of the relative magnitude of harvest from each sector is necessary.

The third temporal aspect of the model that we would encourage the AT to review is the temporal scale of the indices of abundance used in the assessment model. We encourage the AT to review the indices of abundance to identify the time period (months) and associated length-class (minimum and maximum carapace lengths) that are representative of the pre- and post-recruit individuals. Such an approach would require censoring the indices of abundance using methods as described in Sections 2.1 and 2.2 of this report.

We would encourage the AT to consider reducing the number of parameters that are estimated in the model. One way this could be accomplished is to aggregate sexes which would result in increased parsimony because the number of catchability parameters would be reduced. Similarly, the aggregation of sex in the model and the reasonable assumption of a 1:1 sex ratio may result in a greater precision of fitted abundance indices.

The review panel was concerned that estimates of some biological characteristics are not consistent with those of the natural stock, particularly the estimated natural mortality rates. We believe that the magnitude of the natural mortality rate estimates for both the pre- and post-recruit stages are unreasonably low – at least when compared with those incorporated into the Chesapeake Bay blue crab stock assessment (Miller et al., 2011, 2005). That the natural mortality rate estimates of the pre-recruit and post-recruit stages are equal does not seem biologically reasonable. We believe that aggregating sexes and using an informed prior on the natural mortality rate is necessary and desirable as it would provide more structure to model and perhaps reduce the problematic boundary condition estimates exhibited by the posterior distribution. Further, the RP is concerned about the ability for natural mortality to be estimated within the model, especially when the estimated values are so different from previously published estimates (*e.g.* those in the Chesapeake Bay).

The *de facto* alternative model used in the assessment was a qualitative "traffic light" approach that made use of a variety of indices to describe the fishery and the biological conditions of the stock (Caddy, 1999). We believe that an alternative model, such as a biomass dynamics model, should be used to support the assessment. The use of an alternative model can be used as a validation of the results of the stage-structured model. Surplus production models of blue crab

have been used previously for this purpose, notably for the Chesapeake (Miller 2011) and Gulf of Mexico (VanderKooy, 2013). In these assessments the production model can provide support for the reference point MSY.

2.4 Evaluate the adequacy and appropriateness of recommended stock status determination criteria. Evaluate the methods used to estimate values for stock status determination criteria.

The AT established biomass threshold and target reference points as spawner per recruit (SPR) values 30% and 40% greater than the average of three lowest SPR values observed over the time period of the assessment. Fishing mortality reference points were set at the F values that produced these levels of SPR. The AT indicated that a poor fit to the spawner-recruit relationship and difficulty estimating an unfished (virgin) biomass prevented development of more commonly used maximum sustainable yield (MSY) reference points, or those based on overall spawning potential. The RP notes that there is little variability in SPR over time, and the degree of risk in the SPR values selected is unknown (*i.e.* they could be ultra-conservative or ultra-liberal). Also, it would be useful to present the YPR and SPR surfaces, rather than just the time series, in order to evaluate the selected reference point values relative to alternative values.

The RP recognizes the difficulty establishing more quantitative reference points given the available data, and status determinations appear robust to model assumptions using the reference points selected; however, the RP recommends the AT investigate development of more quantitative reference points. For example, stock assessments for blue crab in the Gulf of Mexico (Vanderkooy 2013) and Chespeake Bay (Miller et al 2011) have similar issues fitting the spawner-recruit relationship, yet both establish MSY-based reference points. We believe that although MSY or MSY proxy reference points, though plagued with considerable uncertainty because of the environmental dynamics that impact the stock, should be explored and discussed. At a minimum these could be used as qualitative references for management (Fogarty and Gendron, 2004).

Blue crab population dynamics are considered to be highly influenced by regional environmental variation (Vanderkooy, 2013). Vanderkooy (2013) notes that for the Gulf of Mexico Blue Crab stock: “Changes in the supply and distribution of rainfall could have significant impacts on estuarine productivity and threaten blue crab fishery sustainability”. Recruitment of Atlantic menhaden (*Brevoortia tyrannus*) is also highly influenced by a number of interacting environmental factors and processes (Buccheister et al. 2016), and management is based on relative spawning potential (ASMFC 2017). We recommend further investigation into methods to estimate unfished biomass, and therefore development of reference points based on spawning potential.

Other possible reference point methods include egg per recruit models, as have been used for both US and Canadian lobster (although this method is not currently used for either stock), or incorporation of environmental parameters to improve understanding of recruitment dynamics. Leaf and Friedland (2014) used environmental indices of stock productivity to identify drivers of recruitment patterns of Georges Bank Haddock.

We reiterate that although status determination appears robust to the model, the RP has concerns about the reference points selected. A number of alternatives are provided above, with a priority on MSY-based reference points. The above guidance should not be considered a comprehensive discussion on the available alternatives, and the AT is encouraged to conduct research into

appropriate reference points given the life history and data gaps, and also to further evaluate the risks associated with per recruit reference points selected.

2.5 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.

The RP is satisfied that the sex- and stage-structured CSA model presented as the base run of the assessment report is suitable for management use for the next five years. A number of uncertainties and possible areas of concern with the available data, model assumptions and structure, and reference points have been identified throughout this report that could be addressed to improve the model in the future; however, sensitivity runs clearly indicate that the model results and status determinations are robust to the RP's primary areas of concern. Further, the results of the assessment are consistent with the lead biologists' perceptions of the fishery and stock dynamics. These two points provide credence to the RP's determination that the model provides a valid basis for management of North Carolina's blue crab stock.

Although the RP approves the use of this model for the next five years, we do not advocate that management decisions over that entire time period be based on the results of a 2018 model run. Because of the short life span of blue crabs, as well as other biological and environmental influences, it is strongly recommended that the model be updated at least once within the approved management time period of 5 years.

2.6 Evaluate appropriateness of research recommendations. Suggest additional recommendations warranted, clearly denoting research and monitoring needs that may appreciably improve the reliability of future assessments. Team

The RP agrees with many of the research recommendations in the assessment report. However, we advise that the AT prioritize these, categorically at a minimum, to focus primarily on improving the precision and accuracy of those data that address deficiencies in the assessment model and decision-making. For this reason, we recommend categorizing as high priority the development of a state-wide fishery-independent index of abundance for both life-stages, beyond the "continue existing" programs. This would serve to reduce the dimensionality of the input data (and number of parameters) and allow aggregation of the spatial-temporal issues in the indices. Similarly, the review panel would advise that a high priority research item is to characterize the magnitude of recreational harvest. Finally, given the difficulty to understand stock and fishery status, we believe that the evaluation of alternative reference points should be a top priority. We suggest that the assessment and management group in the agency review the options of fishery-reference points for invertebrate stocks (crustacean and molluscan stocks) that exhibit similar life history and stock recruitment dynamics.

Of medium priority, the RP would recommend evaluating ecosystem and environmental effects on the blue crab stock. Blue crab are a common prey item of many benthivores (Oshima and Leaf, 2018), and patterns in predator abundance likely influence stock dynamics. Further, the influence of environmental events, such as rainfall/freshwater influx, temperature anomalies, or major storms could be evaluated with respect to abundance, or even just availability to surveys and the fishery. We would also recommend investigation of alternative model types, such as a biomass dynamic model. Alternative models could provide corroboration in model results, but

may also provide more quantitative reference points. Finally, we believe that exploring genetic stock structure and age and growth determination of blue crab to be of relatively low priority.

3 ADDITIONAL COMMENTS

Overall, we would like to commend the AT for their innovative approach to the assessment of blue crab in the State of North Carolina. The RP does have a few suggestions that might help improve this assessment as well as future assessments. The traffic light approach should have been included within the body of the assessment report to consider a continuity run of a previously established management method alongside the newly developed assessment model. However, it should be noted that the AT did provide the results of a continuity run in comparison to the new model during the peer review. Also, the RP would have appreciated if the model was made available in print and digital form prior to the review workshop in order to evaluate the code, understand mechanics of the analyses, and perform sensitivity runs independently. Finally, the RP would have preferred more time prior to the review in order to allow for a longer period of review.

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10.3 APPENDIX C: Additional Sensitivity Analyses

Per the peer reviewers' request, the working group explored eight candidate models (Model 5 – Model 12), additional to the baseline model (Model 1) and the three ones (Model 2 – Model 4) that are included in the report (Table C1). The fitting to catch data (Figures C1-C3), estimated population size (Figures C7-C8), estimated natural mortality (Figures C9-C10) and fishing mortality (Figures C11-C12) by the two-stage model were quite robust to the assumptions that have been explored, such as natural mortality assumptions, recruitment-spawner relationship, dropping spawner indices, higher catch to account for recreational catch. One exception occurred in Model 8 in which a high input value of natural mortality (M=1.2) resulted in relatively high population size estimates (Figure C8).

Assumption of time-block catchability and the use of combined indices slightly improved the model fitting to abundance indices (Figures C4-C6). Estimated spawner abundance and recruitment showed weak relationship in all candidate models except the Model 4 where a Ricker curve was assumed (Figures C13-C14). Comparing the stock status from all candidate models based on biological reference points that are commonly used (including the maximum sustainable yield based, yield-per-recruit based), an overfished stock and overfishing were suggested in most cases (Table C2).

Tables

Table C1. Additional sensitivity runs (bolded) that have been explored during peer-review workshop.

Model	Features
Model 1 (baseline)	Sex- and stage-specific natural mortality Recruitment free parameter to estimate (lognormal distribution) Time-constant catchability All abundance indices Initial year when catch data start (1995) Sex-specific recruits selectivity to estimate
Model 2	Same as Model 1 except a constant natural mortality to estimate
Model 3	Same as Model 1 except a constant natural mortality to input (M=0.55)
Model 4	Same as Model 1 except recruitment follows a Ricker mode
Model 5	**Same as Model 1 except a time-block catchability (2007)**
Model 6	**Same as Model 1 except dropping P100 indices**
Model 7	**Same as Model 1 except dropping P120 recruit indices**
Model 8	**Same as Model 3 except M=1.2**
Model 9	**Same as Model 1 except using the combined indices**
Model 10	**Same as Model 1 except increasing catch by 15% to account for recreational catch**
Model 11	**Same as Model 1 except dropping all spawner indices (P195 and SEAMAP)**
Model 12	**Same as Model 1 except using fishing year catch data (September 1-August 31)**

Table C2. Stock status determination from sensitivity analysis.

Scenario ID	$N_{SP,\ 2016}$ (10^6)	F_{2016}	$N_{SP,\ MSY}$ (10^6) - threshold	F_{MSY} - threshold	Overfished	Overfishing
Model 1 (baseline)	49.98	1.48	64.48	1.46	Y	Y
Model 2	47.66	1.49	68.54	1.37	Y	Y
Model 3	48.68	1.49	65.1	1.52	Y	N
Model 4	46.03	1.71	79.78	0.94	Y	Y
Model 5	49.47	1.5	63.02	1.46	Y	Y
Model 6	46.22	1.67	67.47	1.32	Y	Y
Model 7	53.5	1.34	71.11	1.31	Y	Y
Model 8	62.13	1.54	59.86	1.84	N	N
Model 9	50.57	1.64	147.63	1.13	Y	Y
Model 10	56.99	1.5	74.41	1.42	Y	Y
Model 11	50.7	1.49	61.38	1.55	Y	N
Model 12	56.57	1.84	74.24	1.39	Y	Y

Figures

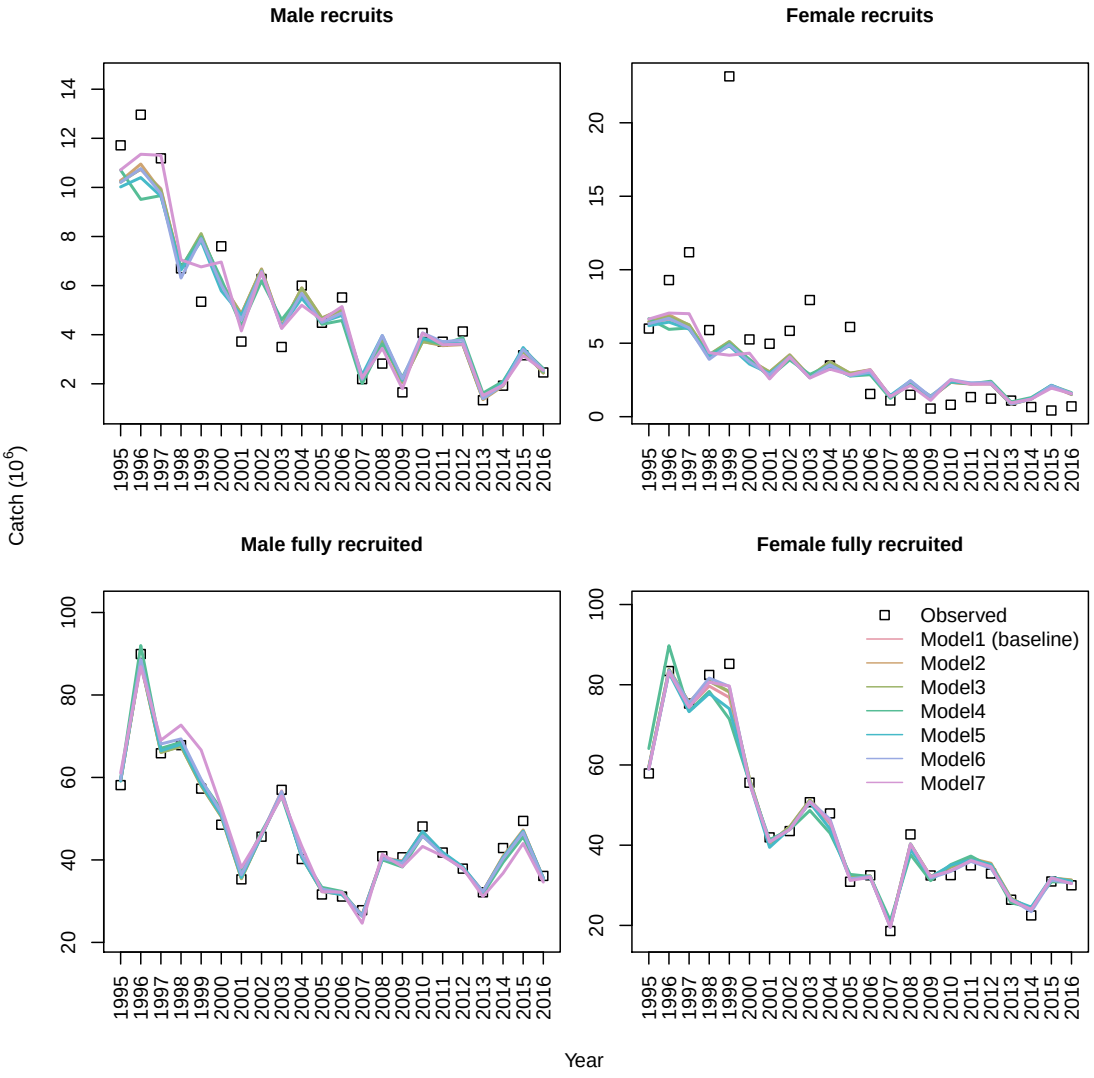

Figure C1. Estimated commercial catch of North Carolina blue crab from candidate models M1-M7, with lines representing posterior mean. The Please refer to Table 1 for the explanation of candidate models.

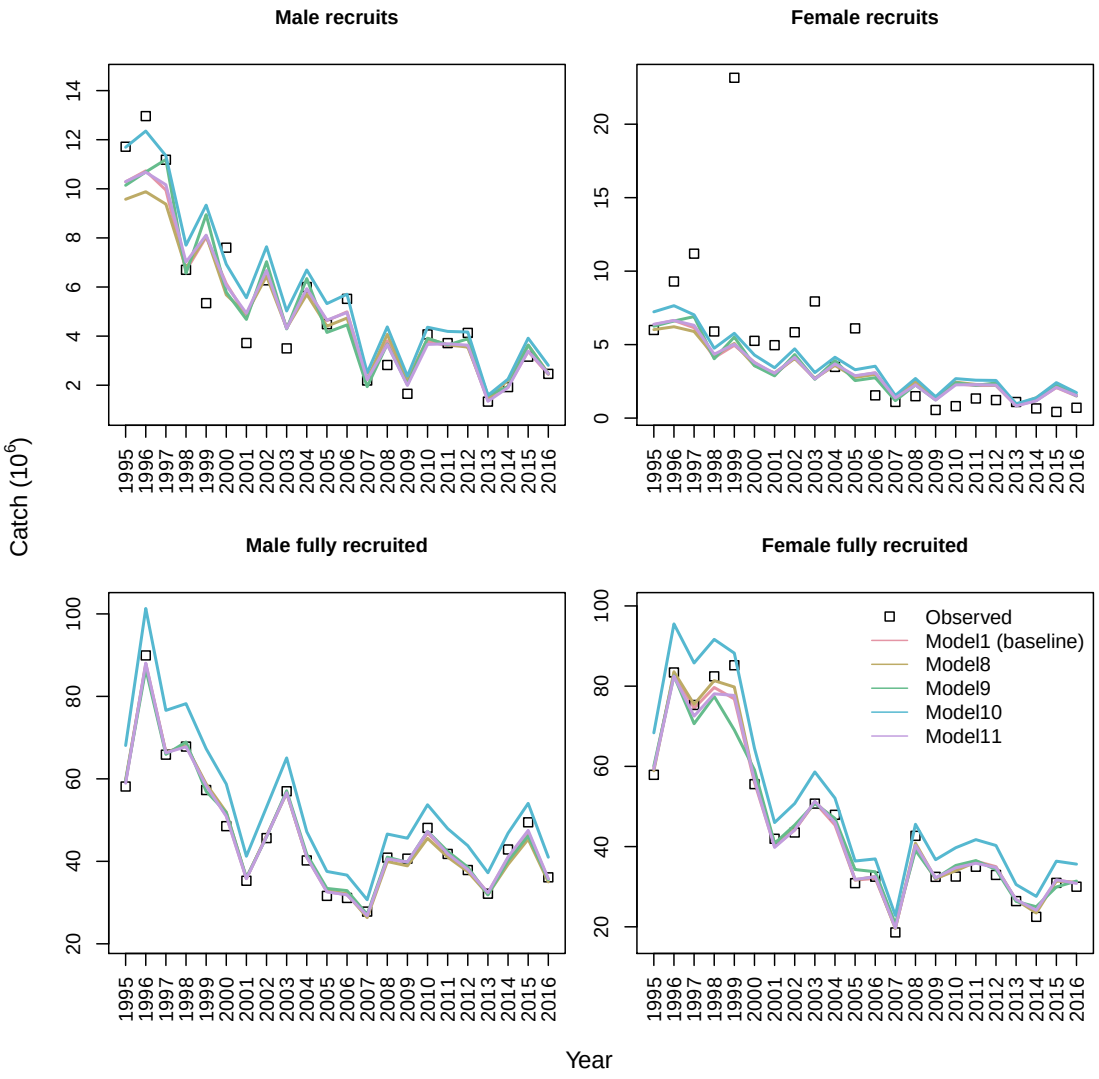

Figure C2. Estimated commercial catch of North Carolina blue crab from candidate models M8-M11, with lines representing posterior mean. The Please refer to Table 1 for the explanation of candidate models.

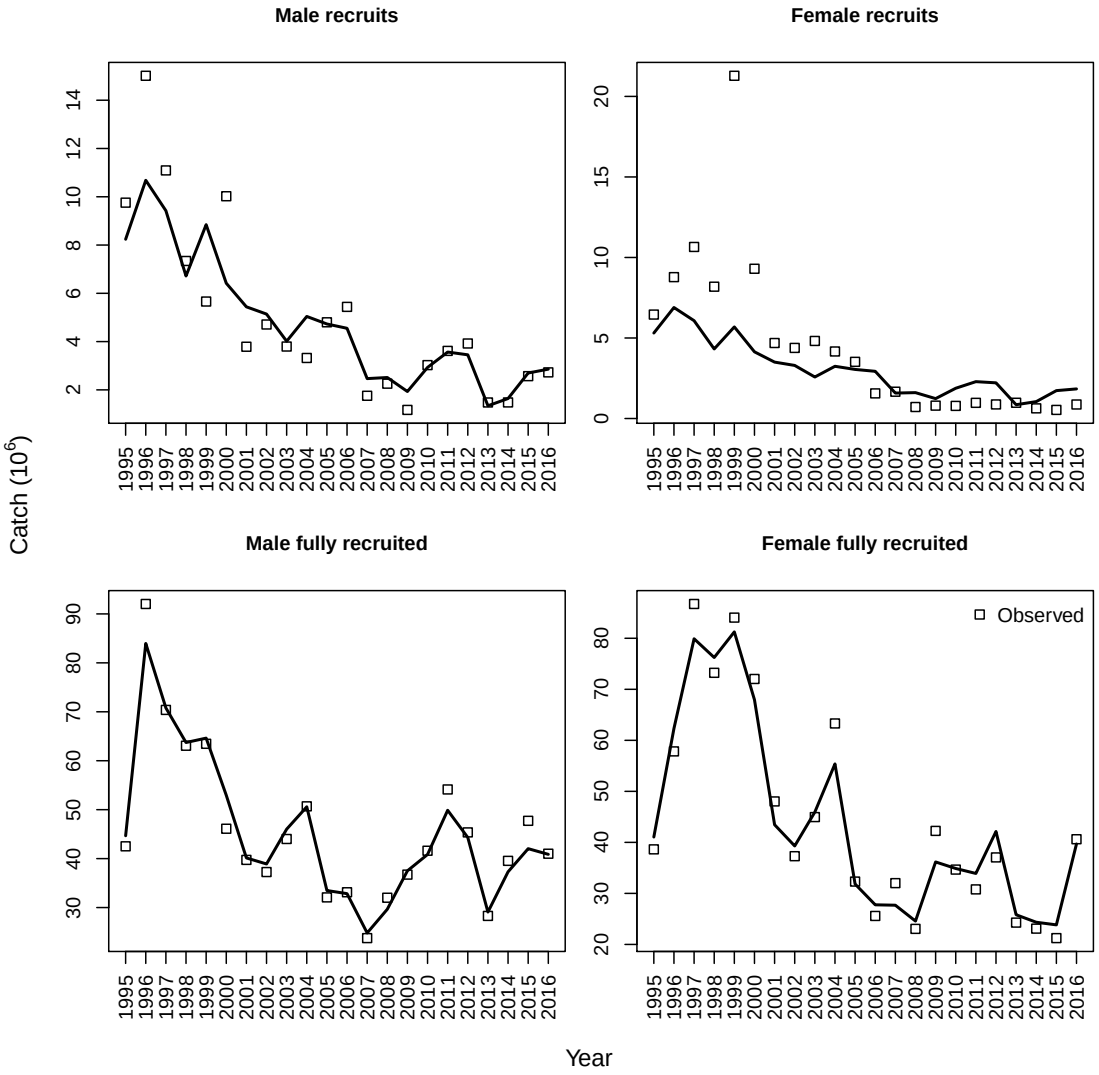

Figure C3. Estimated commercial catch of North Carolina blue crab from candidate models M12, with lines representing posterior mean. The Please refer to Table 1 for the explanation of candidate models.

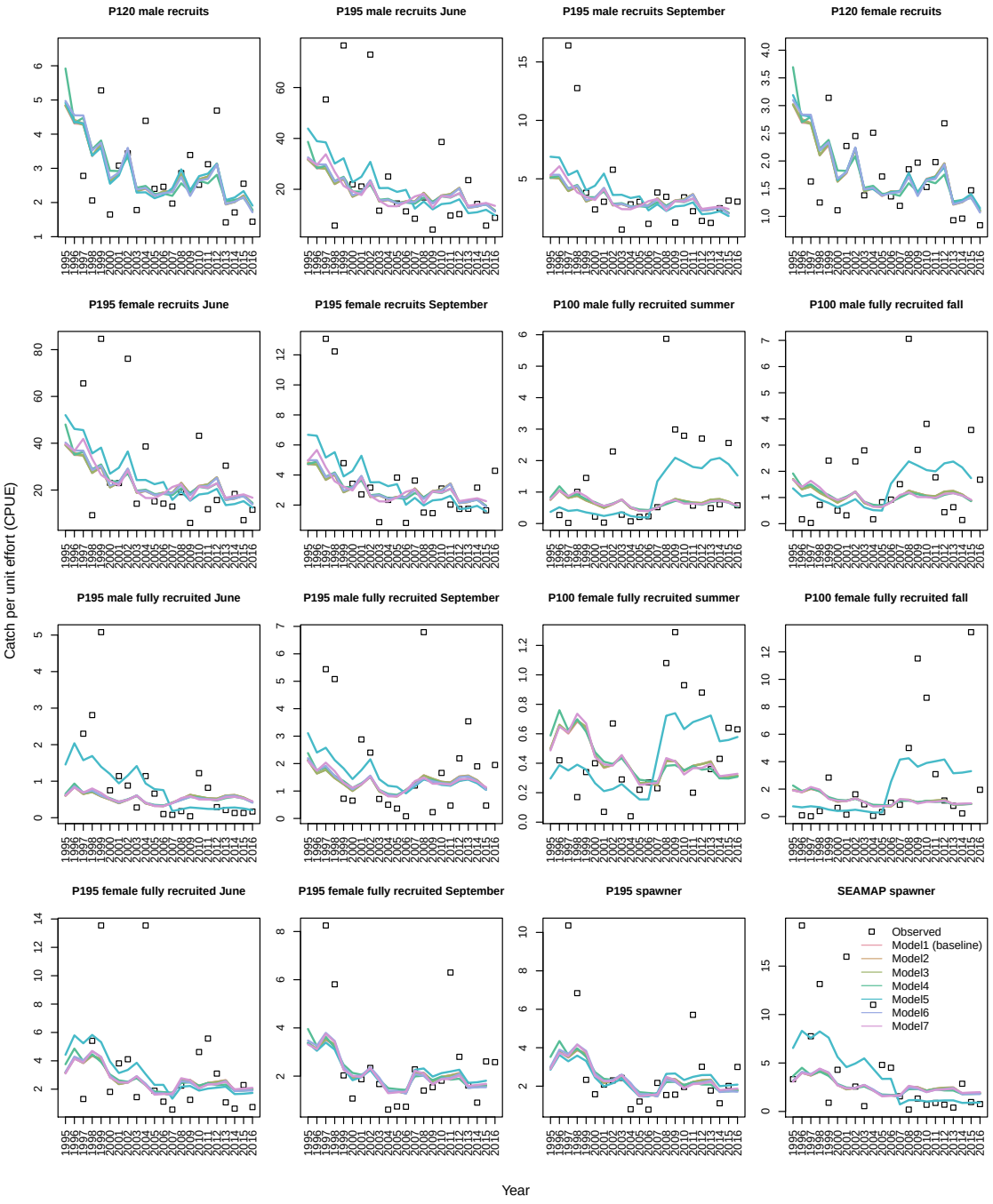

Figure C4. Estimated abundance indices of North Carolina blue crab from candidate models M1-M7, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

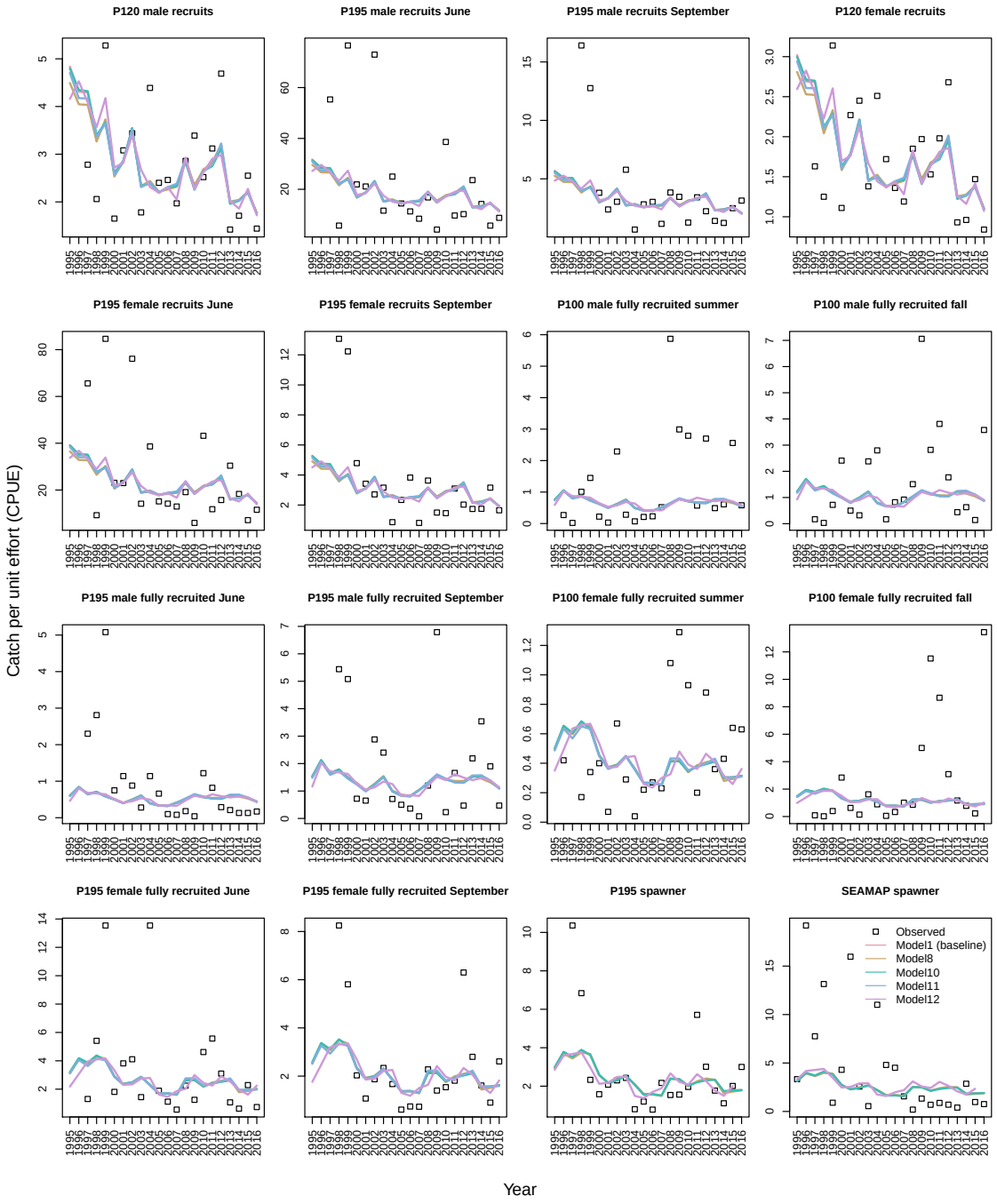

Figure C5. Estimated abundance indices of North Carolina blue crab from candidate models M8, M10-M12, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

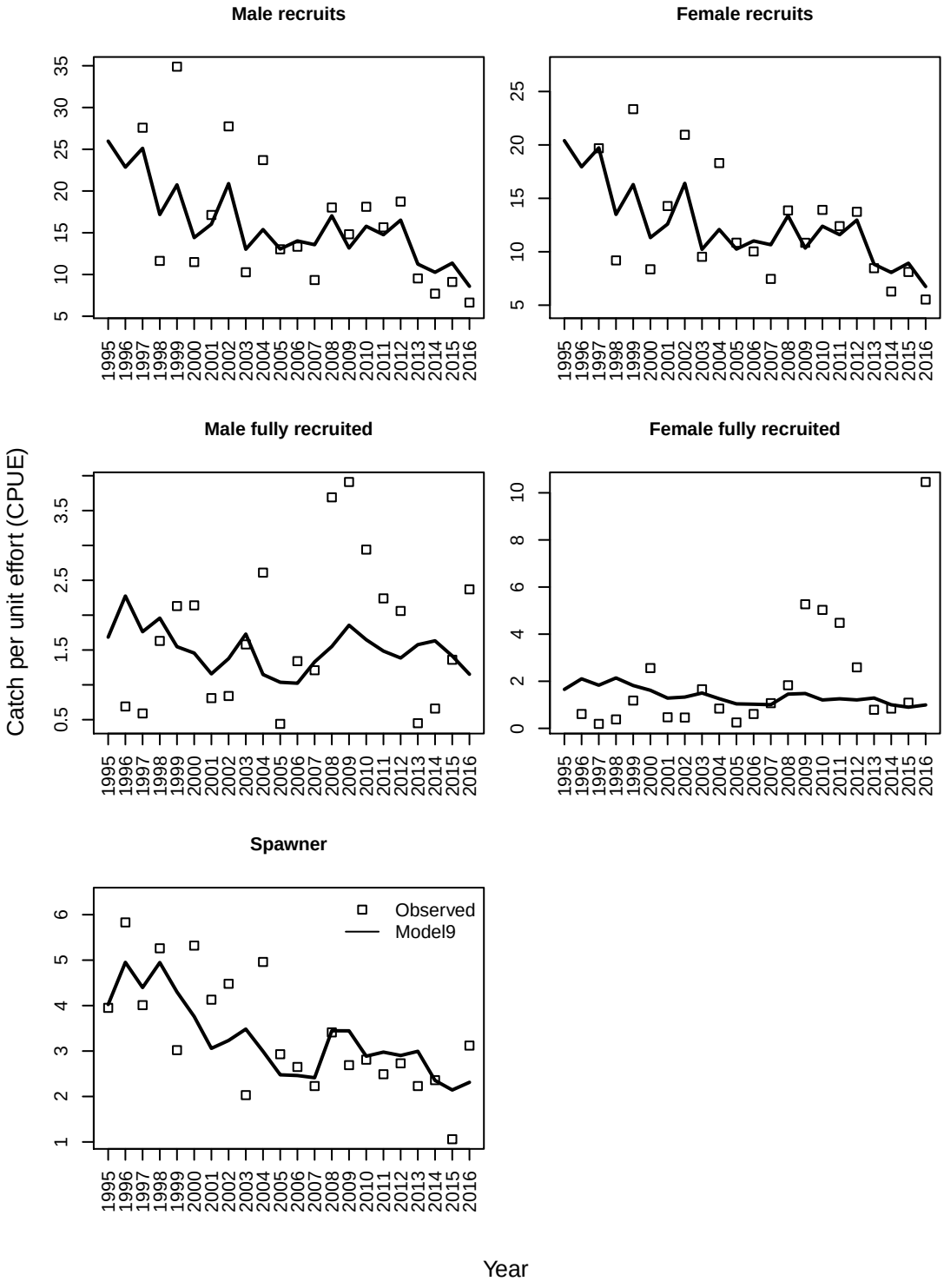

Figure C6. Estimated abundance indices of North Carolina blue crab from candidate models M9, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

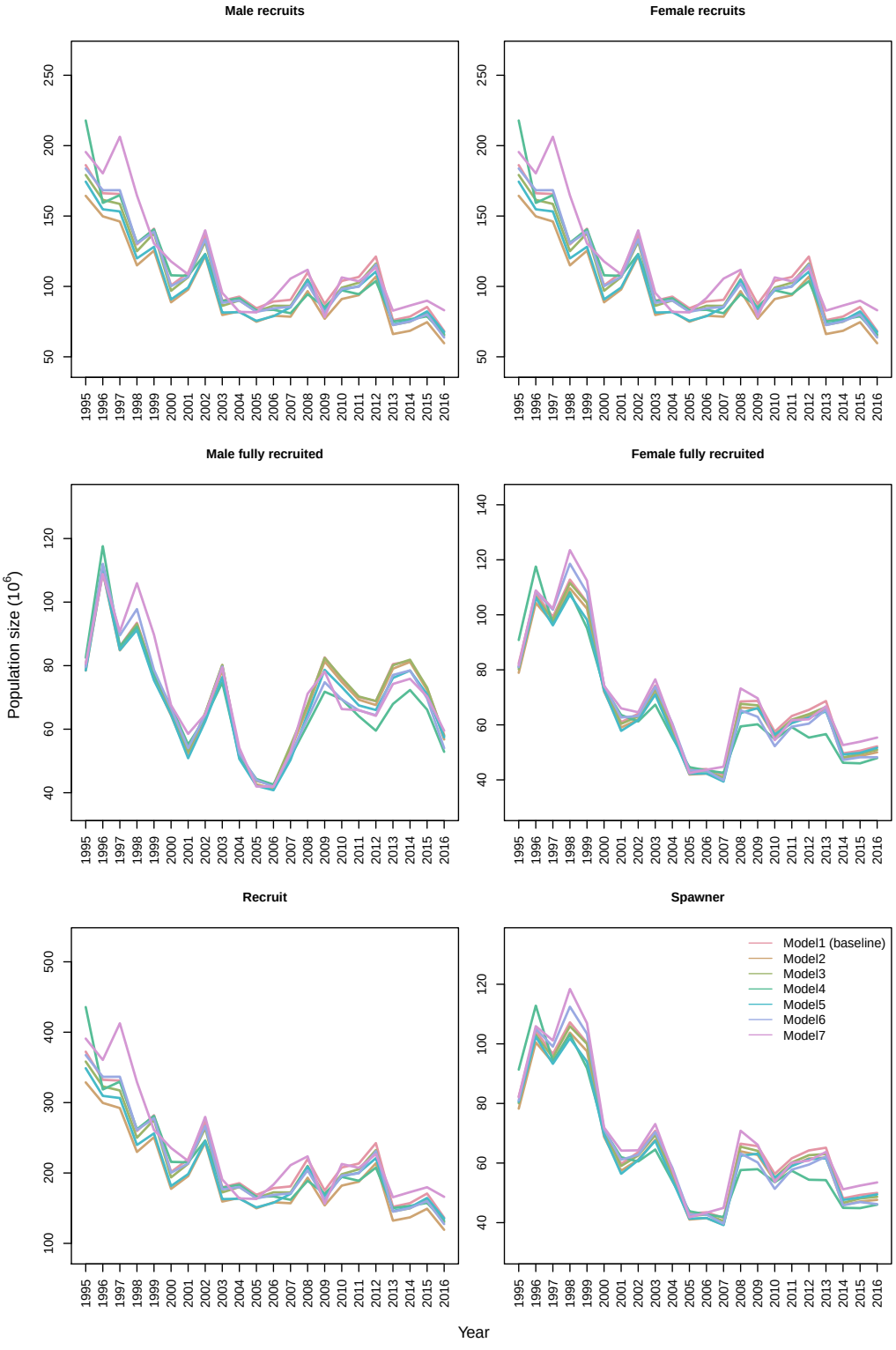

Figure C7. Estimated population size of North Carolina blue crab from candidate models M1-M7, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

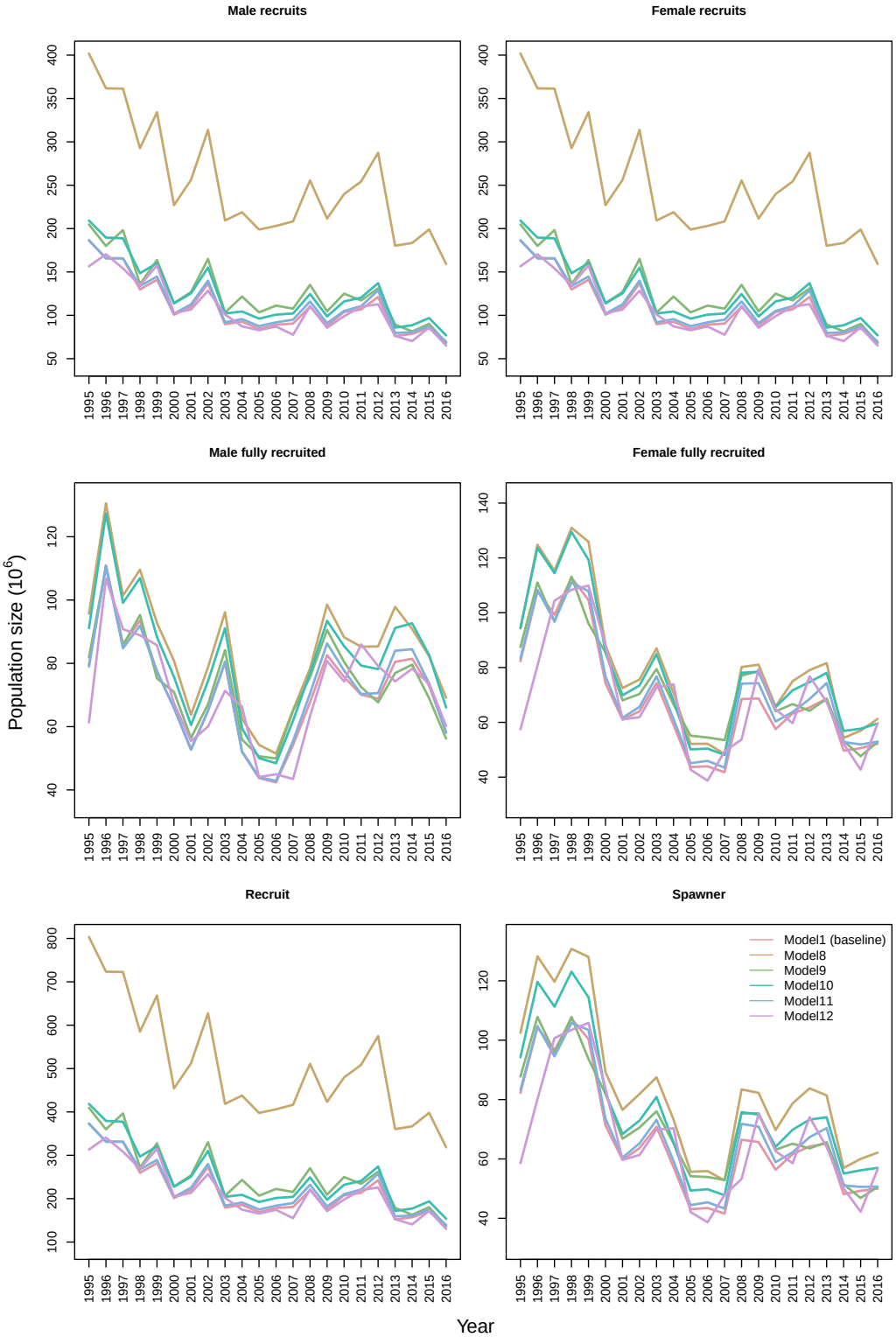

Figure C8. Estimated population size of North Carolina blue crab from candidate models M8-M12, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

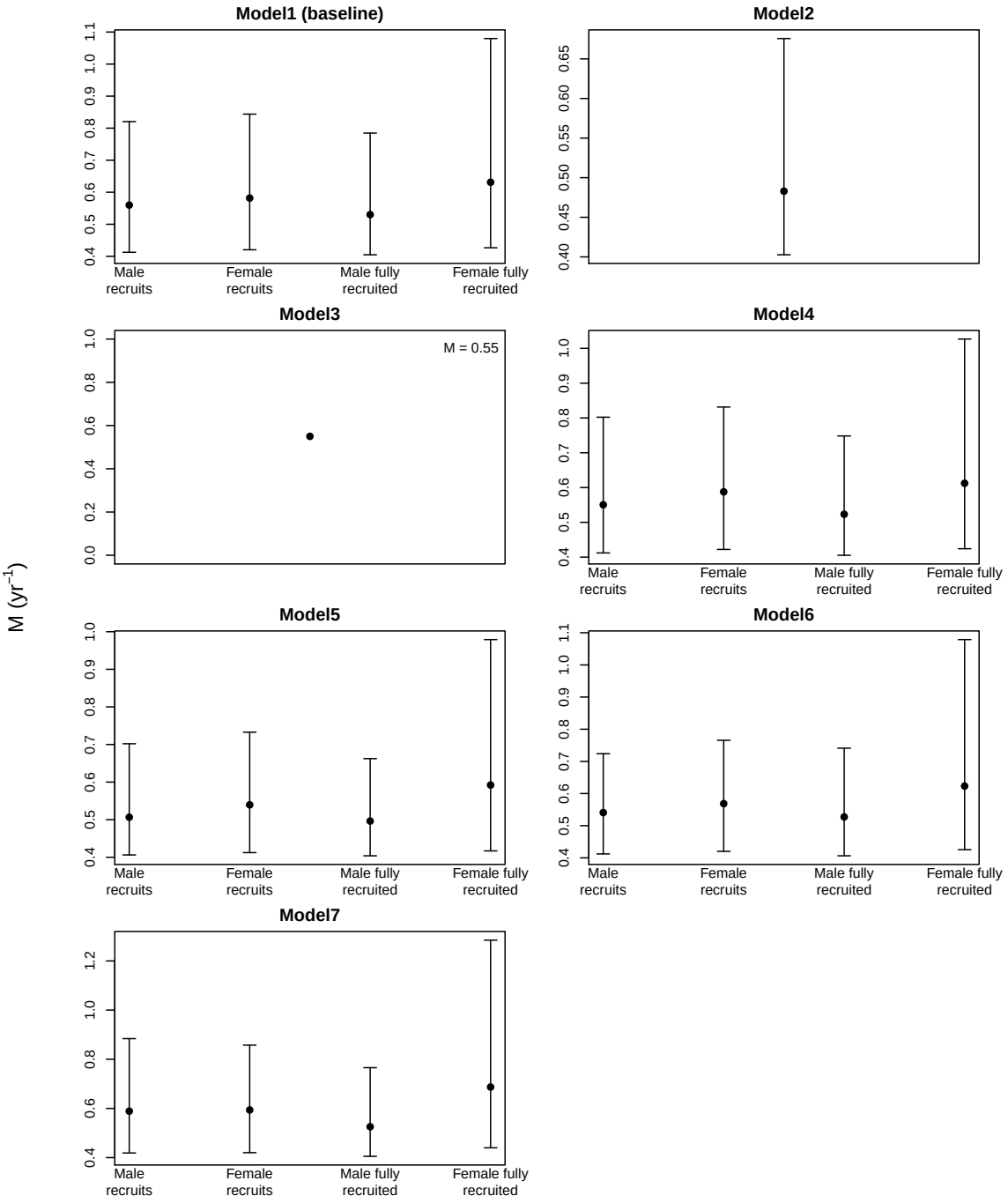

Figure C9. Estimated natural mortality (*M*) from candidate models M1-M7, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

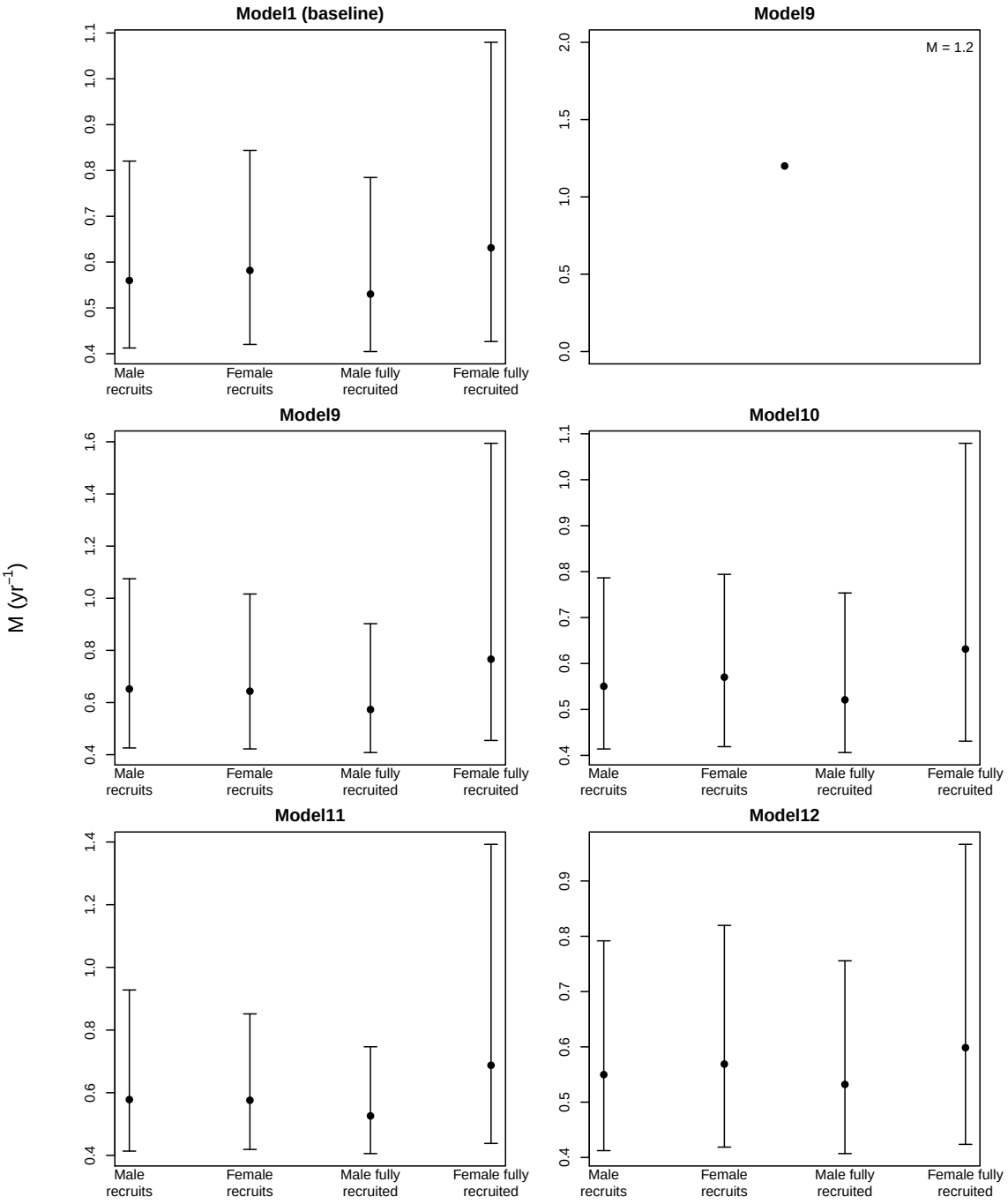

Figure C10. Estimated natural mortality (*M*) from candidate models M8-M12, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

Figure C11. Estimated fishing mortality (*F*) of North Carolina blue crab from candidate models M1-M7, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

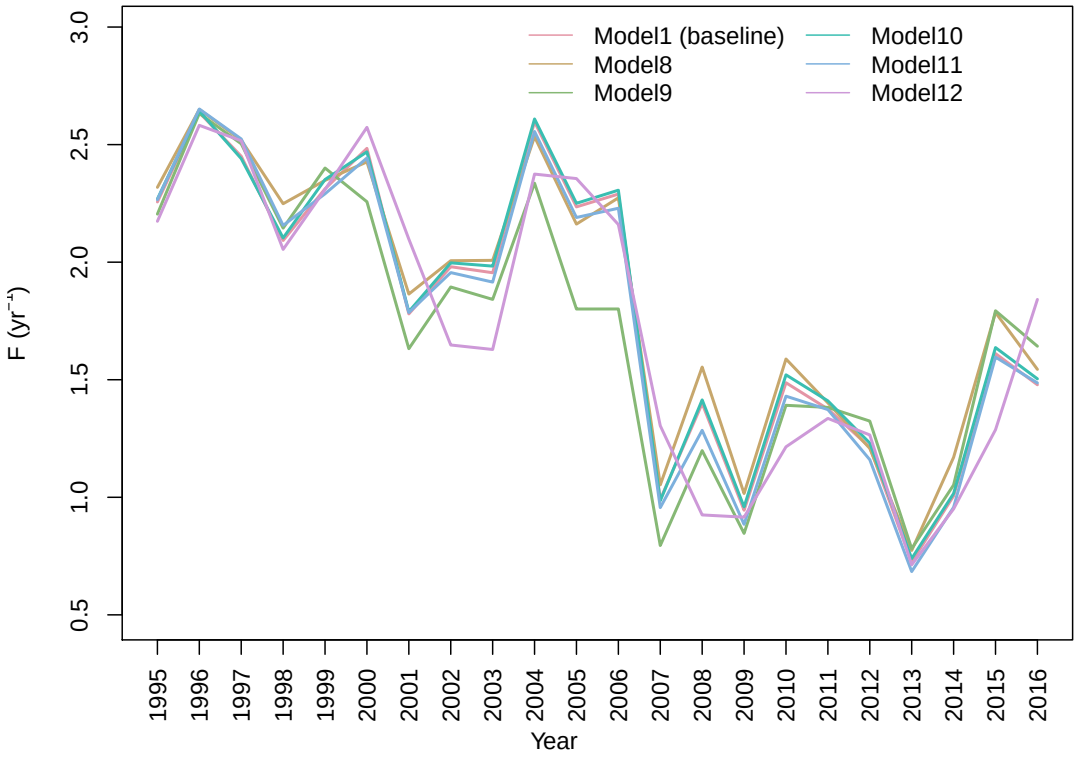

Figure C12. Estimated fishing mortality (*F*) of North Carolina blue crab from candidate models M8-M12, with lines representing posterior mean. Please refer to Table 1 for the explanation of candidate models.

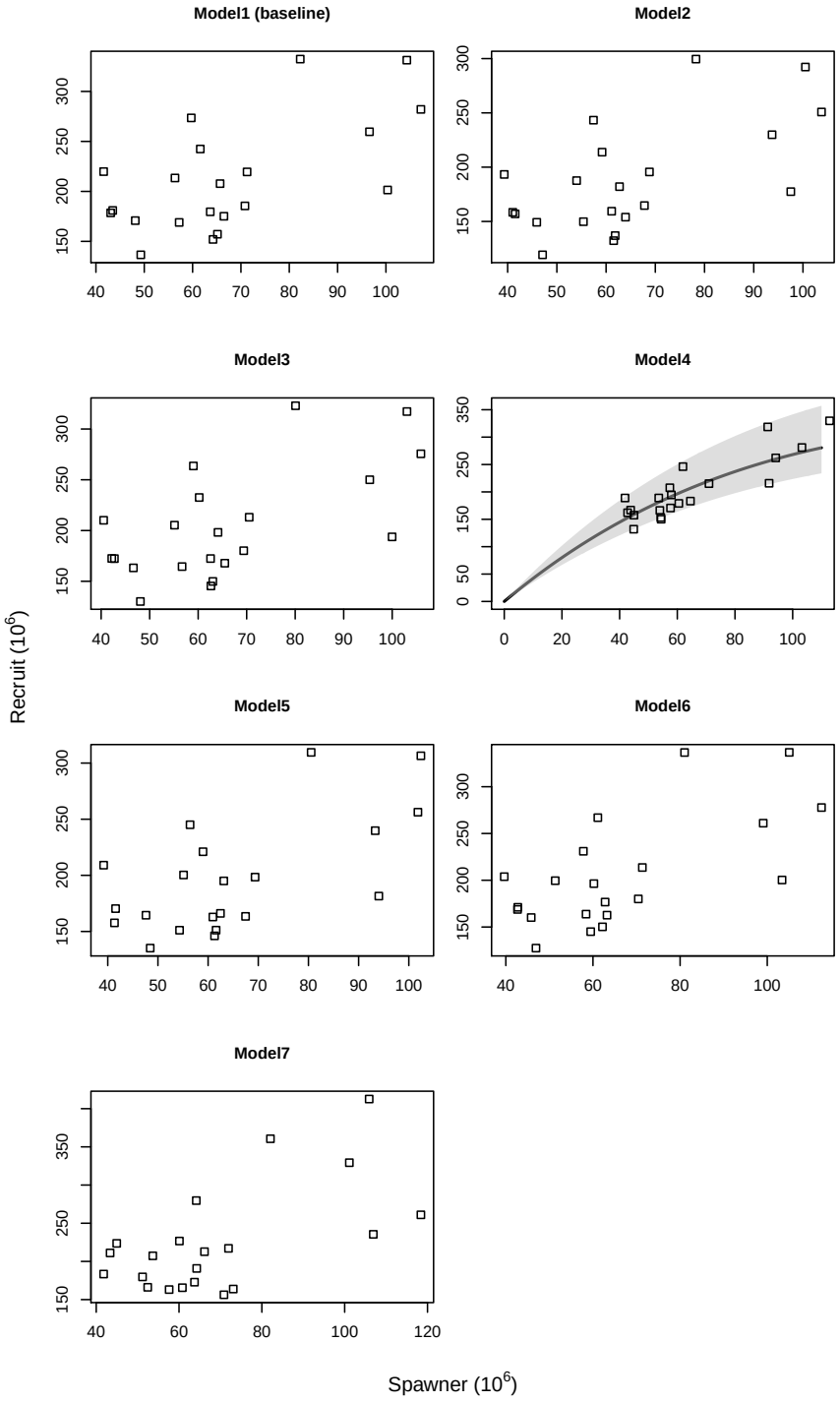

Figure C13. Estimated recruitment and spawner relationships from candidate models M1-M7. Models show the estimated annual average of recruits and spawner stock size except Model 4 which shows the estimated recruits given a spawner stock size assuming a Ricker curve, with lines representing posterior mean and shaded area representing 95% credible interval. Please refer to Table 1 for the explanation of candidate models.

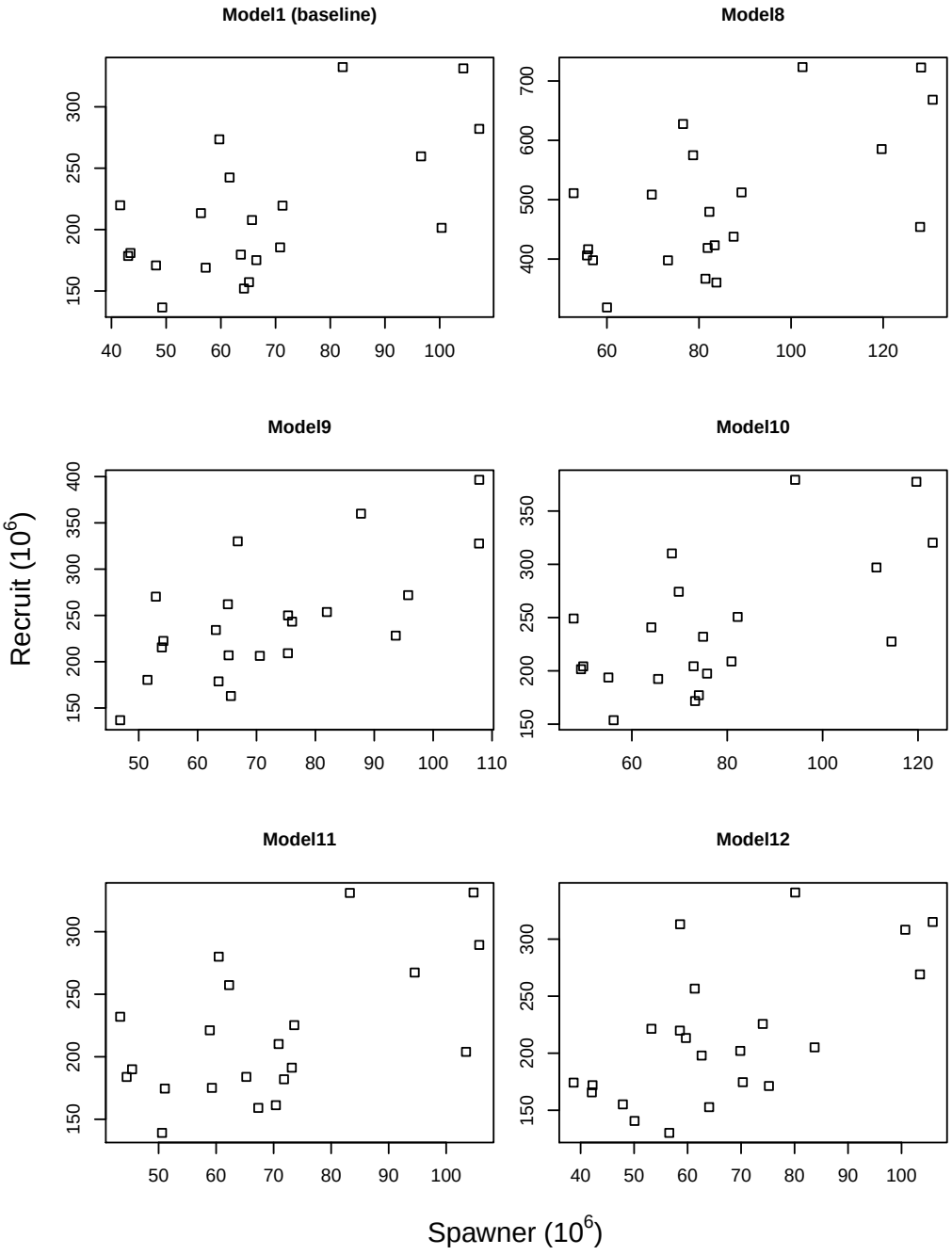

Figure C14. Estimated recruitment and spawner relationships from candidate models M8-M12. Models show the estimated annual average of recruits and spawner stock size Please refer to Table 1 for the explanation of candidate models.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 16, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Chris Stewart, Shrimp Species Lead
Jason Rock, Shrimp Species Co-Lead
Kevin Brown, Gear Development Biologist
Fisheries Management Section

SUBJECT: Shrimp Fishery Management Plan Workgroup Update

The Shrimp Bycatch Reduction Industry Workgroup met on April 4, 2018 to review the final results of the 2015-2017 gear testing and develop its recommendations to reduce bycatch in the shrimp trawl fishery as mandated by the Shrimp Fishery Management Plan Amendment 1. The workgroup was tasked to initiate a three-year study to test bycatch reduction devices to reduce bycatch to the extent practicable, with a 40 percent target reduction. Promising gear configurations were to be brought back to the Marine Fisheries Commission for consideration for mandatory use in the shrimp trawl fishery. Four of the gears tested met or exceeded the 40 percent target reduction in finfish bycatch while also minimizing shrimp loss. A summary of the results from this gear testing, as well as the workgroup's recommendations can be found in the information paper titled "Shrimp Fishery Management Plan Amendment 1: Consideration of Gear Modifications to Reduce Bycatch in the North Carolina Shrimp Trawl Fishery."

Recommendations from the industry workgroup on bycatch reduction in shrimp trawls that may be adopted by the commission as a result of language in Amendment 1 can be implemented by existing proclamation authority and do not require an amendment to the plan (Marine Fisheries Commission Rule 15A NCAC 03J .0104, 15A NCAC 03L .0101, 15A NCAC 03H .0103(b)). Once final management measures are approved by the commission, the information paper will serve as a Revision to Amendment 1 to the North Carolina Shrimp Fishery Management Plan and will document the management strategy changes and rationale. All other management strategies contained in Amendment 1 will remain in force until another Revision, Supplement or Amendment to the N.C. Shrimp Fishery Management Plan occurs. However, due to the number of existing fishery management plans currently open for review, the division does not recommend a review of the Shrimp Fishery Management Plan until warranted by an amendment or the five-year review in 2020.

Shrimp Fishery Management Plan (FMP) Amendment 1: Consideration of Gear Modifications to Reduce Bycatch in the North Carolina Shrimp Trawl Fishery

April 25, 2018

I. SUBJECT

Investigate gear modifications that could be implemented to reduce bycatch in the shrimp trawl fishery.

II. ORIGINATION

The North Carolina Shrimp Fishery Management Plan (FMP) Amendment 1 and the North Carolina Marine Fisheries Commission (MFC).

III. BACKGROUND

MFC Action

In February 2015, the MFC adopted the Shrimp FMP Amendment 1 and its associated rules (NCDMF 2015). The amendment's primary focus is bycatch reduction in the shrimp trawl fishery. The MFC's preferred management strategy called for three years of industry testing of various gear configurations to reduce bycatch to the greatest extent practicable, with a 40% target reduction goal. Testing is to be conducted by a stakeholder group consisting of fishermen, net/gear manufacturers and scientific/gear specialists, partnered with staff from the North Carolina Division of Marine Fisheries (NCDMF) and North Carolina Sea Grant.

Results should minimize shrimp loss and maximize reduction of finfish bycatch. Promising gear configurations are to be brought back to the MFC for consideration for mandatory use in the shrimp trawl fishery.

Various gear combinations were tested against a control net that used a Florida Fish Eye bycatch reduction device (BRD), a federally-approved turtle excluder device (TED) and a 1 1/2-inch mesh tail bag. Gear combinations tested include:

- Composite/square mesh panels,
- State and federal fisheyes,
- Minimum tailbag mesh size, and
- Reduced bar spacing in TED.

In the development of the final management strategies the MFC passed a motion at its February 2014 business meeting specifying the composition of the stakeholder workgroup and gear testing to be conducted. This was presented to the Shrimp FMP Advisory Committee (AC), as well as the MFC regional and standing advisory committees. In February 2015, the Shrimp FMP Amendment 1 and its rules were adopted by the MFC (see Appendix 1 for supporting motions).

Gear specific management strategies implemented by Amendment 1 not only required the development of the stakeholder group and gear testing, but also required fishermen to use either a

T-90/square mesh tailbag or other applications of square mesh panel (e.g., skylight panel), reduced bar spacing in a TED, or another federal or state certified BRD in addition to existing TED and BRD requirements in all skimmer and otter trawls (Proclamation SH-2-2015; Figure 1). To further address bycatch issues and provide fishermen more flexibility, the MFC also allowed the use of any federally certified BRD in all internal and offshore waters of NC. A maximum combined headrope length of 220 feet was also established in all internal coastal waters that did not have existing maximum headrope requirements to put a cap on fleet capacity as a management tool.

Industry Workgroup

The Shrimp Bycatch Reduction Industry Workgroup was formed in 2015. The workgroup met throughout the gear testing process to discuss results and plan for testing. A list of workgroup members is provided in Appendix 2.

Workgroup meeting summary:

- March 31, 2015 – Reviewed existing and previously completed BRD research and selected designs to be tested by the workgroup. Developed operating procedures and established a schedule and protocols for gear testing in 2015.
- Jan. 25, 2016 – Reviewed first year of testing and plan for the second year. Based on testing results, the workgroup further recommended that new BRD/gear configurations should have an acceptable shrimp loss between 3% to 5%, depending on the reduction in bycatch achieved.
- Jan. 9, 2017 – Reviewed results from the second round of testing and selected gears to be tested in 2017. After focusing on large vessels in estuarine waters the first two years, the workgroup added gear testing for small vessels and testing in the ocean in the third year of the study.
- Jan. 22, 2018 – Review the data and findings from the third year of gear testing.
- April 4, 2018 – Review results from the three years of testing and make recommendations for consideration by the MFC.

NCDMF staff provided the MFC updates on the workgroup's efforts during the testing period. NCDMF staff will present the workgroup's recommendations to the MFC at its May 2018 business meeting.

Industry Gear Testing

To evaluate the effectiveness of the various gear combinations selected by the workgroup, comparative tows were conducted aboard large commercial vessels (>46 ft) in 2015 and 2016; testing in 2017 also included smaller vessels (<45 ft) and in the ocean. Comparative tows consisted of paired net tests where a control net and an experimental net are fished simultaneously. Experimental nets were equipped with the candidate BRD or modification to be tested. Control nets for this project consisted of a typical commercial shrimp two-seam otter trawl with a Florida Fish Eye BRD (state certified), 4-inch bar spacing TED, and 1 1/2-inch stretched mesh tailbag. Headrope length was standardized for both control and experimental nets for each vessel. All experimental nets were calibrated prior to formal field trials to minimize potential net bias and all prototype testing following the National Oceanic and Atmospheric Administration (NOAA) BRD Testing Manual (NOAA 2008). A successful tow was defined as the control and experimental

trawl fishing without an indication of problematic events (i.e., crab pots in net) occurring during the tow to impact or influence the fishing efficiency (catch) of one or both nets. Experimental and control nets were also switched from side to side to reduce the potential for side bias and ensure an equal number of successful tows. To eliminate bias associated with the use of a try net (test net pulled for brief periods), the control and experimental nets were tested in the outside nets of the four-barrel (quad) rigs. Gear specification data were collected for both experimental and control nets and included headrope length, mesh size of wing and tail bag, TED type, TED bar spacing, BRD type, location, and duration (tow time). The catch from each net (experimental and control) were sampled by two NCDMF observers. After each paired tow, the entire catch was sampled and the total of weight (kg) of each catch category was recorded. In 2015, only Penaeid shrimp and finfish were recorded; non-shrimp invertebrates, elasmobranchs (sharks/rays), and miscellaneous categories were added for the 2016 and 2017 testing.

Following the completion of each trip, all data were coded and entered into the NCDMF database. Tows were dropped from subsequent analyses if a problematic event (i.e., crab pots in net, hang) was experienced. Paired t-tests (alpha = 0.05) were used to determine whether the catches between the control and experimental nets were significantly different for each category (shrimp and bycatch species). While calibration tows were made prior to testing, some side bias was still assumed in testing. To account for this, test gears were switched between the sides of the vessel throughout testing with the goal of having an even number of tows with the experimental gear on each side of the vessel. When this was not achieved, analyses randomly picked tows so the comparisons would be made with an equal number of tows (with the control and experimental gear) on each side of the vessel. Observed weights were standardized to the target two-hour tow time to adjust for differences in tow times. In 2017, tow-times were standardized to one hour to accommodate the addition of small vessels. The average weight of each net (control and experimental) was computed for each gear and species combination along with the difference in average weight and percent change (percent reduction). A randomization procedure (Manly 2007) was also used to compare catches between control and experimental nets for each gear/species/net combination. The randomization test does not require the data to be normally distributed and does not require tows to be dropped from the analysis. In 2016 and 2017, exploratory analyses were performed to investigate tow side (port versus starboard), time of day (day versus night), and location (2017 only). The results of these analyses indicate that variation in bycatch catch rates is not always due to changes in gear alone; tow side, time of day, and spatial location may also play a role in influencing bycatch catch rates. Generalized linear modeling (GLM) was not used to adjust randomization catch values for potential biases and may differ from those reported in Brown et al. 2017. For a detailed description of the sampling methodology, gear parameters, and full data analysis see Brown et al. (2017, 2018).

Results

A total of 267 comparative tows were made using nine experimental gears during the summer and fall in the Pamlico Sound in 2015 and 2016 (Figure 2). In 2017, a total of 120 comparative tows were made on four experimental gears during the summer and fall in the Pamlico Sound and the nearshore waters of the Atlantic Ocean (Figure 2). Only larger vessels (>46 ft) were used for testing in 2015 and 2016. Testing in 2017 also included smaller vessels (<45 ft). Approximately 98% of the tows (2015-2017) were available for analyses; problematic tows were excluded.

In 2015, only one gear met the 40% target reduction in finfish bycatch set by the MFC (Table 1). The double federal fisheye, 4-inch TED, and 1 7/8-inch tailbag gear combination was found to significantly reduce finfish bycatch by 40.8% based on the t-test results. The randomization test found that finfish bycatch was reduced by 40.1% for this gear combination. While the other experimental gears tested in 2015 failed to meet the 40% target, many of the gears were found to reduce finfish bycatch while minimizing shrimp loss. The composite panel with fish spooker cone significantly reduced finfish bycatch by 25.8% (t-test) to 27.6% (randomization test). Tows made with a 3-inch TED, square mesh panel, and 1 7/8-inch tailbag significantly reduced finfish bycatch by 25.3% (t-test) to 27.5% (randomization test). T-test results indicated the mean weight of finfish bycatch was significantly reduced by 16.2 % using a 3-inch TED and one state fisheye. Of all the gears tested by the workgroup in 2015, the Ricky BRD had the lowest observed reduction in finfish bycatch. Finfish reductions ranged from 4.5% (randomization test) to 6.6% (t-test). The mean weight of shrimp was not significantly different from the control net for all gears tested in 2015.

During the second year of testing, three out of four gears tested met or exceeded the 40% target reduction in finfish bycatch (Table 2). Tows made using a 4-inch TED, double federal fisheyes, and 1 3/4-inch tailbag significantly reduced finfish bycatch by 54.0% (randomization test) to 57.2% (t-test) and had the greatest reduction in finfish bycatch of all the gears tested by the workgroup. Tows made with a 3-inch TED, double federal fisheyes, and 1 3/4-inch tailbag yielded the second highest reduction of the gear combinations tested, reducing finfish bycatch by 44.9% (t-test and randomization test). Finfish bycatch reductions were slightly lower in the fall using one state fisheye, the Virgil Potter BRD, and 1 3/4-inch tailbag gear combination. Finfish bycatch reductions ranged from 43.2% (t-test) to 44.3% (randomization test). While not significant, t-test results indicated the mean weight of shrimp was reduced by 5.5% for this gear combination. A similar gear combination tested in the summer using a slightly smaller mesh tailbag (1 1/2-inch), one state fisheye, and Virgil Potter BRD reduced finfish bycatch 26.9% (t-test) to 28.5% (randomization test). The mean weight of non-shrimp invertebrates and elasmobranchs was not significantly different from the control net for all gears tested in 2016.

While none of the gear combinations tested in 2017 met the 40% target reduction for finfish bycatch (Table 3), the 3-inch TED, double state fisheye, and 1 5/8-inch tailbag did significantly reduce finfish bycatch in the ocean by 32.6% (t-test and randomization test) during summer testing. The mean weight (kg) of shrimp for this gear was also found to be significantly different from the control net, reducing the catch of shrimp by 6.8% (t-test). Testing the same gear combination in the ocean in the fall using a 3-inch TED, double state fisheye, and 1 5/8-inch tailbag did not significantly reduce finfish bycatch and shrimp loss almost tripled the acceptable range recommend by the workgroup. The t-test and randomization test did however indicate the catch of non-shrimp invertebrates and elasmobranchs were significantly reduced by 65.1% and 57.1%, respectfully for this gear combination. The 3-inch TED, single state fisheye, and 1 5/8-inch tailbag experimental gear combination significantly reduced finfish bycatch by 22.8% (t-test) in the summer in Pamlico Sound. However, the mean weights of the other species groups were not significantly different from the control net for this gear. Though not statistically significant, tows made using this gear combination also reduced the shrimp catch by 7.8% (t-test) to 9% (randomization test).

IV. AUTHORITY

§ 113-134. Rules
§ 113-173. Recreational Commercial Gear License
§ 113-182. Regulation of fishing and fisheries
§ 113-182.1 Fishery Management Plans
§ 113-221.1 Proclamations; emergency review
§ 143B-289.52 Marine Fisheries Commission - powers and duties

15A NCAC 03H .0103 Proclamation Authority of Fisheries Director
15A NCAC 03J .0104 Trawl Nets
15A NCAC 03L .0101 Shrimp Harvest Restrictions
15A NCAC 03L .0103 Prohibited Nets, Mesh Lengths and Areas

V. DISCUSSION

Reducing bycatch in the shrimp trawl fishery and the development of gear configurations that maximize finfish reduction and minimize shrimp loss has been an ongoing task for the Division since the 1980s (NCDMF 2015). The 1992 Atlantic States Marine Fisheries Commission (ASMFC) Weakfish FMP recommended that states implement programs to reduce bycatch mortality of weakfish in the shrimp trawl fishery by 40% (ASMFC 1992). Following this recommendation, the NCDMF conducted a series of independent gear tests as well as tests in cooperation with the shrimp industry. Results from this testing lead to the development of new BRDs and gear modifications to reduce bycatch and North Carolina became the first state to require BRDs in shrimp trawls in 1992. Amendments 3 and 4 to the ASMFC Weakfish FMP later changed the certification requirement to demonstrate a 40% reduction in catch (by number) or a 50% reduction in bycatch mortality of weakfish (ASMFC 1996, 2002). In 2004, Addendum III to Amendment 4 of the ASMFC Weakfish FMP again changed the BRD requirements from a 40% reduction in weakfish by number to 30% by weight (ASMFC 2007). This change was made to compliment the South Atlantic Fishery Management Council (SAFMC) Shrimp FMP and has allowed for more flexible testing and development of BRDs. With the adoption of Amendment 1 to the NC Shrimp FMP, the use of any federally certified BRD in all internal and offshore waters was approved as well as a recommendation to update testing protocols for state BRD certification (NCDMF 2015). These changes, as well as continued industry collaboration, should give fisheries managers more flexibility identifying, developing, and implementing new gears to reduce bycatch.

The use of minimum tailbag mesh regulations has been a common management strategy used by fisheries managers to reduce bycatch. As early as 1949, researchers in North Carolina have examined how larger mesh sizes in tailbags can reduce finfish bycatch in shrimp trawls (Roelofs 1950). Testing conducted by the NCDMF has also shown that larger tailbag mesh sizes and how they are hung (diamond vs. square) can reduce bycatch. Brown (2010) compared the catch rates of shrimp and bycatch in modified trawls with various tailbag mesh sizes in the Neuse River and Pamlico Sound. Experimental nets with 1 3/4-inch tailbags showed significant reductions in Atlantic croaker (16%) and spot (50%) as compared to the control net (standard 1 1/2-inch mesh tail bag); however, no significant difference in the catch of shrimp was detected between the

control and experimental net. Experimental nets with a 2-inch tailbag (hung on the square) were found to have even greater reductions for Atlantic croaker (69%) and spot (82%). Results from the 2015-2017 industry field testing also showed that gears with larger tailbag mesh sizes had greater reductions in finfish bycatch than those constructed with smaller mesh tailbags. Of the four gear combinations that met or exceeded the 40% target reduction in finfish bycatch, three of those used a 1 3/4-inch tailbag. Gear combinations using a 1 7/8-inch mesh tailbag were also found to significantly reduce finfish bycatch by 25.3% to 40.8% (randomization test data: 27.5% to 40.1%).

NOAA Fisheries has required the use of TEDs since 1992 to reduce the number of strandings and incidental takes of sea turtles (NCDMF 2015). TEDs have also been shown to reduce the bycatch of smaller finfish and invertebrates in both otter and skimmer trawls (Broome 2011; Price and Gearhart 2011). Currently, federal law mandates a 4-inch maximum TED bar spacing between grids. Broom et al. 2011, found that reduced TED grid spacing was very effective at reducing finfish bycatch while maintaining minimal shrimp loss. The authors also noted a noticeable reduction in large rays, sharks, jellyfish and horseshoe crabs in the 2-inch reduced grid TED. Of the gear combinations tested by the workgroup that met the 40% reduction in finfish bycatch, only one used a 3-inch TED. Results from both the t-test and randomization test indicated that tows made using double federal fisheyes, 1 3/4-inch tailbag, and 3-inch bar TED reduced finfish bycatch by 44.9% and only had a 4.9% loss of shrimp. Tows made with double state fisheyes, 1 5/8-inch mesh tailbag, and 3-inch TED bar spacing were also found to significantly reduce the catch of elasmobranchs by approximately 57% (t-test and randomization test) in the fall ocean fishery. Raborn et al. (2012) noted that the use of TEDs in the Gulf of Mexico Penaeid shrimp fishery reduced the catch of blacknose sharks by 94% and bonnethead sharks by 31%. The authors further note, that smaller coastal sharks, such as Atlantic sharpnose sharks, may be more effectively excluded by TEDs with reduced bar spacing. Both t-test and randomization tests indicated the catch of non-shrimp invertebrates was significantly reduced (by 65.1%) for tows made using double state fisheyes, 1 5/8-inch tailbag, and a 3-inch TED. When used in combination with larger tailbag mesh sizes (>1 1/2-inch), TEDs with reduced bar spacing appear to be very effective at reducing the bycatch of elasmobranchs and non-shrimp invertebrates in the ocean.

With the adoption of Amendment 1 the MFC also mandated the use of an additional federal or state certified BRD in all skimmer and otter trawls. Most fishermen have opted to use an additional state fisheye due to their low cost and ease of installation (K. Brown. NCDMF, personal communication). State fisheyes are a diamond shaped BRD (sometimes oval) that measure 5 1/2 inches by 6 1/2 inches, which provides an opening of approximately 20 square inches (Figure 3). The use of two state fisheyes provides approximately 40 total square inches of opening. Federal fisheye must have a minimum opening of 36 square inches; however, all federal fisheyes tested by the workgroup were built with a margin of error that expanded the opening to 40 square inches (Figure 3). Thus, the use of two federal fisheyes provided approximately 80 square inches of opening. Of the four gear combinations that met or exceeded the 40% target reduction in finfish bycatch, three used double federal fisheyes. Gear combinations tested using double federal fisheyes were found to reduce finfish bycatch by 54% (randomization test) to 57.2% (t-test), whereas those using two state fisheyes only reduced finfish bycatch by as much as 32.6% (t-test and randomization test). The additional 40 square inches of opening gained using double federal fisheyes appears to provide greater escapement of finfish than the use of double state fisheyes. Overall shrimp loss of gears using double federal fisheyes was comparable to losses of gears using

double state fisheyes. However, tows made with double federal fisheyes with the addition of a float (Ricky BRD) had shrimp losses nearly double the industry recommendation and only minimal reduction in finfish bycatch. Gear combinations that incorporated two federal fisheyes and large mesh tailbags (1 3/4-inch or greater) appeared to provide the greatest reductions in finfish bycatch and further allow fishermen to use the same gear in both state and federal waters within the Exclusive Economic Zone (EEZ).

While all the gear combinations tested resulted in reductions in finfish bycatch, it is hard to specify what element of the design made the largest contribution. Conversely, it is also hard to identify what design elements played the greatest role in minimizing shrimp loss. However, results from the industry field testing do indicate that small modifications in gear configuration such as TED bar spacing and tailbag mesh size can significantly impact gear performance. The addition of a 1 3/4-inch tailbag to the Virgil Potter BRD was found to reduced finfish bycatch an additional 15.8% (randomization test) to 16.3% (t-test) as compared to same gear rigged with a 1 1/2-inch tailbag. These reductions could be even greater with the addition of a 3-inch reduced grid TED. Nevertheless, the individual contribution of each modification cannot be quantified until further testing is done to test each specific design element of the gear combinations that met the 40% target reduction in finfish bycatch. Future testing should also incorporate design elements of gear combinations that did not meet the 40% target reduction in finfish bycatch. While several of those tested failed to meet the target, many obtained finfish bycatch reductions ranging from 25% to 30%. Thus, it is important to note that these reductions in bycatch are in addition to the 30% reduction in finfish mandated by the federal BRD certification process and gears that met the MFC's 40% finfish bycatch reduction achieved nearly twice the federal requirements for reducing bycatch. Results from the industry gear testing should further encourage the use and development of new and innovative BRD designs.

Management decisions based on the results of the industry gear testing should not only consider which gear combinations had the greatest reduction in finfish bycatch, but should also consider vessel size as well as their contribution to the overall landings. In the last ten years (2007-2016), vessels greater than 55 feet made up roughly 30% of North Carolina's shrimp trawl fleet and landed 73% of the total shrimp landings (Table 4). In North Carolina's estuarine waters, roughly 67% of the vessels were 45 feet or less in length and harvested 17% of the total estuarine shrimp landings. Of the gear combinations that met the 40% reduction in finfish bycatch, vessel size ranged from 68 to 88 feet in the Pamlico Sound (Tables 1-2). Thus, it's important to note that observed finfish reductions obtained on larger vessels may not be directly applied to smaller vessels that operate in smaller waterbodies. The mandated use of untested gears on smaller boats could negatively impact gear performance and efficiency due to differences in tow times and haul-back practices. Furthermore, bycatch reductions achieved on smaller vessels should not be directly applied to larger vessels until further testing can be done. Future gear testing should include a wide variety of vessels across multiple areas throughout the state to determine how seasonal differences in species abundance, movement associated with life stage, and environmental factors influence gear performance.

All the necessary data do not currently exist to adequately quantify the overall reduction in bycatch gained by the mandated use of the gear combinations tested that met the 40% target reduction in finfish bycatch. Thus, management decisions should further consider the full extent of the social

and economic factors that may impact the shrimp trawl fishery and its associated gears. Costs associated with purchasing and installing gear could become cost prohibitive making it no longer feasible for fishermen to continue in the fishery once their current gear configuration is obsolete; these costs could further be amplified for vessels using double and four-barrel rigs. To lessen these costs, a phase-in period should be considered. Furthermore, the mandated use of untested gear combinations could further hinder the development and voluntary use of new BRDs. While gears such as the Ricky BRD did not meet the 40% target reduction in finfish, it is important to note that these gears were developed by fishermen and had promising results. Industry involvement is a key factor in not only the development and testing of new gears, but the overall acceptance of new gears. Murry et al. (1992) noted that shrimpers prefer to reduce bycatch because of the additional culling time, damage it causes to the quality of shrimp, and the extra weight in the tailbags which can reduce trawl door spread and fuel efficiency. Without acceptance from the public, the overall reduction in bycatch could be minimal if gear specific regulations are difficult to enforce. Regulations based on vessel length would be easier to enforce than those based on total combined headrope length. Vessel length can be determined from the Commercial Fishing Vessel Registration. Gear specific regulations should also consider user group (recreational, commercial) and gear type (otter trawl, skimmer trawl, crab trawl) in addition to vessel size. Recommendations from the industry workgroup on bycatch reduction in shrimp trawls that may be adopted by the MFC do not require an amendment and could be implemented by existing proclamation authority. Based on the motion passed at their February 2014 business meeting, the MFC may consider promising gear configurations that were tested by the industry workgroup for mandatory use in the shrimp trawl fishery. Management decisions based on industry collaboration, such as the work summarized in this paper, should provide further insight on solutions that limit bycatch while minimizing shrimp loss.

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VIII. THE FOUR GEAR COMBINATIONS THAT ACHEIVED AT LEAST A 40% REDUCTION IN FINFISH BYCATCH

1) Double federal fisheyes, 1 7/8-inch tailbag, and 4-inch TED
   + Significantly reduces finfish bycatch (t-test: -40.8%, randomization test: -40.1%)
   + Net gain in shrimp observed; however, not significant (t-test: +1%, randomization test: +2.2%)
   + Reduces culling time due to less bycatch
   + Implements actions of Amendment 1 to the Shrimp FMP
   - Costs associated with purchasing and installing gear (+$600 per net)
   - Untested on smaller vessels, skimmer trawls, and in the Atlantic Ocean

2) Double federal fisheyes, 1 3/4-inch tailbag, and 4-inch TED
   + Significantly reduces finfish bycatch (t-test: -57.2%, randomization test: -54.0%)
   + Reduces non-shrimp invertebrate bycatch; however, not significant (t-test: -15.7, randomization test: -4.9%,)
   + Reduces culling time due to less bycatch
   + Implements actions of Amendment 1 to the Shrimp FMP
   - Shrimp losses greater than 5%; however, not significant (t-test: -12.1%, randomization test: -16.2%)
   - Costs associated with purchasing and installing gear (+$600 per net)
   - Untested on smaller vessels, skimmer trawls, and in the Atlantic Ocean

3) Double federal fisheyes, 1 3/4-inch tailbag, and 3-inch TED
   + Significantly reduces finfish bycatch (t-test and randomization test: -44.9%)
   + Observed shrimp losses less than 5%; however, not significant (t-test and randomization test: -4.9%)
   + Reduces non-shrimp invertebrate bycatch; however, not significant (t-test and randomization test: -13.3%)
   + Reduces elasmobranch bycatch; however, not significant (t-test and randomization test: -18.6%)
   + Potential reductions in debris and jellyfish
   + Reduces culling time due to less bycatch
   + Implements actions of Amendment 1 to the Shrimp FMP
   - Costs associated with purchasing and installing gear (+$1,250 per net)
   - Potential fouling issues in areas and times of high grass concentrations
   - Untested on smaller vessels, skimmer trawls, and in the Atlantic Ocean

4) Single state fisheye, 1 3/4-inch tailbag, and Virgil Potter BRD
   + Significantly reduces finfish bycatch (t-test: -43.2%, randomization test: -44.3%)
   + Reduces culling time due to less bycatch
   + Implements actions of Amendment 1 to the Shrimp FMP
   - Costs associated with purchasing and installing gear (+$800 per net)
   - Shrimp losses greater than 5%; however, not significant (t-test: -5.5%, randomization test: -5.8%)
   - Untested on smaller vessels, skimmer trawls, and in the Atlantic Ocean

IX. RECOMMENDATION

Shrimp Industry Bycatch Reduction Workgroup

- Does not want to go on record recommending a range of acceptable shrimp loss; if finfish bycatch reduction is significant, a larger range could be acceptable (beyond range used by workgroup of 3-5%).
- Does want to recommend continued collaborative bycatch reduction research, specifically continuance of the N.C. Shrimp Bycatch Reduction Industry Workgroup, requesting that funding from gear testing possibly come from surplus funds from increased license fees (i.e., Commercial Fishing Resources Fund). Industry continues to be willing to provide in-kind contributions.
- Does endorse for use on otter trawls fishing in inside waters (in areas where a combined head rope of 90-feet or greater is allowed as identified in the Shrimp FMP; Figure 4) the four combinations of bycatch reducing gears that met the target of 40% bycatch reduction, but specifically recommends:
- Use of the combination gear of double Federal fisheyes, 4-inch TED and 1 ¾-inch tailbag, again, in inside waters where an otter trawl with a combined head rope of 90-feet or greater is allowed. (Specific intent is not to have this change applied to other areas open to otter trawls, channel nets, and skimmer trawls until further bycatch reduction testing has been completed.)
- Recommends the N.C. Division of Marine Fisheries explores valid survey techniques to gather information on current bycatch reduction devices being used by industry.

Summary of Additional Comments from Absentee Workgroup Members*

- Some members gave blanket support.
- Would like consideration of a phase-in period.
- Had reservations on more than 5 percent shrimp loss.
- Support not setting arbitrary shrimp loss levels.
- Support for reduced bar spaced TED, but defer to those working affected areas.
- The double federal fisheyes and 1 ¾-inch tailbag produced desired goal and should not be a burden for affected boats.
- 1 ¾-inch tailbag not tested on smaller boats
    - Anecdotal testing showed shrimp loss on 21/25 and 16/20 count shrimp
- More testing on small vessels
    - Allow more time to find working combination for small vessels

**See Appendix 3 for complete correspondences received from absentee workgroup members on proposed recommendations.*

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Table 1. Results from the paired t-test and randomization test of the five experimental gears tested during 2015. Mean weight of catch data reported in kg. Values in bold indicate significant p-values (alpha = 0.05). Gears in grey met or exceeded the 40% reduction target for finfish bycatch.

Season / Waterbody	Vessel size (ft)	Gear	Tailbag (in.)	TED (in.)	Species group		Control	Exp.	T-test			Control	Exp.	Randomization*	
						N	Mean	Mean	% Change	p-value	N	Mean	Mean	% Change	p-value
Summer / Pamlico Sd.	68	Composite panel, spooker cone	1 1/2	4	Finfish	44	178.1	132.1	-25.8	**< 0.001**	60	177.3	128.4	-27.6	**< 0.001**
					Shrimp	44	64.3	63.9	-0.7	0.754	60	67.3	65.2	-3.1	0.776
Summer / Pamlico Sd.	75	Single state fisheye	1 1/2	3	Finfish	16	107.3	90.0	-16.2	**0.029**	19	112.8	89.8	-20.4	0.217
					Shrimp	16	49.6	46.0	-7.4	0.078	19	48.2	45.5	-5.6	0.739
Summer / Pamlico Sd.	75	Single state fisheye, square mesh panel	1 7/8	3	Finfish	40	104.8	78.2	-25.3	**< 0.001**	51	102.3	74.1	-27.5	**0.007**
					Shrimp	40	65.7	64.4	-1.9	0.309	51	67.3	65.2	-3.0	0.775
Summer / Pamlico Sd.	88	Ricky BRD	1 1/2	4	Finfish	10	110.6	103.3	-6.6	0.503	15	100.0	95.5	-4.5	0.793
					Shrimp	10	35.3	31.8	-9.9	0.449	15	35.4	33.3	-6.1	0.728
Summer / Pamlico Sd.	88	Double federal fisheye	1 7/8	4	Finfish	25	90.0	53.3	-40.8	**< 0.001**	32	88.3	52.9	-40.1	**< 0.001**
					Shrimp	25	61.3	61.9	1.0	0.778	32	60.6	61.9	2.2	0.862

** Generalized linear modeling (GLM) was not used to adjust randomization catch values for potential biases and may differ from those reported in Brown et al. 2017.*

Table 2. Results from the paired t-test and randomization test of the five experimental gears tested during 2016. Mean weight of catch data reported in kg. Values in bold indicate significant p-values (alpha = 0.05). Gears in grey met or exceeded the 40% reduction target for finfish bycatch.

Season / Waterbody	Vessel size (ft)	Gear	Tailbag (in.)	TED (in.)	Species group	N	Control Mean	Exp. Mean	T-test % Change	T-test p-value	N	Control Mean	Exp. Mean	Randomization* % Change	Randomization* p-value
Summer/ Pamlico Sd.	68	Single state fisheye, Virgil Potter BRD	1 1/2	4	Finfish	30	146.3	106.9	-26.9	**< 0.001**	33	149.4	106.9	-28.5	**0.005**
					Shrimp	30	62.6	68.8	9.9	**0.050**	33	61.8	67.0	8.5	0.696
					Invertebrates┼	10	3.3	2.7	-18.8	0.384	33	1.0	0.8	-18.8	0.681
					Elasmobranchs	7	5.3	5.9	11.1	0.589	33	1.1	1.2	11.1	0.912
Summer / Pamlico Sd.	75	Double federal fisheye	1 3/4	4	Finfish	6	201.5	86.3	-57.2	**0.001**	23	164.5	75.6	-54.0	**< 0.001**
					Shrimp	6	23.0	20.2	-12.1	0.215	23	28.1	23.6	-16.2	0.280
					Invertebrates┼	6	7.2	6.1	-15.7	0.081	23	5.4	5.1	-4.9	0.833
					Elasmobranchs	6	1.8	2.6	45.8	0.509	23	2.1	2.5	18.8	0.573
Summer / Pamlico Sd.	75	Double federal fisheye	1 3/4	3	Finfish	30	115.4	63.6	-44.9	**< 0.001**	30	115.4	63.6	-44.9	**0.007**
					Shrimp	30	27.0	25.7	-4.9	0.435	30	27.0	25.7	-4.9	0.706
					Invertebrates┼	30	2.1	1.8	-13.3	0.418	30	2.1	1.8	-13.3	0.601
					Elasmobranchs	27	1.8	1.4	-18.6	0.404	30	1.6	1.3	-18.6	0.568
Fall / Pamlico Sd.	68	Single state fisheye, Virgil Potter BRD	1 3/4	4	Finfish	20	189.0	107.0	-43.2	**< 0.001**	25	172.3	96.1	-44.3	**0.001**
					Shrimp	20	33.1	31.3	-5.5	0.055	25	31.3	29.5	-5.8	0.691
					Invertebrates┼	25	0.0	0.0	n/a	n/a	25	0.0	0.0	n/a	n/a
					Elasmobranchs	25	0.0	0.1	n/a	n/a	25	0.0	0.0	n/a	n/a

** Generalized linear modeling (GLM) was not used to adjust randomization catch values for potential biases and may differ from those reported in Brown et al. 2017.*

┼ *Non-shrimp invertebrates*

Table 3. Results from the paired t-test and randomization test of the five experimental gears tested during 2017. Mean weight of catch data reported in kg. Values in bold indicate significant p-values (alpha = 0.05). Gears in grey met or exceeded the 40% reduction target for finfish bycatch.

Season / Waterbody	Vessel size (ft)	Gear	Tailbag (in.)	TED (in.)	Species group	N	Control Mean	Exp. Mean	T-test % Change	T-test p-value	N	Control Mean	Exp. Mean	Randomization** % Change	Randomization** p-value
Summer / Pamlico Sd.	44	Single state fisheye	1 1/2	3	Finfish	*	*	*	*	*	5	12.3	12.9	5.1	0.732
					Shrimp	*	*	*	*	*	5	18.7	17.3	-7.8	0.827
					Invertebrates┼	*	*	*	*	*	5	4.9	6.8	38.8	0.281
					Elasmobranchs	*	*	*	*	*	4	0.2	0.4	75.0	0.487
Summer / Pamlico Sd.	40	Single state fisheye	1 5/8	3	Finfish	20	34.6	26.7	-22.8	**0.019**	22	34.9	27.8	-20.4	0.341
					Shrimp	20	12.1	11.2	-7.8	0.294	22	11.6	10.6	-9.0	0.556
					Invertebrates┼	18	2.3	2.1	-6.1	0.692	22	2.1	2.1	-0.4	0.993
					Elasmobranchs	*	*	*	*	*	3	0.3	0.1	-80.0	0.397
Summer / Ocean	40	Double state fisheye	1 5/8	3	Finfish	30	146.0	98.5	-32.6	**< 0.001**	30	146.0	98.5	-32.6	**0.002**
					Shrimp	30	2.9	2.7	-6.8	**0.039**	30	2.9	2.7	-6.6	0.598
					Invertebrates┼	30	17.2	15.9	-7.6	0.086	30	17.2	15.9	-7.6	0.505
					Elasmobranchs	29	3.0	2.5	-16.3	0.184	30	2.9	2.4	-16.7	0.425
Fall / Ocean	35	Double state fisheye	1 5/8	3	Finfish	30	57.5	54.9	-4.6	0.670	30	57.5	54.9	-4.6	0.890
					Shrimp	30	9.8	8.3	-14.9	**< 0.001**	30	9.8	8.3	-14.8	0.365
					Invertebrates┼	30	8.2	2.9	-65.1	**0.001**	30	8.2	2.9	-65.1	**< 0.001**
					Elasmobranchs	28	4.4	1.9	-57.1	**0.009**	29	4.3	1.8	-57.3	**0.014**
Fall / Ocean	60	Double federal fisheye	1 5/8	3	Finfish	30	75.6	97.7	29.3	0.204	30	75.6	97.7	29.3	0.250
					Shrimp	30	17.3	15.7	-9.0	**0.002**	30	17.3	15.1	-12.5	0.234
					Invertebrates┼	25	2.2	2.7	21.9	0.276	30	2.3	2.9	25.1	0.455
					Elasmobranchs	15	1.3	1.0	-24.3	0.271	28	0.9	0.7	-24.5	0.360

** Tows were dropped from analysis due to the low number of matched pairs.*

*** Generalized linear modeling (GLM) was not used to adjust randomization catch values for potential biases.*

┼ *Non-shrimp invertebrates*

Table 4. North Carolina commercial shrimp trawl landings (all species) by vessel length and waterbody, 2007-2016 (NC Trip Ticket Program).

Waterbody	Vessel length	Vessels (10-year)			Trips (10-year)			Landings (10-year)		
	(Feet)	(Total number)	(% Total)	(Avg.)	(Total number)	(% Total)	(Avg.)	(Total number)	(% Total)	(Avg.)
Estuarine	0-15	99	2.6	10	294	0.7	29	74,368	0.1	7,437
	16 to 30	1,648	43.9	165	16,996	42.1	1,700	3,036,958	5.8	303,696
	31 to 45	765	20.4	77	10,597	26.3	1,060	5,839,690	11.2	583,969
	46 to 55	287	7.6	29	3,187	7.9	319	4,728,222	9.1	472,822
	> 55	956	25.5	96	9,275	23	928	38,563,295	73.8	3,856,329
State Ocean (0-3 mi)	0-15	9	0.7	2	21	0.1	4	30,802	0.2	5,134
	16 to 30	265	21	27	3,194	18.3	319	620,296	4.2	62,030
	31 to 45	292	23.2	29	4,640	26.6	464	1,708,624	11.6	170,862
	46 to 55	174	13.8	17	3,874	22.2	387	1,990,624	13.6	199,062
	> 55	519	41.2	52	5,721	32.8	572	10,333,660	70.4	1,033,366
Federal Ocean (3-200 mi)	0-15	3	2.5	3	5	1.6	5	1,289	0.1	1,289
	16 to 30	5	4.1	1	17	5.4	4	2,518	0.2	629
	31 to 45	13	10.7	2	31	9.9	5	11,109	1.1	1,852
	46 to 55	14	11.6	2	43	13.7	7	39,582	3.9	6,597
	> 55	86	71.1	10	217	69.3	24	968,016	94.7	107,557
Total (all waters)	0-15	111	2.2	7	320	0.6	525	106,459	0.2	6,262
	16 to 30	1,918	37.4	80	20,207	34.8	19	3,659,771	5.4	152,490
	31 to 45	1,070	20.8	41	15,268	26.3	842	7,559,424	11.1	290,747
	46 to 55	475	9.3	18	7,104	12.2	587	6,758,428	9.9	259,940
	> 55	1,561	30.4	54	15,213	26.2	273	49,864,971	73.4	1,719,482

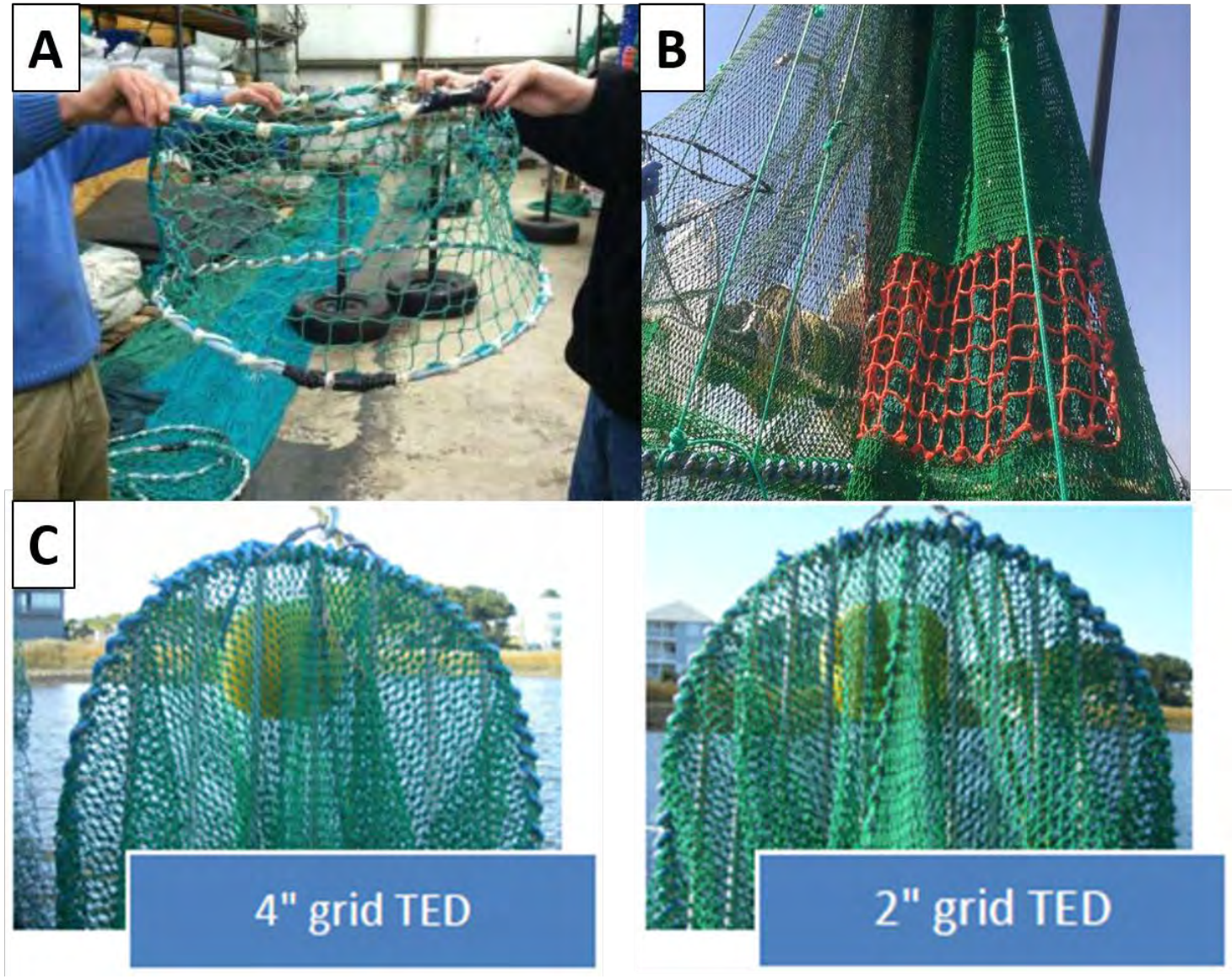

Figure 1. Newly approved BRDs as part of Amendment 1 to the NC Shrimp FMP: A) T-90 BRD, B) square mesh panel (skylight panel), and C) reduced bar spacing turtle excluder device (2-inch grid TED).

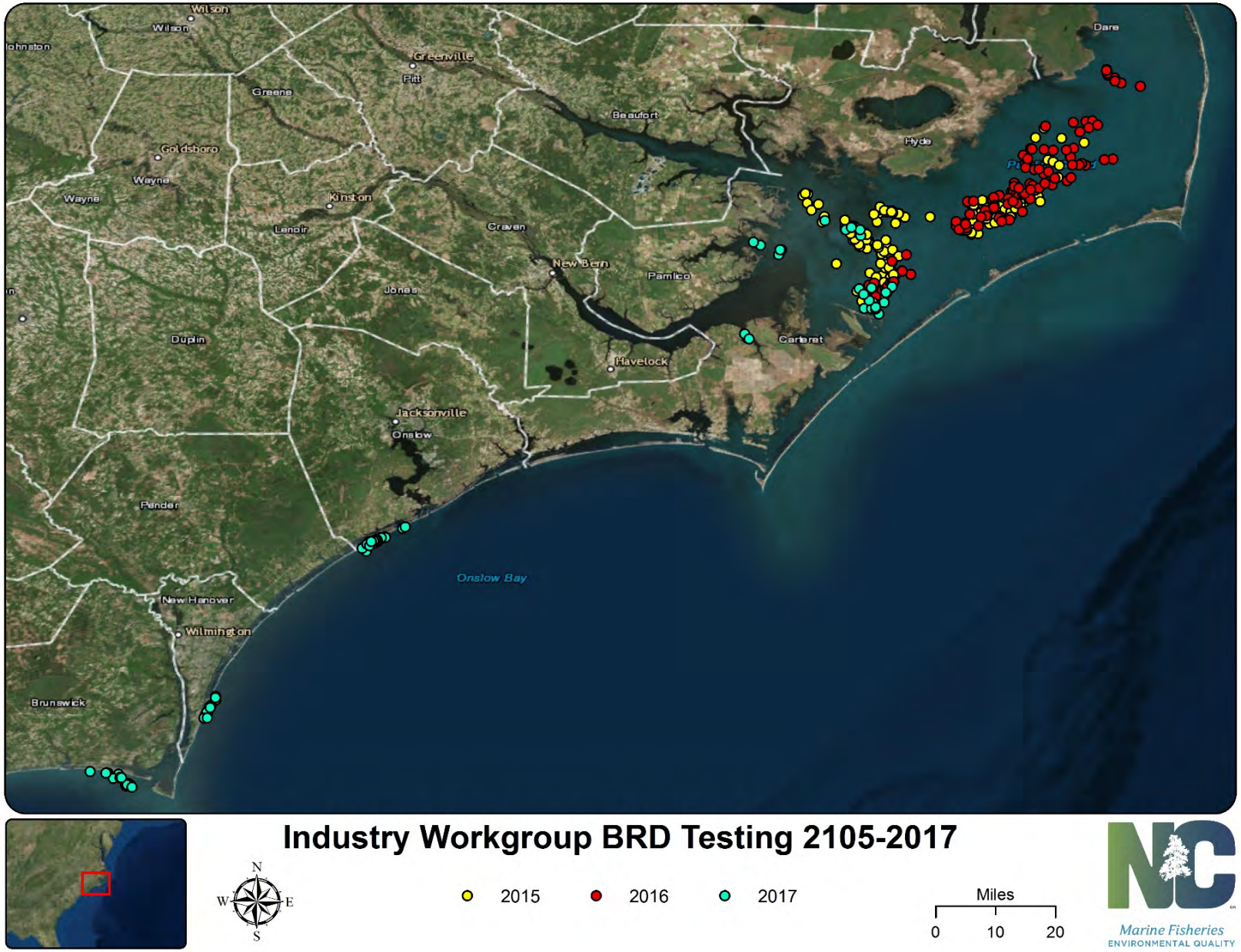

Figure 2. Location of industry workgroup shrimp trawl gear testing (all gears), 2015-2017.

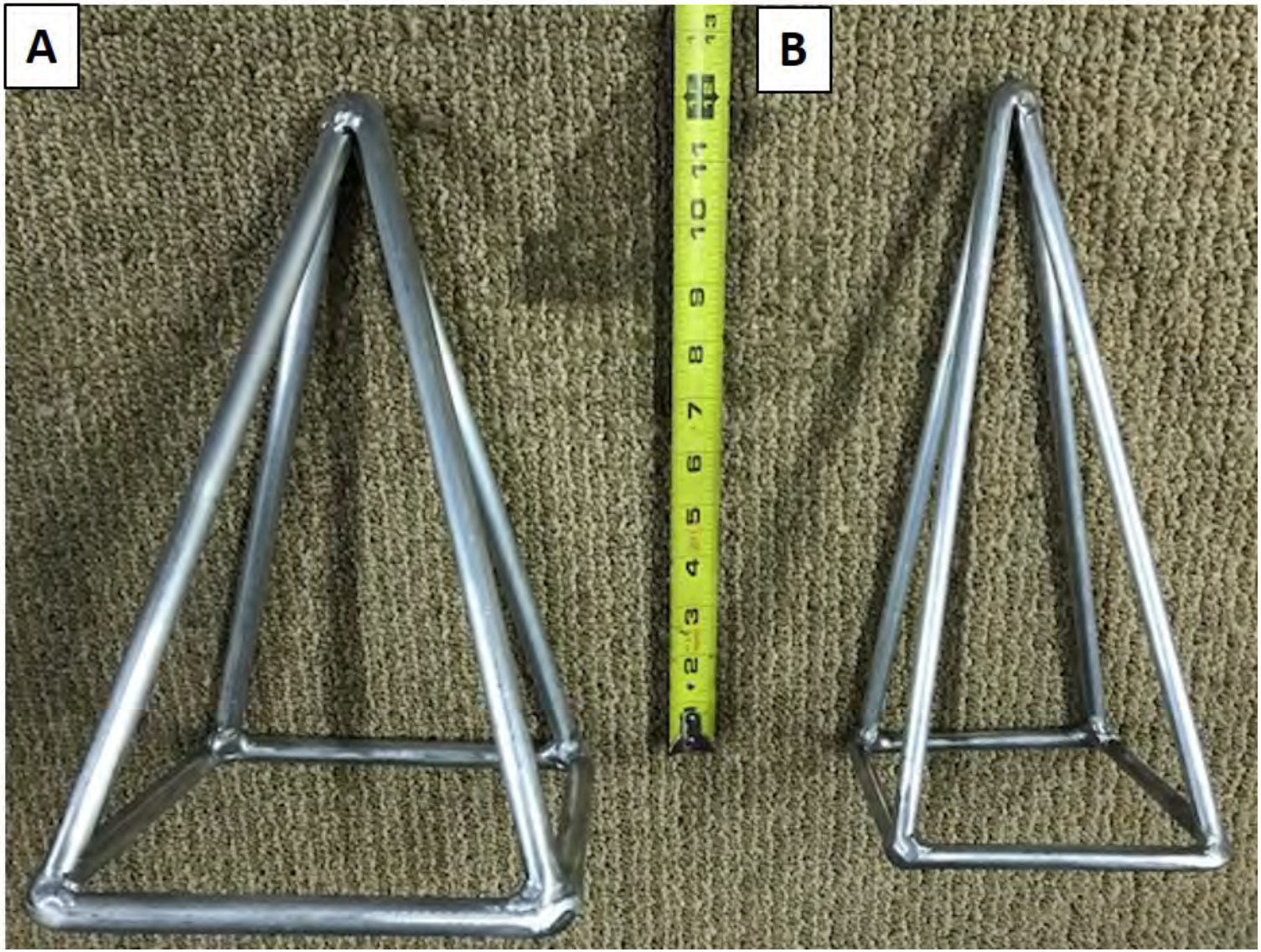

Figure 3. Federal fisheye BRD (A) compared to state fisheye BRD (B).

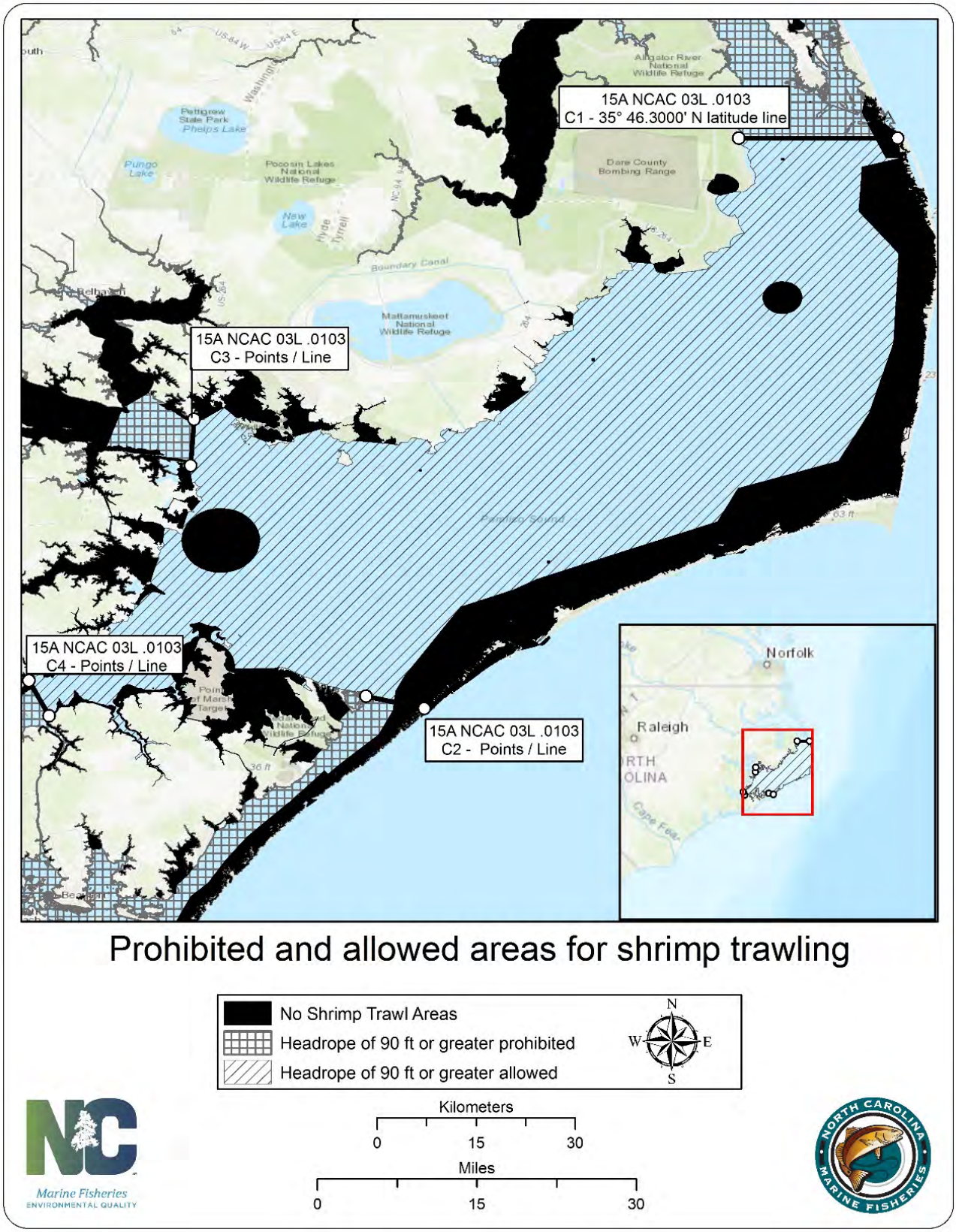

Figure **4. Location of area affected** (headrope of 90 ft or greater allowed) **by proposed recommendations from the Industry Workgroup.**

Appendix 1. MFC motions for Amendment 1 to the North Carolina Shrimp FMP to address bycatch.

In November 2013, prior to approving Amendment 1 for public comment the MFC passed a motion to:

Motion to add a recommendation to the draft Shrimp Fishery Management Plan Amendment 1 for a stakeholder group to initiate a three-year study testing minimum tail bag mesh T-90 (square mesh) panels, skylight panels, reduced bar spacing in turtle excluder devices and any other new methods of reducing unwanted finfish bycatch to achieve a minimum of a 40 percent reduction by weight compared to a control net with a Florida fish excluder, a federally approved turtle excluder device, and 1 1/2 inch mesh tail bag. The stakeholder group should partner with the Division of Marine Fisheries and N.C. Sea Grant to help secure funding for the study. If the target of a 40 percent reduction by weight in finfish is not achieved, further restrictions will be placed on the shrimp trawl industry to achieve the 40 percent reduction by weight. Those restrictions will be reviewed and discussed at that time.

Based on this motion management options examined in the FMP were separated into: 1) gear modifications, 2) effort management, 3) area restrictions, and 4) the use of other fishing gears. For each of these management options, issue papers were developed and presented to the Shrimp FMP Advisory Committee (AC), as well as the regional and standing advisory committees. Gear modifications evaluated included: tailbag mesh size, Turtle Excluder Devices (TEDs) with reduced bar spacing, T-90 tailbags, and Skylight Panels (Figure 1).

In February 2014, prior to the approval of the draft Shrimp FMP Amendment 1 for review by the Secretary of the Department of Environment and Natural Resources and the Joint Legislative Commission on Governmental Operations, the MFC passed a motion that became the final management strategy in Amendment 1 to address bycatch:

Motion to convene a stakeholder group to initiate industry testing of minimum tail bag mesh size, T-90 panels, skylight panels, and reduced bar spacing in turtle excluder devices to reduce bycatch to the extent practicable with a 40 percent target reduction. Upon securing funding, testing in the ocean and internal waters will consist of three years of data using test nets compared to a control net with a Florida Fish Eye, a federally-approved turtle excluder device and a 1.5-inch mesh tail bag. Results should minimize shrimp loss and maximize reduction of bycatch of finfish. Promising configurations will be brought back to the Marine Fisheries Commission for consideration for mandatory use. The stakeholder group may be partnered with the Division of Marine Fisheries and Sea Grant. Members should consist of fishermen, net/gear manufacturers and scientific/gear specialists.

The commission gave its final approval of the Shrimp Fishery Management Plan Amendment 1 and associated rules Feb. 19, 2015 and implementation of the rules came into effect May 1, 2015. Gear specific management strategies from Amendment 1 not only required the development of the stakeholder group and gear testing, but also required fishermen to use either a T-90/square mesh tailbag or other applications of square mesh panel (e.g., skylight panel), reduced bar spacing in a

TED, or another federal or state certified bycatch reduction device (BRD) in addition to existing TED and BRD requirements in all skimmer and otter trawls (Proclamation SH-2-2015; Figure 1).

Appendix 2. List of industry workgroup members, collaborators, and guest presenters.

Workgroup members:
Steve Parrish, net maker, Supply (passed, replaced by Douglas Todd)
Kenny Midget, net maker, Wanchese
Brent Fulcher, fish house owner/industry leader, New Bern
Clyde Potter, fishermen, Hobucken
Stevie Davis, fishermen, Sneads Ferry
Clyde Phillips, fishermen, Swansboro
Kenny Rustic, fishermen (skimmer), Gloucester
John Broome, fishermen, Wilmington
Virgil Potter, net maker, Bayboro
Douglas Todd, fishermen, Supply (replaced Steve Parrish)
Gordon Winfree, net maker, Shallotte
Mikey Daniels, industry leader/fish house owner (previously), fishermen, Wanchese
David Jarvis, fishermen, Bear Creek (added in 2018, tested gear in 2017)
Robbie Metcalf, fishermen, Carolina Beach (added in 2018, tested gear in 2017)

Collaborators:
Kevin Brown, NCDMF
Laura Lee, NCDMF
Blake Price, NOAA-HSU
Scott Baker, NC Sea Grant
Sara Miriabilio, NC Sea Grant

Guest Presenters:
Pingguo He, U-Mass Dartmouth
Frank Helies, GSAF
Dan Foster, NOAA-HSU
Gary Graham, Texas Sea Grant
Steve Eayrs, GMRI

Appendix 3. Comments from absentee workgroup members on proposed recommendations.

Robbie Metcalf verbal communication 4/18/18:

- Supported all of the recommendations, but has some concern with any shrimp loss over 5%.
- He supports continuing the workgroup and gear testing and improving the gear survey.
- He always wants to make things better for the industry and what's best for the fishery.

Clyde Phillips phone conversation 4/19/18:

- Supported a phase in period.

David Jarvis phone conversation 4/19/18:

- Does not want to go on record recommending a range of acceptable shrimp loss; if finfish bycatch reduction is significant, a larger range could be acceptable (beyond range used by workgroup of 3-5%).
- Comments: Supportive, even 10% is acceptable if finfish loss is significant.

- Does want to recommend continued collaborative bycatch reduction research, specifically continuance of the N.C. Shrimp Bycatch Reduction Industry Workgroup, requesting that funding from gear testing possibly come from surplus funds from increased license fees (i.e., Commercial Fishing Resources Fund). Industry continues to be willing to provide in-kind contributions.
- Comments: Fully supportive, willing to offer his vessel for continued testing.

- Does endorse for use on otter trawls fishing in inside waters (in areas where a combined head rope of 90-feet or greater is allowed as identified in the Shrimp FMP) the four combinations of bycatch reducing gears that met the target of 40% bycatch reduction, but specifically recommends:
- Comments: Supportive with some reservations because these gears haven't been tested on small boats. Doesn't believe it will be a burden on the industry.

- Use of the combination gear of double Federal fisheyes, 4-inch TED and 1 ¾-inch tailbag, again, in inside waters where an otter trawl with a combined head rope of 90-feet or greater is allowed. (Specific intent is not to have this change applied to other areas open to otter trawls, channel nets, and skimmer trawls until further bycatch reduction testing has been completed.)
- Comments: Supportive with some reservations because these gears haven't been tested on small boats. Doesn't believe it will be a burden on the industry.

- Recommends the N.C. Division of Marine Fisheries explores valid survey techniques to gather information on current bycatch reduction devices being used by industry.
- Comments: Supports as long as they are valid techniques.

14 Apr 18

To: Kevin Brown

RE: Industry Workgroup Draft Recommendation to the Marine Fisheries Commission

Kevin: The recommendations set forth in the Memorandum dated 6 Apr 2018 seem very logical proposals based on the testing results thus far.

O I totally agree that a range of acceptable shrimp loss should not arbitrarily be set. Any acceptable shrimp loss should be a function of the BRD's efficiency.

O I work in the ocean off New Hanover County and Brunswick County and I have very little knowledge of the working conditions in Pamlico Sound. After conducting research with a FRG through N.C. Sea Grant (2" reduced spaced TED vrs. 4" spaced TED), I have been using 2" reduced spaced TED's as BRD's. Because of different conditions, such as large quantities of moss, a reduced spaced TED might not be the best BRD for Pamlico Sound or other areas. Because of this, I would like to defer to the boat owners that this proposal would affect.

O The double Federal fisheye and 1 ¾ -inch tail bag produced the desired goal and should not be a burden for the boats affected.

John O Broome

John D. Broome

April 18, 2018.

Dear Marine Fisheries Commissioner,

My name is Kenny Rustick. I am a commercial fisherman from Carteret County, North Carolina and I serve on the Shrimp Industry Work Group. I was unable to attend the group's last meeting on April 4th, 2018 due to a prior surgery. I have been informed that several recommendations were voted on to pass onto the commission at it's May meeting.

I know one of the recommendations was for a 1 3/4" mesh tail bag. While the 1 3/4" mesh tail bag combined with other byrds showed a sizable reduction for the larger boats, it was never tested on the smaller boats like mine. I have tried this size tail bag before in the ocean on my boat and I noticed shrimp loss on 21/25 and 16/20 count shrimp. There were shrimp hanging out of the meshes on the tail bags when I would retrieve the trawls. I changed one tail bag to a 1 1/2" mesh and did not notice shrimp hanging out of the tail bag, and the 1 1/2" tail bag produced more shrimp.

Although this was by no means a scientific study, the 1 3/4" bags were a set of tail bags on a set of nets and turtle excluders I purchased. I tell you this because I believe we can reduce bycatch and do it with a minimal shrimp loss. I do believe we need more testing on the small boats. We could possibly try 1 5/8" and different byrd combinations. I have always found that what works for someone else might not work for me. So please give us some more time to find a combination of byrds that we know works for the small class boats.

Thank you for your time,

Kenny Rustick

Brown, Kevin

From: DOUGLAS TODD <dtodd@atmc.net>
Sent: Thursday, April 19, 2018 2:02 PM
To: Brown, Kevin
Subject: [External] Bycatch

CAUTION: External email. Do not click links or open attachments unless verified. Send all suspicious email as an attachment to Report Spam.

Kevin the only comment that I have got back is some of the them want to know if the one fisheye with the 3-inch or less TED is still going to be approved to be used. The rest on the inform they were good with. Thanks Douglas Todd

Brown, Kevin

From: stevie <steviedavis134@hotmail.com>
Sent: Thursday, April 19, 2018 3:22 PM
To: Brown, Kevin
Subject: [External] Recommendations

CAUTION: External email. Do not click links or open attachments unless verified. Send all suspicious email as an attachment to Report Spam.<mailto:report.spam@nc.gov>

I , Stevie Davis, support each of the recommendations the workgroup is proposing to the Marine Fisheries Commission
Stevie Davis
04/18/2018

Sent from my iPhone

Brown, Kevin

From: gordonsnet <gordonsnet@atmc.net>
Sent: Thursday, April 19, 2018 5:52 PM
To: Brown, Kevin
Subject: [External] Industry Workgroup Draft Recommendation to the Marine Fisheries Commission

CAUTION: External email. Do not click links or open attachments unless verified. Send all suspicious email as an attachment to Report Spam.

I, Gordon Winfree, owner Gordons' Networks Inc. agree with the draft recommendations to the Marine Fisheries Commission listed in the memorandum.

Sent from Mail for Windows 10

INFORMATION WILL BE PROVIDED AT THE MEETING.

INFORMATION WILL BE PROVIDED AT THE MEETING.

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 17, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Anne Deaton and Casey Knight, Habitat and Enhancement Section

SUBJECT: Advisory Committee Recommendations on Region 4 Strategic Habitat Areas, Cape Fear River Basin

---

As part of the Coastal Habitat Protection Plan (CHPP) implementation, Division of Marine Fisheries staff has been conducting regional spatial analyses of the coastal ecosystem to identify a subset of priority habitat complexes that are critical to fisheries species. These areas are referred to as Strategic Habitat Areas (SHAs) and were defined in the Marine Fisheries Commission's rulebook as "locations of individual fish habitats or systems of habitats that provide exceptional habitat functions or that are particularly at risk due to imminent threats, vulnerability, or rarity" (15A NCAC 03I .0101(4)(h)).

At the November 2017 Marine Fisheries Commission meeting, staff presented draft Strategic Habitat Areas for Region 4, which includes the Cape Fear River system and estuarine waters from Surf City through Brunswick County. The analysis involves:

1. Using a GIS-based site-selection software to select the initial habitat areas based on their condition, value, and connectivity; and
2. Reviewing and modifying selections based on input from a scientific advisory committee.

The resulting SHA nominations encompassed 21.3 percent (74,451 acres) of the Region 4 focus area.

A presentation on the Region 4 Strategic Habitat Areas was given to the Southern and Habitat and Water Quality advisory committees, on April 11 and 12, respectively. No public comment was received. The advisory committee members had some questions and discussion, but did not propose any changes to the draft Strategic Habitat Area nominations. The Southern Advisory Committee unanimously approved a motion to recommend that the commission approve the draft Region 4 Strategic Habitat Areas. The Habitat and Water Quality Advisory Committee did not vote due to lack of a quorum, but recommended by consensus that the commission approve the draft Region 4 Strategic Habitat Areas.

Staff is asking the commission for final approval of the Region 4 Strategic Habitat Area report and nominated sites.

Strategic Habitat Area Nominations for Region 4:

The Cape Fear River Basin in North Carolina

DRAFT REPORT

October 2017

By

Casey Knight and Anne Deaton
North Carolina Division of Marine Fisheries
Wilmington, North Carolina

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TBD

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GLOSSARY OF ACRONYMS

AFSA	Anadromous Fish Spawning Areas
CHPP	North Carolina Coastal Habitat Protection Plan
DCM	North Carolina Division of Coastal Management
DEQ	North Carolina Department of Environmental Quality
DMF	North Carolina Division of Marine Fisheries
DOT	North Carolina Department of Transportation
DWQ	North Carolina Division of Water Quality
DWR	North Carolina Division of Water Resources
GIS	Geographic Information System
HWQ	High Quality Waters
HU	Hydrologic unit
MFC	North Carolina Marine Fisheries Commission
NERR	National Estuarine Research Reserve
NHD	National Hydrologic Dataset
NOAA	National Oceanographic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRT	Natural resource targets
NWI	National Wetlands Inventory
ORW	Outstanding Resource Waters
PNA	Primary Nursery Area
SAV	Submerged Aquatic Vegetation
SGA	Shellfish Growing Area
SHA	Strategic Habitat Area
SSNA	Special Secondary Nursery Area
SS&RWQ	North Carolina Division of Marine Fisheries – Shellfish Sanitation and Recreational Water Quality section
TNPA	Trawl Net Prohibited Area
USACE	United States Army Corps of Engineers
WRC	North Carolina Wildlife Resources Commission

EXECUTIVE SUMMARY

Strategic Habitat Areas (SHAs) represent priority locations for protection or restoration due to their exceptional ecological functions or areas that are particularly at risk due to imminent threats to their ability to support coastal fisheries. Identification and designation of SHAs is a main goal of the North Carolina Coastal Habitat Protection Plan (CHPP). The identification of SHAs was conducted in a two-step process: 1) using GIS-based habitat and alteration data in a computerized site-selection analysis and 2) verifying and modifying information based on input from a scientific advisory committee. North Carolina Division of Marine Fisheries (DMF) staff and the advisory committee determined representation levels for multiple unique habitat types. There are also several types of alteration factors that are represented geospatially (i.e., hydrologic alterations, water quality degradation, and physical disturbances). The site selection program Marxan was used to select areas that met representation levels while limiting the selection of highly altered sites. The scientific advisory committee modified the computer results based on their expert knowledge and experience. The resulting SHA nominations encompass 21.3% of the Region 4 focus area (i.e., riparian targets within 500 m of the shoreline, open waters and the Atlantic Ocean out to 3 nmi) (Maps 7a-d). There were 43 discrete SHAs selected within Region 4. Large areas of Masonboro and Topsail sounds and the Cape Fear River were selected due to its biodiversity and high quality of habitats and fishery species. Many of the SHAs overlap with lands that are already managed for conservation. The SHAs were corroborated with biological data, ecological designations, and specific knowledge of the area. The SHA nominations will be incorporated into future conservation and restoration planning efforts.

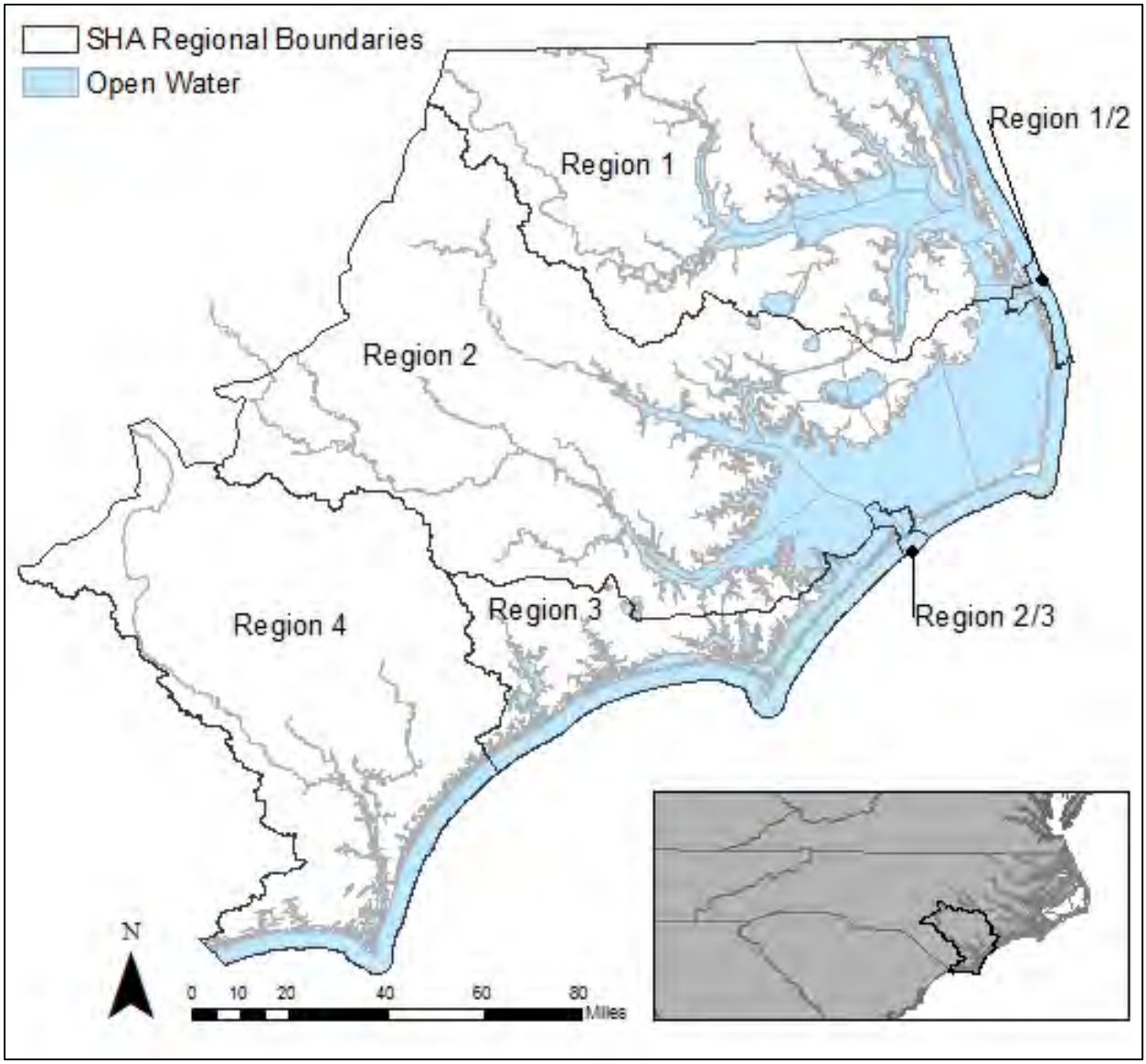
1 INTRODUCTION

The identification and designation of Strategic Habitat Areas (SHAs) for marine and coastal fishery species is a critical component in the implementation of North Carolina's approved Coastal Habitat Protection Plan (CHPP). Strategic Habitat Areas were defined in the CHPP as, "specific locations of individual fish habitat or systems of habitats that have been identified to provide exceptional habitat functions or that are particularly at risk due to imminent threats, vulnerability, or rarity" (DEQ 2016; Deaton et al. 2010; Street et al. 2005). Criteria for identifying SHAs were developed by North Carolina Division of Marine Fisheries (DMF) staff and a Marine Fisheries Commission (MFC) advisory committee established in the summer of 2005. The committee developed a scientifically based process for identifying candidate areas for designation using biological data and the consensus of a regional expert panel (regional advisory committee). Their generic process is described in the guidance document entitled, "Process for Identification of Strategic Habitat Areas" (Deaton et al. 2006) that was approved by the MFC.

Strategic Habitat Area designations are based on regional analyses that identify optimally placed habitat areas of various ecological condition (exceptional or at risk). Strategic Habitat Areas may include areas that have already been protected by other designations, as well as areas not currently recognized in any way. Thus, areas designated as SHAs will require various site-specific management actions that best address the threats affecting that site. A network of designated SHAs providing habitat connections throughout North Carolina's coastal waters will help ensure that the complex life history needs of all species are met. Once SHAs are designated, resource managers may address priority fish habitat issues and take steps to prevent further alteration of strategic areas. Thus, the necessary protections for some areas may go above and beyond current measures designed to protect habitat. The nomination of SHAs will provide guidance for other conservation projects focused on conservation/acquisition, enhancement, or restoration projects.

The identification of SHAs addresses the continuing degradation and loss of important habitats referenced in the CHPPs (DEQ 2016; Deaton et al. 2010; Street et al. 2005). Current rules and policies of the resource management agencies fail to adequately address the individually small but cumulatively large alterations of fish habitat for development and associated human activities. Eventually, resource management and conservation agencies must address the issue of cumulative impacts in terms of fisheries ecosystem integrity and threshold alteration levels (DMF 2016; Deaton et al. 2010). On a regional scale, the concept of managing ecosystems to avoid cumulative impacts is partially addressed by assessing the condition of natural resource targets based on the presence, extent, and influence of multiple alteration factors. Maintaining a healthy ecosystem through focus on SHAs is based on the interdependent relationship between 1) natural resource targets, 2) alteration factors, 3) the spatial landscape, and 4) fish distribution and movement. Averting threshold levels of cumulative alteration to SHAs could be accomplished with both regulatory and non-regulatory tools, although the focus will be on non-regulatory tools.

Four regional analyses are being done to identify SHAs in coastal waters. Region 1 (Albemarle Sound System), Region 2 (Pamlico Sound system), and Region 3 (White Oak River Basin) were completed in 2009, 2011, and 2014 respectively (Map 1). SHAs in these regions are already being used by conservation groups to a limited extent. Sampling will begin in 2018 to verify fish productivity in SHAs and determine if modifications are needed. Once complete, staff will focus on developing site-specific measures to protect and enhance SHAs.



Map 1. Regional boundaries for Strategic Habitat Area (SHA) nominations.

1.1 Geographic Scope of Region 4

Region 4 is the southernmost region and has a riverine and estuarine component. It includes the southern estuaries from Surf City to the South Carolina border, and the Cape Fear River system upstream to approximately Lillington (Map 1). This upstream limit encompasses the historical anadromous fish spawning grounds of Smiley Falls (approximate fall line). Region 4 does not include the entire Cape Fear river basin, which extends to the Greensboro area. The Advisory Committee recognized that anadromous fish utilize waters upstream of the Region 4 boundary and that these areas are equally important but beyond the scope of this process. The estuarine component includes the coastal U.S. Geological Survey hydrologic units (HUs) east (part of the White Oak river basin) and west (part of the Lumber river basin) of the Cape Fear River basin. Hydrologic units are a defined area of land and water within a drainage divide. The USGS categorizes these with a standardized classification system, from the largest (region) to the smallest catchment basin (subwatershed). These coastal waters drain to the ocean through the numerous inlets.

The estuarine waters from Surf City through Sunset Beach include many mainland tidal creeks, small sounds, and inlets, as well as the Intracoastal Waterway. There are eight inlets in addition to the mouth of the Cape Fear, separating ten islands and the peninsula of Carolina Beach. These include New Topsail, Rich, Mason, Masonboro, Carolina Beach, Lockwood Folly, Shallotte, and Tubbs inlets. Mainland tidal creeks east of the Cape Fear in Pender, New Hanover, and Brunswick counties include Becky's, Virginia, Mallard, Topsail, Mill, Futch, Pages, Howe, Bradley, Hewletts, and Whiskey creeks. Tidal creeks west of the Cape Fear in Brunswick County include Dutchman Creek, Elizabeth, Lockwood Folly, Shallotte, and Calabash rivers occur (Map 2).

The riverine component of Region 4 includes the three lower subbasins of the Cape Fear River basin – Northeast Cape Fear, Black River, and Lower Cape Fear systems. Each subbasin includes other smaller waterbodies. Counties in riverine component of Region 4 include Brunswick, New Hanover, Pender, Duplin, Sampson, Bladen, and Cumberland, as well as a small amount of Hoke, Harnett, Wayne, and Onslow (Map 2).

Map 2. Major water bodies in Region 4.

All six habitat types described in the CHPP (DEQ 2016; Deaton et al. 2010; Street et al. 2005) are present within the region. The estuarine water column is characterized as having relatively small waterbodies a large portion of high salinity waters, and lunar tides with a large tidal range (3-5ft). Subsequently, shell bottom is primarily intertidal and salt marsh is extensive. Despite the small estuarine waterbodies in Region 4, there is a disproportionately large amount of shell bottom habitat, relative to other regions (DEQ 2016). Submerged Aquatic Vegetation (SAV) is less abundant and patchier than in the other regions but has been increasing over the past ten years. The Cape Fear system ranges from high salinity at the mouth, brackish in the vicinity of Wilmington, to non-tidally influenced fresh water in the upper portion of the region. The Cape Fear River is the only coastal river that drains directly to the ocean. Habitat is primarily forested wetlands, freshwater marsh, and riverine soft bottom. Most nearshore hard bottom in North Carolina predominantly occurs within Region 4. Concentrations of low to moderate profile hard bottom occur in state waters offshore of Topsail and Masonboro Islands (Onslow Bay) and Brunswick County (Long Bay). In federal waters, hard bottom is more extensive and is characterized as having greater topographic complexity.

Because of the large portion of shallow structured habitats in this region, designated Primary Nursery Areas are abundant in both the coastal and Cape Fear River components. Waters of the Cape Fear River, beginning downstream at Town Creek, and extending upstream through most of the region, are designated as Anadromous Fish Spawning Areas. A diversity of anadromous fish uses the Cape Fear, including striped bass, American shad, river herring, American eel, and Atlantic and shortnose sturgeon. In addition to supporting a diversity of aquatic habitat and fish, this region, referred to as the Cape Fear Arch, supports a unique geological landscape and high biodiversity in upland and wetland habitats and many endemic species (Cape Fear Arch Conservation Collaboration 2015).

1.2 Land Use

The counties of Brunswick, New Hanover, and Pender counties had the highest population increase in the 20 coastal counties between 1990 and 2015 (DEQ 2016). New Hanover and Brunswick counties are the first and third most populated counties. Most the increased population and associated development has occurred along the coast. Wilmington and Fayetteville are the two largest cities in the region. Development in, and urban sprawl adjacent to, these cities accounts for most of the increase in developed land use, and decrease in evergreen forest and forested wetlands. Land use is primarily residential along the coast and around Wilmington and Fayetteville. Land use in rural inland areas of Region 4 consists of crop and animal agriculture, as well as industrial use along the main stem of the Cape Fear River. Swine and poultry farms are highly concentrated in the Northeast Cape Fear watershed. Municipalities use the river for wastewater discharge and drinking water uptake. Many industries have been located along the Cape Fear River for decades due to the need to discharge industrial waste. Subsequently there are several EPA Superfund sites along the river. However, with these exceptions, many other areas between Wilmington and Fayetteville are fairly undeveloped and support productive habitat and fisheries.

The large population increase puts stress on the adjacent ecosystem. For example, of the coastal river basins, the Cape Fear, which includes the southern estuaries of Pender and New Hanover counties, had the second greatest acreage of impacted wetlands based on 401 permit records, from FY 2000- FY 2014. Increasing development stresses shell bottom habitat through point and nonpoint sources bringing sediment and other pollutants to shellfish waters. In 2014 48% of

shellfish harvest waters in the southern counties (Onslow through Brunswick counties) were closed due to bacterial contamination. Despite multiple anthropogenic threats and large areas closed to harvest, 45% of the total landings in North Carolina came from the southern counties in 2013 (DEQ 2016), which further impacts the habitat. In the low salinity and fresh waters of the Cape Fear River, runoff from agriculture, concentrated animal feeding operations (CAFOs), and industrial discharges is the primary water quality threat. Since 2009, algal blooms of toxic *Microcystis* have been occurring in the Cape Fear River and been concentrated between Lock and Dam 1 and upstream of Lock and Dam 3. Obstructions to anadromous fish passage from dams are also a significant concern in the Cape Fear River.

There are several conservation lands that provide habitat protection as well as recreation opportunities. Among the conservation lands are two undeveloped islands (Masonboro Island National Estuarine Research Reserve and Lea Island), Fort Fisher State Recreation Area, Carolina Beach State Park, Holly Shelter and Angola Bay Game Lands, and Singletary Lake State Park and Raven Rock State Park. Additionally, over 24,000 acres have been purchased for conservation along the Black River, Northeast Cape Fear River, and Town Creek.

The DMF Management Review Team noted increasing shellfish harvest closures as a priority threat throughout the estuarine region. Degraded nursery conditions due to toxin and nutrient contamination, sedimentation, and altered flow and salinity was also considered a concern overall. Algal blooms, low dissolved oxygen, and stream obstructions to fish passage were the primary concerns in the Cape Fear system.

1.3 Identification of Priority Species

The priority fisheries species of the Cape Fear River Basin encompasses many shellfish and finfish including eastern oyster (*Crassostrea virginica*), clam (*Mercenaria mercenaria*), blue crab (*Callinectes sapidus*), shrimp (Penaeus spp.), bay scallop (*Argopecten irradians*), southern flounder (*Paralichthys lethostigma*), red drum (*Sciaenops ocellatus*), spotted seatrout (*Cynoscion nebulosus*), kingfishes (*Menticirrhus* spp.), and spot (*Leiostomus xanthurus*). The Cape Fear River system is vital to anadromous species, including striped bass (*Morone saxatilis*), shad and river herring (*Alosa* spp.), and sturgeon (*Acipenser* spp.), that migrate up river for spawning; while the nearshore provides important habitat for gag (*Mycteroperca microlepis*), black sea bass (*Centropristis striata*), sheepshead (*Archosargus probatocephalus*), and mackerels (*Scomberomorus* spp.). Commercial and recreational landings support the value of these fisheries to the region. Commercially blue crab, shrimp, spot, oysters, king mackerel and gag grouper had the highest average landings (2005-2015) in Pender, New Hanover, and Brunswick counties (Table 1). Recreationally, flounder, red drum, spotted seatrout, king and Spanish mackerel, and spot were the most targeted species. These were all considered priority species for Region 4 by the DMF Management Review Team.

The CHPP states that "The areas that contribute most to the integrity of the system are a category of habitat termed Strategic Habitat Area" (DEQ 2016; Deaton et al. 2010). In a general sense, the abundance and diversity of habitat such as shallow nursery areas, SAV, and oyster beds is what sustains productivity in Region 4. The Region 4 SHA assessment focused on identifying habitat areas that provide critical functions to various life stages of priority species and are minimally degraded.

Table 1. Commercial landings of priority fishery species in Region 4 (DMF, unpublished data).

		Commercial Landings (lbs)			
	Species	2005	2010	2015	2005-2015 Avg.
Shellfish/ crustacean	Blue Crab	1,057,677	1,004,967	843,108	1,055,345
	Shrimp	680,384	806,235	588,632	585,211
	Oysters	87,933	159,419	153,741	149,931
	Clams	69,277	52,139	33,575	56,462
	Bay Scallop*	-	-	-	34
Estuarine finfish	Spot	261,357	57,982	119,858	165,403
	Kingfishes	99,450	133,107	118,682	102,408
	Southern Flounder	66,384	66,702	93,337	78,546
	Spotted Seatrout	8,921	9,224	15,156	12,464
	Red Drum	7,088	6,189	12,454	7,402
Anadromous fish	Striped Bass**	2,721	-	-	611
	Sturgeon	-	-	-	-
Reef Fish and coastal pelagics	Grouper, Gag	160,443	151,385	67,984	126,449
	Black Sea Bass	146,538	65,009	100,425	103,470
	Sheepshead	2,183	2,526	10,893	6,731
	King mackerel	266,007	158,996	128,748	210,080
	Spanish mackerel	2,183	2,526	10,893	6,731

*Landings in 2013 only
**Landings from 2005-2008 only

2 METHODOLOGY

A guidance document was developed to direct the methods for identifying SHAs (Deaton et al. 2006). The SHA identification process consists of three main phases, each of which requires input from a regional expert panel. The first phase in the SHA process is to identify priority species and habitats, and build a GIS database of existing biological and anthropogenic use data for Region 4. The DMF Management Review Team selected priority species for the region based on their importance to both the recreational and commercial fishing industries in the region. Once data was assembled by DMF staff, the regional advisory committee for Region 4 reviewed the data to ensure that they have sufficient spatial coverage and are current enough to be included in the SHA selection process. Then the committee examined the priority fish species for the region and suggested the amounts, or representation levels, of each habitat, or natural resource target (NRT), that should be included in the final SHA network. The second phase of the process was to run the site selection software Marxan (Ball et al. 2009) to determine an initial configuration of SHAs. Once the Marxan modeling was complete, the third phase consisted of an expert committee reviewing the Marxan selections and using corroborating information and their own ecological knowledge to modify the boundaries of the SHAs and derive a final network of SHA nominations.

2.1 Natural Resource Targets

In this analysis, natural resource targets (NRTs) are defined as the habitats that represent essential or unique components of the fisheries ecosystem. Natural resource targets vary by

region and representation levels (the amount of a habitat to be included in the SHA nominations) should be chosen to differentiate between habitats that are used differently by fish species. To do this, priority species were grouped into shellfish/crustaceans, estuarine finfish, anadromous fish, and reef fish and coastal pelagics based on common life history strategies (Table 2). Each NRT was evaluated based on its value to these species' groups. Once identified, the use of NRT by each group of priority species was used to set representation levels. In addition to the importance to priority species, the ability of the NRT to improve water quality was also considered when setting representation levels. After an initial value was set, representation levels were adjusted by the advisory committee based on the regional importance of a habitat type, quality of habitat data, and overall amount of habitat in a region. Additional adjustments were made to the NRT representation levels by the advisory committee after reviewing the sensitivity analysis (See Sensitivity Analysis Section). A comprehensive list of NRTs and the chosen representation levels are listed in Table 2.

Table 2. Natural resource targets (NRTs) and representation levels used in the analysis and the importance of each NRT to priority species in Region 4.

Habitat type	Natural resource target	Total acres within focus area	Rep level (%)	Importance to priority species				
				Shellfish	Anadromous fish	Estuarine finfish	Reef fish & coastal pelagics	Water quality
				oysters, blue crabs, hard clams, bay scallops, shrimp	striped bass, American Shad, river herring, sturgeon	southern flounder, spot, spotted seatrout, red drum, weakfish	gag, black seabass, sheepshead, kingfishes, mackerels	-
Hard bottom	Hard Bottom	3,689	0				X	
SAV	High salinity SAV	653	60	X		X	X	X
Shell bottom	Intertidal shell bottom	3,708	60	X		X	X	X
	Subtidal shell bottom	2,395	60	X		X	X	X
SAV & shell bottom	SAV & shell bottom	130	80	X		X	X	X
Creeks & Rivers	Riverine soft bottom (0-3ft)	1,902	30	X		X		
	Riverine soft bottom (3-6ft)	292	20	X		X		
	Riverine soft bottom (>6ft)	1,174	20			X		
	Riverine soft bottom (ND)	6,764	10			X		
Shallow soft bottom	Palustrine soft bottom (0-3ft)	18	0			X		
	Palustrine soft bottom (ND)	195	0			X		
	Estuarine soft bottom (0-3ft)	18,430	20	X		X		
	Estuarine soft bottom (3-6ft)	3,507	20	X		X		
	Estuarine soft bottom (ND)	6,965	0	X		X		
	Marine soft bottom (0-3ft)	4,226	30			X	X	
	Marine soft bottom (3-6ft)	3,576	20			X	X	
	Marine soft bottom (ND)	54	0			X	X	
Deep soft bottom	Estuarine soft bottom (>6ft)	6,911	10	X		X	X	
	Marine soft bottom (>6ft)	176,471	0			X	X	
Wetland	Emergent wetland	34,629	10			X		X
	Forested wetland	58,637	30			X		X
	Shrub & scrub wetland	3,792	0					X
	Wetland edge	9,067	40			X		X
Low-elevation upland	Low-elevation upland	2,110	0					X
Water column	Streams (low elevation)	624	20			X		
TOTAL AREA		**349,918**						

2.1.1 Hard Bottom

Locations of hard bottom in the ocean are not well documented, and only a few datasets exist that give specific locations and information about hard bottom habitats. For the Region 4 analysis data was combined from several different data sets to create a mosaic of hard bottom habitat. The most extensive survey was based on the Southeast Area Monitoring and Assessment Program's reef-dependent fish collections from the 1990s (SEAMAP 2001). In addition, the list of wrecks and obstructions was obtained from the National Oceanic and Atmospheric Administration (NOAA) Office of Coast Survey Automated Wrecks and Obstructions Information System database (https://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html). Natural Heritage Areas of hard bottom outcrops near Fort Fisher, Masonboro, and Topsail were included (https://ncnhde.natureserve.org/content/data-download).

Due to geographic and spatial relationship constraints between NRTs (See Sensitivity Analysis section), the advisory committee decided to remove hard bottom from the model, setting a representation level of zero, and hand select during the corroboration stage (Table 2). Because of its importance to priority species such as gag, black sea bass, and sheepshead, as well as the lack of mapping data documenting hard bottom habitat, more than 77.4% of all known locations of hard bottom material were selected in the proposed SHA network for Region 4. Unlike previous regions DMF artificial reefs were not excluded from these selections since they are an important and large part of the offshore hard bottom habitat.

2.1.2 Submerged Aquatic Vegetation

Submerged aquatic vegetation beds were mapped using aerial photography interpretation and transect data interpolation. Source data for Region 4 were acquired in 2007 and 2015 (Benthic Habitat Mapping Program 1988-March 2016, unpublished data). Mapped SAV was further differentiated into low (0-15ppt) and high salinity (>15ppt) beds, based on NOAA salinity classifications. All SAV within Region 4 is classified as high salinity.

The presence of SAV indicates an area with good water quality that is sufficient to support a wide variety of essential ecological functions within coastal habitats, providing an implicit way to differentiate between qualities of areas in soft bottom habitats. In the context of other Marxan inputs, a sensitive habitat such as SAV can help distinguish between otherwise similar habitats such as shallow estuarine soft bottom. Because of its regional importance and uniqueness, high salinity SAV targets were set relatively high (60%; Table 2).

2.1.3 Shell Bottom

Shell bottom habitat in Region 4 was based on interpolated transect data collected by the DMF Estuarine Benthic Habitat Mapping Program (http://data.nconemap.com/geoportal/catalog/search/resource/details.page?uuid=%7BECC895DB-5A1C-4F13-98C3-1AB080F4B4B5%7D). The source data ranges from 1988 to 2016, depending on the geographic area. The shell bottom target is defined as areas with at least 30% coverage of shell material (typically oysters) in water generally less than 12 feet deep. Shell bottom is subdivided into intertidal and subtidal by the Estuarine Benthic Habitat Program.

Other sources of data were incorporated into the shell bottom target, including cultch planting

sites (DMF unpublished data, 1981-2016) and an oyster reef mapping assessment of Masonboro Island conducted by the National Estuarine Research Reserve (NERR) (Manley 2016). Cultch planting data was classified as either intertidal or subtidal based on depth recorded at the time of deployment. All the Masonboro Island NERRs data was considered to be intertidal. Representation levels were set at 60% for both intertidal and subtidal shell bottom because they are regionally important as a fishery resource, serve as fish habitat, and are important for maintaining water quality (Table 2).

2.1.4 Submerged Aquatic Vegetation and Shell Bottom

The SAV and shell bottom data was derived from clipping the overlaid SAV and shell bottom layers. Areas where both occurred were then selected. Submerged Aquatic Vegetation and shell bottom are both indicators of good water quality and a high productivity. Therefore, the representation level for areas where both SAV and shell bottom occur was set very high at 80% (Table 2).

2.1.5 Low-Elevation Uplands

Low elevation uplands were included because they are potential sites for marsh migration as inundation occurs (DEQ 2016; Deaton et al. 2010). A 2008 3m digital elevation model with a vertical accuracy of 25cm was used to select areas less than two feet above mean sea level and having a patch size greater than $25m^2$. Non-wetland shorelines were also included in this category of uplands. The non-wetland shoreline was derived from the North Carolina Division of Coastal Management (DCM) estuarine shoreline data. A 15m landward buffer was applied to the shoreline and the resulting data was combined with the uplands derived from the digital elevation model. Only low elevation uplands adjacent to other NRTs were retained; all others were eliminated from the dataset. Due to this connectivity, the model will inherently select any upland associated with the other NRTs. Therefore, the representation level was set to 0% (Table 2).

2.1.6 Wetlands

Wetland targets were extracted from the U.S. Fish and Wildlife's National Wetlands Inventory (NWI) (https://www.fws.gov/wetlands/data/data-download.html) where wetlands are classified according to Cowardin et al. (1979). Wetlands of the following types are included in the Region 4 analysis: estuarine intertidal emergent, shrub/scrub, and forested wetlands and palustrine emergent, shrub/scrub, and forested wetlands. Only contiguous wetlands within 90m of a stream or shoreline of the National Hydrography Dataset (NHD) high resolution data (1:24,000-scale) were included as a target for assessment (https://nhd.usgs.gov/NHD_High_Resolution.html). Representation levels were set at 10%, 30%, and 0% for emergent, forested, and shrub/scrub wetlands, respectively, based on their importance to the estuarine system (Table 2).

2.1.6.1 Wetland Edge

This target consists of the linear wetland edge as designated in the DCM estuarine shoreline data layer with a 15m landward buffer applied. The wetland edge target does not differentiate between the marsh and forested edges. The inclusion of wetland edge, in addition to riparian/interior wetlands, was intended to capture the important linear ecotone within aquatic systems. Wetland shorelines are important habitat for juveniles of some priority species and the Wetland edge representation level was set relatively high at 40% to reflect such (Table 2).

In Region 2, the linear wetland edge features were buffered and converted to polygon features while in the Region 3 analysis the wetland edge feature was kept linear. In Region 3, the linear features were retained with the intention of maintaining the integrity of the linear dataset and avoiding potential false inflation of alterations many of the alterations affecting these features were also linear. For Region 4, most alteration are polygon features and it was determined that buffering the wetland edge would not falsely inflate alteration factors.

2.1.7 Streams

Small creeks and streams were represented using the NHD high resolution data (1:24,000-scale). This dataset represents a connected network of stream channels. The streams were clipped out of the open water features to leave a continuum from linear to polygon water features. The artificial connectors, an artifact needed to maintain the datasets continuous linear network between features, were removed from the dataset because they did not represent stream habitat. A representation level of 20% was set for streams (Table 2).

2.1.8 Soft Bottom

Soft bottom or water column habitat was designated as any area without submerged aquatic vegetation, shell bottom, or other structured habitat. This soft bottom habitat was derived using the DCM estuarine shoreline layer, the NOAA bathymetry contour dataset (https://data.noaa.gov/dataset/bathymetric-contours), and the NWI dataset. The DCM estuarine shoreline data was used as the base or boundary for the soft bottom natural resource target because it was recently digitized using high quality aerial imagery. All other structured features were removed from this base layer; this includes submerged aquatic vegetation, shell bottom, and hard bottom. The remaining features were considered soft bottom features.

The soft bottom features were further classified by depth and system. The depth categories included 0-3ft, 3-6ft, and no depth (ND). These distinctions are important because they correspond to major differences in ecological function (i.e., shallow water nurseries). Depth was derived from the NOAA bathymetric dataset. The no depth category was assigned to channel-like hydrographic features adjoining more open waters, or where the bathymetric charts indicated no data.

The soft bottom habitats are also classified into system type using the NWI wetland polygon dataset and classification system (Cowardin et al. 1979). Any soft bottom habitat that did not have a hydrological connection to riverine or estuarine systems by linear water features was removed from the dataset by applying a 30m buffer to determine connectedness of water bodies (i.e., lakes and ponds) to adjacent water features. Soft bottom habitats are classified into riverine, estuarine, palustrine, and marine systems.

- Riverine systems were separated from low salinity estuarine systems based on a linear or meandering morphology and a substantial (non-ditched) drainage network upstream.
- Palustrine systems included all non-tidal wetlands dominated by trees, shrubs, persistent emergent, and all such tidal wetlands were ocean-derived salinities are below 0.5ppt. Palustrine systems were only included if they were directly adjacent to connected lacustrine, riverine, or estuarine systems.

- Estuarine systems included all open waters and intertidal flats between riverine and marine systems. The estuarine system also includes pond-like features surrounded by estuarine wetlands.
- Marine systems included the subtidal and intertidal waters of the coastal ocean and inlets.

Due to the abundance of soft bottom in the region most representation levels were set below 30% (Table 2).

2.1.9 Rare or Listed Species

Rare or listed species are not included in the Marxan analysis as targets, but are taken into account indirectly through targeting of associated habitats, and during the second phase of the analysis using expert modification. Rare, listed, or species of special concern in this region include Atlantic sturgeon (*Acipenser oxyrhynchus*), bottlenose dolphins (*Tursiops truncatus*), diamond back terrapins (*Malaclemys terrapin*), and sea turtles (Chelonioidea). Sturgeon habitat will be indirectly targeted through selection of riverine wetlands, streams, and soft and hard bottom. Green (*Chelonia mydas*), Kemp's ridley (*Lepidochelys kempii*) and loggerhead sea turtles (*Caretta caretta*) are the most common of the five listed sea turtle species in Region 4. They tend to enter the estuarine waters in the spring as they migrate north for the summer, and leave the estuary in the fall to migrate south for winter. Sea turtles are highly mobile, moving around as they feed opportunistically. Within Region 4, sea turtles are can be found throughout the sounds and lower rivers. Their habitat will be targeted indirectly through deep soft bottom.

2.2 Alteration Factors

Alteration factors are human activities that impact the marine environment. The alteration factors used in the analysis are listed in Table 3 and described in the sections below. Each factor was evaluated for duplication or overlap with other factors.

Table 3. Alteration factor weightings used in the Marxan analysis. Scale: 0-3, with 0 being no impact, and 3 being the most severe impact.

	Water based Alterations (impact hydrology)*								Land based Alterations (impact water quality)								Physical	
Habitat Categories	Culvert-obstructions	Impoundments	Bridge Constrictions	Bulkheads	Rip rap	Dredged channels	Ditched/Drained	Canals and boat basins	Major NPDES**	Minor NPDES**	Marinas	Animal operations**	Developed land use***	Agricultural land use***	Prohibited shellfish harvest	Docks and piers	Trawling and dredging allowed	Mechanical clam harvest
Hard bottom	1	1	0	1	1	2	0	2	2	1	1	0	1	1	2	1	3	3
Creeks & rivers	2	3	2	1	1	1	1	1	2	1	2	3	2	2	1	0	1	1
SAV	1	1	1	2	1	3	0	3	2	1	2	2	3	2	1	2	3	3
Shell bottom	1	0	1	0	0	3	0	1	1	1	2	1	2	1	1	0	2	3
SAV & shell bottom	1	1	1	2	1	3	0	2	2	1	2	2	3	2	1	2	3	3
Deep soft bottom	0	1	0	0	0	1	0	1	1	1	1	1	1	1	1	0	1	1
Shallow soft bottom	0	1	0	2	1	2	0	1	1	1	2	2	1	1	1	0	2	1
Upland	1	1	0	2	1	0	0	1	0	0	0	0	1	1	0	0	0	0
Wetland	1	2	1	1	0	2	3	1	1	1	1	1	1	1	0	1	0	0
Streams	2	2	2	1	1	1	2	0	3	2	0	3	3	2	0	0	0	0
Wetland edge	1	2	1	3	2	2	2	2	1	1	1	1	1	1	0	1	0	0

*Based on existing GIS layers and factored as presence/absence

**Calculated as the # of a facility per HU

***National Pollutant Discharge Elimination System – Relativized proportion of development/agricultural land use per HU

2.2.1 Natural Resource Targets and Alteration Factors

The NRTs for Region 4 were grouped into general habitat categories for the purpose of applying alteration factor ratings. For example, wetland types are affected similarly by ditching and drainage; therefore, they form one habitat type for alteration calculations. However, there were linear and polygon wetland and shoreline features. To apply the equations to calculate the total alteration score presented in Appendix A, the linear features were converted into narrow polygon features. Like Regions 2 and 3, this conversion was also done for linear water features including linear stream features. The NRT groupings are listed in Table 3 and described below:

- Hard Bottom – All categories of hard bottom.
- Creeks/rivers – Polygon water column features for riverine hard and soft bottom NRTs. This category represents soft bottom under flowing water conditions.
- SAV – All categories of SAV, only high salinity present in Region 4.
- Shell bottom – All categories of shell bottom.
- Soft bottom, deep – All categories of estuarine and marine soft bottom >6ft deep. This category represents soft bottom under standing water conditions.
- Soft bottom, shallow – All categories of estuarine and marine soft bottom <6ft deep. This category represents soft bottom under standing water conditions.
- Uplands – Line features that were converted to polygons using a buffer 15m landward from non-wetland shorelines. The polygon target for low-elevation uplands was included in this basic habitat type for alteration.
- Wetland – Wetland edge was converted to polygons using a buffer 15m landward from wetland shorelines. Interior wetlands are polygon features >15m from wetland edge.
- Streams – Linear water column features converted to polygons using a 2m buffer. The size was based on the thinnest polygon water features, usually upper end of creeks or rivers.

Many other factors were considered, but were not included for various reasons. Among them were 2014 DWQ use support ratings, stormwater outfalls, surface water intakes, silviculture operations, and beach nourishment. Some of these may have been used during the corroboration phase. Their use was excluded for the following reasons:

- DWQ use support ratings were not used because we primarily needed aquatic life use support, which wasn't available in all locations.
- Stormwater outfall maps from DWQ and SS&RWQ were incomplete for the region and overlap with the Shellfish Growing Areas was observed.
- The GIS data for water intakes was extremely outdated, excludes certain areas and intakes under large minimum thresholds, and the National Pollutant Discharge Elimination System (NPDES) sites covered major surface water intakes.
- Silviculture/forestry discharge not included because literature review in the CHPP indicated minor effect on habitat and water quality, previous advisory committees felt the alterations to aquatic habitat were minor relative to other threats, and the activity was difficult to represent spatially (Deaton et al. 2010; Uphoff 2008).
- Dredge material disposal on beaches has occurred in the region (Deaton et al. 2010), but was not included in the alteration factors, since it was episodic and less frequent than

beaches with long term storm protection projects.

Alteration factors are loosely categorized as affecting hydrology (water based alterations), water quality (land based alterations), or physical structure of habitat (physical). The effect of alteration factors on natural resource targets is represented in various ways:

1. *Overlap of habitat area and alteration footprint* – This was done for alteration features whose effect could be accurately represented by a discrete area. Altered areas for these features were represented as the area of the intersection between the habitats present and alteration. This was done for culverts-obstructed areas, impoundments, bridge constrictions, bulkheads, rip rap, dredged channels, ditched/drained wetlands, canals and boat basins, prohibited shellfish harvest, marinas, piers and docks, trawling, and mechanical clam harvest.

2. *Relative impact of the alteration factor to a hydrologic unit* – This was done for alteration factors that were theorized to have watershed-level impacts or if the data collection prevented a discrete area of impact from being delineated. To calculate this, the extent of an alteration factor (whether it be total area or the sum of point counts) is summed across HUs and amount is scaled to the maximum value occurring in any HU in the region. This includes major and minor NPDES, animal operations, developed land use, and agricultural land use.

2.2.2 Hydrological Alterations

2.2.2.1 Culvert-Obstructed Areas

This factor identifies the stream segments with possible obstructions by small barriers including culverts and fords. The source of the culvert data was the North Carolina Barrier Prioritization tool which was funded by American Rivers and supported by the Southeastern Aquatic Resource Partnership (SARP). This tool uses state specific natural heritage and anadromous fish data to prioritize dams for fish passage within the state boundaries (Hoenke 2014). The Small Barriers layer from the prioritization tool was used to identify culvert obstructed areas.

2.2.2.2 Impoundments

Impounded waters include the watershed upstream from documented dam locations and waterfowl impoundments. The data sources for dam locations were the North Carolina Barrier Prioritization tool which was funded by American Rivers and supported by the SARP. This tool uses state specific natural heritage and anadromous fish data to prioritize dams for fish passage within the state boundaries (Hoenke 2014). The Dam Inventory Version 2 layer from the prioritization tool was used to identify dam obstructed areas.

2.2.2.3 Bridge Constrictions

The bridge constriction data set was selected from the North Carolina Division of Transportation structure location shapefile (https://connect.ncdot.gov/resources/gis/pages/gis-data-layers.aspx). From this shapefile, all bridges, including railways and ferry ramps, were extracted.

2.2.2.4 Bulkheads and Riprap

Shoreline type was extracted from the DCM 2012 estuarine shoreline data (McVerry 2012).

Alteration was rated as the ratio of the linear distance of stabilized structures to the linear distance of shoreline within an assessment hexagon. Stabilized structures were defined as bulkheads and riprap. Alteration weight was higher for bulkheads than for riprap because bulkheads have a greater negative impact on the shorelines than riprap.

The DCM survey was based on 2006-2010 county level digital orthophotos from 6 in and 2ft resolution. Structure polyline features were generated from the imagery through heads up digitizing, and were digitized at a scale between 1:300 and 1:500 feet. Structure type is based on the presence of commercial, recreational, and erosion control structures and attributed using guidance provided in a DCM-generated methodology entitled "Charting the Estuarine Environment: A methodology spatially delineating a contiguous, estuarine shoreline of North Carolina" (Geis and Bendell 2008).

2.2.2.5 Dredged Channels

This alteration factor includes areas dredged by the U.S. Army Corp of Engineers (USACE) on a regular basis. The source data originated from 2003. This layer does not include channels dredged by the DWR or private channels dredged for deep-water access, though these areas may be included in the canals and boat basins layer.

2.2.2.6 Ditched/Drained

For the drained alteration factor, wetland polygons with partially drained wetland areas were derived using the “drained” attribute in the NWI dataset. For the ditched alteration factor, linear stream features with the classification in the high resolution NHD was used to select all ditched stream linear features.

2.2.2.7 Canals and Boat Basins

This alteration factor included very long and straight polygon features (obvious canals for navigation) or relatively short and straight elongate polygons with no upstream hydrology (short, water access canals or boat basins). Some of the delineated boat basins could also overlap with marinas. This file was created by clipping out portions of the DMF jurisdictional waters that appeared to be excavated canals or boat basins. Some modifications were made by hand to remove areas that were for obviously for drainage instead of navigation when compared with 2012 imagery data. Additional areas were added based on obvious canals and boat basins observed through various aerial imagery sources.

2.2.3 Water Quality and Land Use Alterations

2.2.3.1 Major and Minor NPDES

The major and minor NPDES alteration factor was derived from NPDES sites locations provided by DWR (2014 data). Major NPDES sites in the region included municipal wastewater discharges such as those for the cities of Carolina Beach, Wilmington, Elizabethtown, Fayetteville, and Dunn, and the counties of Brunswick and Harnett, and industrial process and commercial wastewater discharges such as those for the Brunswick and Sutton power plants, Riegelwood papermill, and other manufacturers. Minor NPDES sites were more numerous and variable in type including water plants and water conditioning, municipal, industrial process and commercial, groundwater remediation. It is difficult to determine the area of influence for a point source without a detailed hydrologic model. Therefore, major and minor NPDES sites

were summarized by HU to approximate the measure of alteration. The number of major and minor NPDES within HUs was then scaled by the maximum number occurring in the region, and the relative amount was used to calculate the relative severity of alteration. Major NPDES were given high alteration scores than minor NPDES to account for the scale of impact.

2.2.3.2 Marinas

Wildlife Resources Commission and DMF Shellfish Sanitation data on marina locations and numbers of slips were combined to make one dataset of all facilities with > 10 slips. The DMF Shellfish Sanitation Section has determined the area of influence for marinas or groups of marinas on a creek that subject to buffer rules for shellfish sanitation reasons. Areas within these buffers are closed to shellfish harvest. These closure areas were used to define the area of impact for marinas in this analysis. The total number of slips at marina facilities were aggregated by closure area and divided by the amount of area in the closed area to get a slips/acre metric. This metric was scaled to the maximum value occurring in Region 4.

2.2.3.3 Animal Operations

Locations and size of animal operations were obtained for poultry, swine, and cattle operations. The swine and cattle operation information was compiled by the Environmental Working Group (EWG) and Waterkeeper Alliance from the Department of Environmental Quality's (DEQ) animal operations permits as of January 2015 (DWR, Animal Feeding Operations Unit) and the 2015 USDA Cropland data layer. The poultry data was compiled by EWG and Waterkeeper Alliance from the Poultry - Inventory and Sales USDA AG Census 2007 and 2012 and the 2015 USDA Cropland data layer. It is difficult to determine the area of influence for a point source without a detailed hydrologic model. Therefore, animal operations were summarized by HU to approximate the measure of alteration. The number of animal operations within each HU was then scaled by the maximum number occurring in the region, and the relative amount was used to calculate the relative severity of alteration.

2.2.3.4 Developed Land Use

This alteration factor was derived from the NOAA 2006-2010 C-CAP Southeast Region Land Cover dataset using the open space, low-, medium-, and high-intensity development classifications (https://coast.noaa.gov/digitalcoast/tools/lca). The total area of developed land-use within each HU was calculated and scaled to the maximum proportion of developed land use found within a HU in the study region. A greater proportion of developed land within a HU suggests greater nutrient and chemical loadings from non-point development sources.

2.2.3.5 Agricultural Land Use

This alteration factor was derived from the NOAA 2006-2010 C-CAP Southeast Region Land Cover dataset using the cultivated crops and pasture/hay classifications. The total area of agricultural land-use within each HU was calculated and scaled to the maximum proportion of developed land use found within a HU in the study region. A greater proportion of agricultural land within a HU suggests high nutrient and chemical loadings from non-point agricultural sources.

2.2.3.6 Prohibited Shellfish Harvest

Prohibited shellfish harvest area information was obtained from DMF's Shellfish Sanitation and

Recreational Water Quality section. Areas prohibited to shellfish harvest due to high pathogenic microbe counts or automatic closures around wastewater treatment outfalls and marinas were included to represent non-point source alterations at spatial scales smaller than hydrologic units. The benefit of representing localized impacts was considered more important than minimizing the redundancy of similar alterations (i.e., NPDES, marinas, and developed land-use). In addition, the prohibited areas are documented alterations and not reliant upon inferred data. Only waters that fall under the categories of prohibited and conditionally approved, closed harvest are included; conditionally approved, open harvesting waters were not included because they are considered restorable by DMF. Areas that are closed due to marina buffer rules were removed from this layer to avoid duplication with the marina alteration layer.

2.2.3.7 Piers and Docks

Shoreline structures were obtained from the DCM 2012 estuarine shoreline structures survey data (McVerry 2012). These areas were considered an impact due to shading open water areas, disturbing the adjacent shoreline, and increased activity in the surrounding areas.

2.2.4 Physical Disturbance

2.2.4.1 Trawling

Trawling area information was obtained from DMF's Fisheries Management section. This GIS layer depicts areas that are open to both permanently and temporarily open to trawling. Both permanently and temporarily open areas were given the same alteration score because data on trawling effort and frequency of opening in specific areas and is not available at this time.

2.2.4.2 Mechanical Clam Harvest Areas

Mechanical Clam Harvest Area information was obtained from DMF's Fisheries Management section. Two types of mechanical harvest gear are currently used in North Carolina: the hydraulic escalator dredge and the clam trawl or "clam kicking" vessel. The hydraulic escalator dredge penetrates the bottom to a depth of about four inches and collects clams as they are forced from the bottom by water pressure and conveyed up the escalator aboard the vessel. In clam trawling or "kicking", clams are dislodged from the bottom with prop wash, and a heavily chained trawl with a cage behind the boat collects the clams (DMF 2017). It is accepted that these mechanical harvest methods can negatively impact submerged aquatic vegetation (SAV) and oyster rocks (Peterson et al. 1987), thus, mechanical harvest of clams is allowed only in certain areas. In addition, some of these areas are open and closed on a rotational basis of either one or two years (Table 4).

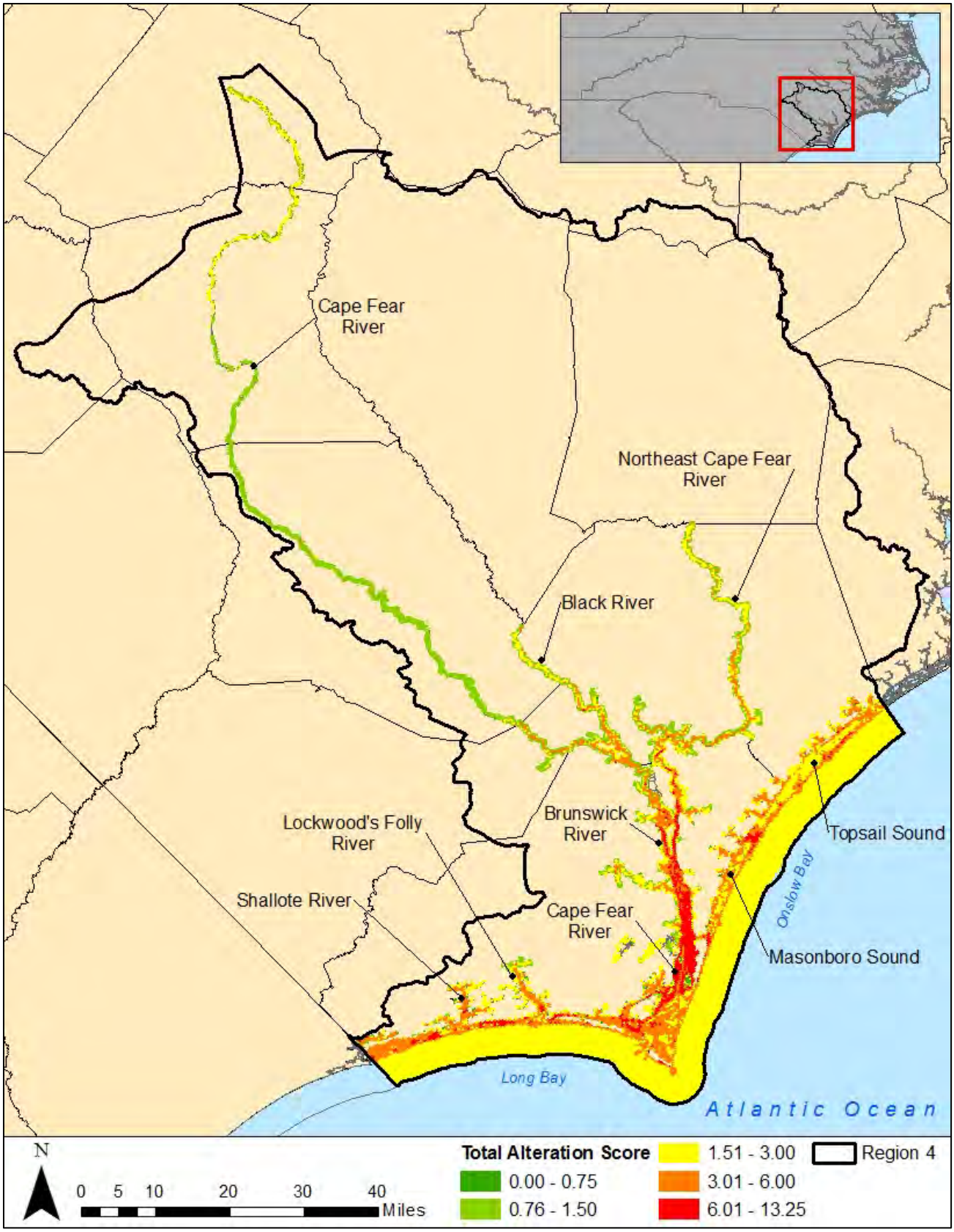
Table 4. Daily mechanical hard clam harvest limits by water body (DMF 2017).

Waterbody	Daily harvest limit (number of clams)	Additional information
Northern Core Sound	5,000	Rotates one year open and one year closed opposite the open/close rotation of the New River
Southern Core Sound	5,000	Limit reduced from 6,250 in 2001. Open annually.
North River	3,750	Open annually
Newport River	3,750	Open annually
Bogue Sound	3,750	Open annually
White Oak River	6,250	Rotates one year open and one year closed opposite the open/close rotation of the New River
New River	6,250	Rotates one year open and one year closed opposite the open/close rotation of the White Oak River and the ICW in the Onlsow/Pender
New River Inlet	6,250	Open annually from Marker 72A to the New River Inlet
ICW Onslow/Pender counties area	6,250	Intracoastal Waterway (maintained marked channel only) from Marker #65, south of Sallier's Bay, to Marker #49 at Morris Landing. All public bottoms within and 100 feet on either side of the Intracoastal Waterway from Marker #49 at Morris Landing to the "BC" Marker at Banks Channel. Open every other year when the New River is closed.

2.2.5 Total Alteration/Cumulative Impacts

Each alteration factor was assigned a rating ranging from 0 (no impact) to 3 (high impact) for each habitat type it coincides with (Table 3). Habitat types were condensed to match the major CHPP habitat types. The factor ratings were guided by a modified version of a similar table in the CHPP (Street et al. 2005), which is based on literature reviews and expert opinion. Because multiple factors can contribute to the alteration within a region, we combined the alteration factors into a total alteration rating which quantitatively measure the amount of alteration to each hexagon in the region. Briefly, the alteration score weights the alteration severity by the amount of habitat impacted and combines the severity and impact scores into a total score by weighting the proportion of each habitat present in the hexagon. The alteration score for Region 4 was created using a combination of ArcGIS models and R scripts and is described in detail in Appendix A.

The Cape Fear and Black rivers above the Pender county line, the Northeast Cape Fear River above Burgaw, and from the north of Wrightsville Beach to Topsail sound were the least altered. The most altered areas were in near developed areas such as the city of Wilmington, Sunny Point Military Terminal, Ocean Isle Beach, and Wrightsville Beach and other industrial areas long the Cape Fear River main stem (Map 3).



Map 3. Total alteration scores for Region 4. Higher values equate to greater degradation.

2.3 Marxan Analysis

The site selection software Marxan (Ball and Possingham 2000) was used to identify an initial network of areas to be considered for SHA nomination. The use of Marxan was recommended by Smith (2005) and adopted as SHA methodology. The site-selection tool makes it possible to systematically consider multiple NRTs and various socio-economic factors represented as alterations. The program provides a way to select a network of areas (classified by hexagon units) with the least amount of alteration, which is helpful because specific information is not available on maximum tolerable alteration levels and specific minimum habitat sizes needed to maintain functional ecosystems (Stewart et al. 2003). Often, the results of site selection tools are used as a starting point from which to determine boundaries and are not considered a final output (Geselbracht et al. 2009). Final SHA nominations incorporate expert scientific knowledge to consider additional biological information and socio-economic factors that may not have been included in the Marxan inputs.

The selection algorithm considers several sources of data and uses an iterative approach to consider multiple network configurations until it finds one that minimizes the area and cost of the network. Marxan allows the user to input data on the distribution of conservation features (NRTs in the SHA process) and to define the desired amount of each conservation feature desired in the final reserve configuration (representation level in the SHA process). In addition, Marxan allows the user to input a cost for each planning unit, which can vary based on the process objectives. The SHA process uses the alteration score of a hexagon as the cost under the assumption that alteration is equal to habitat degradation. This framework was designed so that Marxan would select a network of habitat areas that have the least amount of habitat degradation. In addition to the habitat and alteration inputs, Marxan allows the user to input a boundary length modifier (BLM), which controls the length of border allowed by the solution. Raising the BLM increases the cost of spatially disparate solutions, forcing the program to select hexagons that are closer together.

A Marxan analysis consists of a series of runs, each of which represents a solution found by the computer program. A grid of hexagons is laid over GIS habitat and alteration layers. The hexagons in this analysis were 30 acres in area, 432 m in diameter, and 216 m in side length. Each run consists of a specified number of iterations. Each iteration considers a new reserve configuration of hexagons by calculating a cost that is based on the success of the program at meeting its targets, the reserve boundary length and the cost of the area considered. Iterations proceed until the change between iterations is minimal or the maximum number of iterations is reached. The number of runs, iterations, and BLM can all be specified in the Marxan settings and should be adjusted to attain an appropriate solution for each analysis.

2.3.1 Sensitivity Analysis

A sensitivity analysis was conducted for Region 4, similar to those conducted for other regions, to determine the optimal scenario (DMF 2014; DMF 2011). By examining the scores of the best solution, the distribution of the scores that resulted from an analysis with 500 runs and 100,000 iterations was more robust among lower score, indicating that Marxan is finding similar solution across runs. The BLM was adjusted to 0.005 to produce the most efficient solution in terms of cost (minimizing the total alteration score) and area selected between runs. Lower BLM values produced solutions that were smaller, spatially isolated clusters with less than three hexagons.

Higher BLM values produced SHAs that were too large for management and consumed too much area.

As recommended by the advisory committee, an additional sensitivity analysis was conducted to examine the representation levels of the NRTs to determine which, if any, NRT make the largest difference in the solution generated by the model. That is, in some cases particular targets may have little impact on solutions while other targets are largely driving the solution. Therefore, when the most influential targets that are driving the model are set to zero the total area and alteration score or cost of the model will decrease (Ardron et al. 2010). Most NRTs generated small differences in total cost and total alteration score when set to zero. Forested wetlands, hard bottom, and wetland edge were determined to be the NRTs with the most influence on the model (Figure 1).

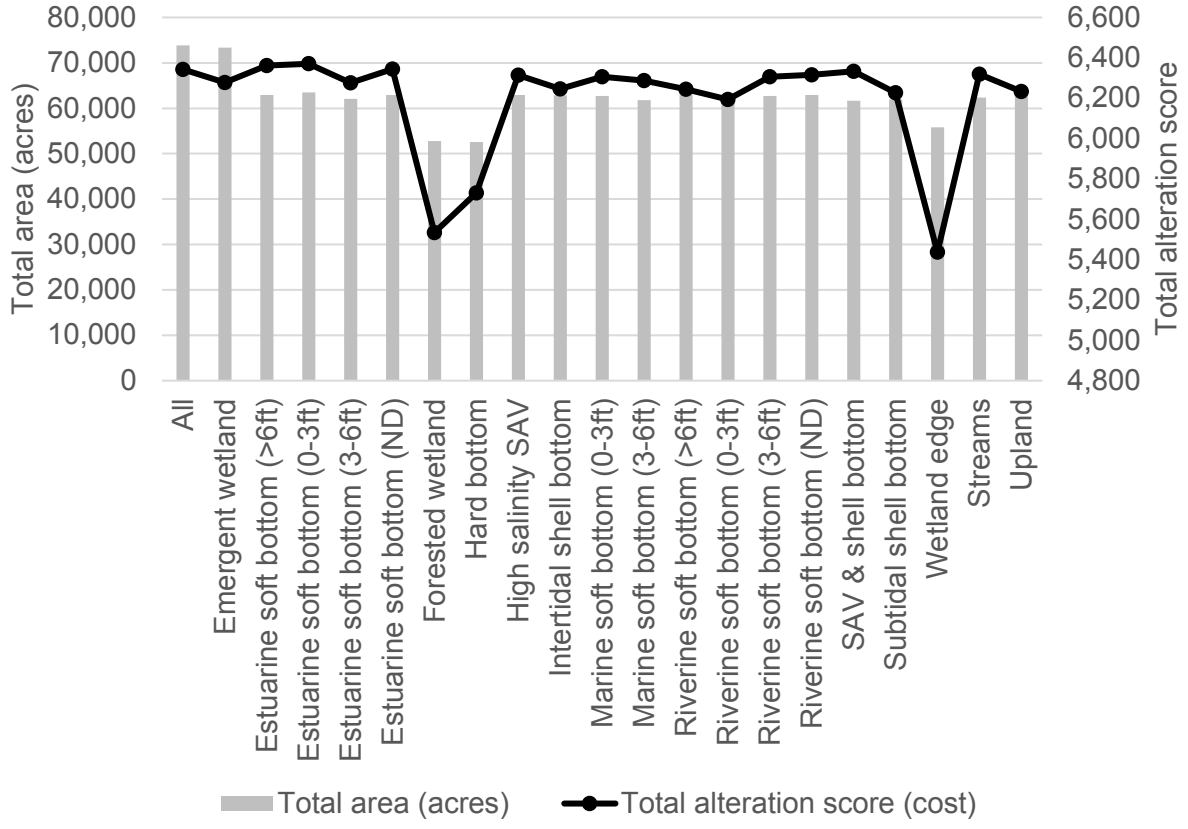


Figure 1. Natural resource target (NRT) sensitivity analysis examining the effect of excluding NRTs from the model on total area (acres) and total alteration score.

After discussing the results of the NRT sensitivity analysis and the resulting Marxan solutions, the advisory committee felt the targets influence on the model was due to geographic distribution and the spatial relationship between these NRTs. To account for this, forested wetlands and wetland edge representation levels were decreased to 30% and 40%, respectively. Hard bottom was excluded setting the representation level to 0% to keep the model from selecting large areas of the ocean with marine soft bottom. The advisory committee felt that the only areas of the ocean that should be included as a SHA would be known hard bottom locations and areas near

inlets. Thus, these areas were added in during the corroboration phase.

Once preliminary areas were identified by the Marxan solution, SHA selections were modified and refined by the advisory committee of regional experts using other known sources of quantitative or qualitative ecological or fishery information and professional knowledge (referred to as corroborating data). Public input is required to finalize identification and nomination of areas for eventual SHA designation.

3 MARXAN RESULTS

After the natural resource targets and total alteration layer were assembled, Marxan was run at the specified representation levels for the NRTs representing priority fisheries habitats (Table 2). Map 4 depicts the Marxan selections from the best solution with the most efficient BLM. This resulted in a large number of small SHAs that the advisory committee thought would be difficult to manage. Thus, the advisory committee decided to examine the selection frequencies, since high selection frequencies are an indication that an area was not erroneously chosen (Map 5). During the corroboration phase, the committee kept the high selection frequency areas in mind.

Large areas of Masonboro and Topsail sounds and associated tidal creeks were selected by Marxan and are known to be ecologically important for both fish and shellfish in Region 4. Other sizeable areas that were selected included parts of Shallotte and Lockwoods Folly rivers and Bald Head Island. Very little was selected around the city of Wilmington due to high alteration scores. The Cape Fear, Black, and Northeast Cape Fear rivers and their tributaries had some clustering but were less connected most likely due to the width of the focus area (Maps 4 and 5).

Map 4. Marxan best solution for Region 4.

Map 5. Marxan selection frequency for Region 4.

4 CORROBORATION

The advisory committee reviewed the initial Marxan selections and made expert modifications as needed. The SHA committee grouped individually selected hexagons into manageable polygons for the corroboration and identification process. Modifications to the Marxan selected SHAs were made using an overlay of selected hexagon polygons on digital imagery. The SHA committee examined maps of both the selection frequency and alteration ratings for guidance during the manual selection phase. For each polygon or group of contiguous hexagons selected by Marxan, the SHA committee reviewed data included within each polygon cluster to confirm inclusion/exclusion as a SHA in a consistent and data based manner. This included examination of the alteration scores, selection frequencies, amount and type of targets present, habitat diversity and rarity, supporting biological data, existing ecological designations that were not included as NRTs (i.e., Anadromous Fish Spawning Areas, Significant Natural Heritage Areas, and water quality ratings) and connectivity with adjacent selections and protected areas. Known studies or information from committee members regarding habitat condition and fish utilization of specific areas were also included.

Criteria to base modifications on included:

- Habitats present – rare, vulnerable, diverse
- Occurrence of ecological designations
- Alteration factors, ratings, and other known alterations not included in the model
- Selection frequency
- Fish and shellfish data/information available from DMF sampling or other research
- Water quality impairment status (5 categories)
- Regional importance of a functional area
- Size/isolation/connectivity/shape

The designations and biological data used in this phase of the analysis are listed in Table 5. These data are meant to support computer-selected areas and identify important areas omitted by the Marxan analysis. Examples of omitted areas would be a tidal creek that was rated as altered but still supports fish or shellfish production that consistently produces high catches relative to other areas. Ideally, the regional expert panel would have local qualitative knowledge that further supported the area as having high fishery or habitat value. Areas with existing habitat designations that were not selected by Marxan could also indicate areas that should be considered for manual addition to the list of proposed SHAs.

Table 5. Ecological designations and biological data used for corroboration of Strategic Habitat Areas (SHAs) in Region 4.

Type	Description	Source
Ecological designations	Anadromous Fish Spawning Areas	MFC designation
	Blue crab spawning sanctuaries	MFC designation
	Estuarine Primary Nursery Areas (PNAs)	MFC designation
	Permanent Secondary Nursery Areas (PSNAs)	MFC designation
	Special Secondary Nursery Areas (SSNA)	MFC designation
	Trawl Net Prohibited Areas (TNPA)	MFC designation
	Inland PNAs	WRC designation
	Open shellfish harvesting waters	DMF - SGA classification
	Significant Natural Heritage Areas (aquatic and terrestrial)	Natural Heritage Program designation
	Lands managed for conservation	DEQ One NC Naturally
Species/ productivity data	Use support and biotic indices for fish and invertebrates (freshwater streams only) – index values	DWR
	Fish and shellfish data	DMF programs 120, 915, 510 and WRC data

The committee used the criteria listed above to cut, extend, and/or consolidate Marxan clusters within the focus area. Selected hexagons with fewer than three contiguous hexagons were excluded. Consolidations were based on avoiding what the group considered over-represented habitats (e.g., soft bottom >6ft) and connecting similar contiguous areas or under-represented habitats. The advisory committee also expanded polygons into some unselected areas that were known to be highly productive for priority species or habitats. The visual assessment was conducted systematically around the region, starting from the South Carolina line and working north to Topsail Sound and then up the Cape Fear River. Inlet areas were added in by default because of their importance to migratory fishes moving in and out of those areas.

4.1 Post-Corroboration Results

Following the corroboration phase, there were a total of 43 discrete areas selected for nomination totaling 74,451 of the 349,918 acres of focus area. This comprises 21.3% the total focus area. All targets were met except for marine soft bottom 0-3ft and 3-6ft, and riverine soft bottom 0-3ft, 3-6ft, and >6ft. However, both marine and riverine soft bottom with no depth exceeded target by 70% and 30%, respectively. The advisory committee felt the exceeded targets of soft bottom unknown depths accounted for the lack of meeting targets in the other depth categories (Table 6). The acreage of NRTs within each individual SHA is included in Table 7. The habitat targets that were most exceeded were soft bottom (riverine, estuarine, and marine, no depth), emergent wetlands, wetland edge, and low elevation uplands. Following ground truthing, developed portions of low elevation uplands should be omitted.

Maps 7a-d and 8a-d show the selection frequency and alteration scores of the post-corroboration

SHA nominations. Most of the areas that were not initially selected by Marxan, but were added by the advisory committee for connectivity reasons, had low selection frequency but low to medium alteration scores.

Table 6. Representation levels, target area (acres), and resulting amounts of natural resource targets (NRTs) post-corroboration.

Habitat type	Natural resource target	Focus area (acres)	Rep. level (%)	Target area (acres)	Percent of target (%)
Hard bottom	Hard Bottom	3,689	0	2,856	77.4
SAV	High salinity SAV	653	60	521	79.8
Shell bottom	Intertidal shell bottom	3,708	60	2,517	67.9
	Subtidal shell bottom	2,395	60	1,570	65.5
SAV & shell bottom	SAV & shell bottom	130	80	113	86.8
Creeks & Rivers	Riverine soft bottom (0-3ft)	1,902	30	386	20.3
	Riverine soft bottom (3-6ft)	292	20	43	14.8
	Riverine soft bottom (>6ft)	1,174	20	103	8.8
	Riverine soft bottom (ND)	6,764	10	2,660	39.3
Shallow soft bottom	Palustrine soft bottom (0-3ft)	18	0	0	0.0
	Palustrine soft bottom (ND)	195	0	13	6.6
	Estuarine soft bottom (0-3ft)	18,430	20	5,768	31.3
	Estuarine soft bottom (3-6ft)	3,507	20	701	20.0
	Estuarine soft bottom (ND)	6,965	0	4,243	60.9
	Marine soft bottom (0-3ft)	4,226	30	846	20.0
	Marine soft bottom (3-6ft)	3,576	20	432	12.1
	Marine soft bottom (ND)	54	0	38	71.1
Deep soft bottom	Estuarine soft bottom (>6ft)	6,911	10	699	10.1
	Marine soft bottom (>6ft)	176,471	0	4,953	2.8
Wetland	Emergent wetland	34,629	10	15,733	45.4
	Forested wetland	58,637	30	23,136	39.5
	Shrub & scrub wetland	3,792	0	916	24.2
	Wetland edge	9,067	40	5,507	60.7
Low-elevation upland	Low-elevation upland	2,110	0	470	22.3
Water column	Streams (low elevation)	624	20	226	36.2
TOTAL AREA		349,918		74,451	21.3

Table 7. Amount of each natural resource target (NRTs) in acres present in each Strategic Habitat Area (SHA) nomination.

Habitat Type	Natural Resource Target	Strategic Habitat Area ID										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Hard bottom	Hard bottom	0	1	0	0	0	582	105	0	0	0	0
SAV	High salinity SAV	0	0	0	1	0	0	0	1	0	0	258
Shell bottom	Intertidal shell bottom	155	141	2	196	0	0	0	45	0	0	0
	Subtidal shell bottom	142	74	0	127	0	0	0	1	0	0	0
SAV & shell bottom	SAV & shell bottom	0	1	0	4	0	0	0	0	0	0	0
Creeks & Rivers	Riverine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (>6ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (ND)	0	0	0	0	8	0	0	0	0	0	0
Shallow soft bottom	Palustrine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Palustrine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
	Estuarine soft bottom (0-3ft)	227	314	18	467	0	0	0	201	18	0	1,681
	Estuarine soft bottom (3-6ft)	15	11	4	2	0	0	0	20	118	0	176
	Estuarine soft bottom (ND)	96	51	4	63	0	0	0	32	0	0	662
	Marine soft bottom (0-3ft)	73	107	0	61	0	0	0	0	76	218	17
	Marine soft bottom (3-6ft)	7	0	0	39	0	0	0	0	67	213	7
	Marine soft bottom (ND)	0	14	0	0	0	0	0	0	0	0	0
Deep soft bottom	Estuarine soft bottom (>6ft)	18	26	5	16	0	0	0	9	172	0	13
	Marine soft bottom (>6ft)	12	0	0	17	0	193	187	0	97	2,618	10
Wetland	Emergent wetland	1,521	378	72	465	0	0	0	718	0	0	3,339
	Forested wetland	1	0	0	5	289	0	0	0	0	0	41
	Shrub & scrub wetland	59	5	0	2	0	0	0	1	0	0	57
Wetland shoreline	Wetland edge	230	99	6	94	25	0	0	103	0	0	541
Low-elevation upland	Low-elevation upland	16	27	0	25	1	0	0	4	2	1	54
Water column	Streams (low elevation)	7	1	0	2	6	0	0	4	0	0	7
Total Area		2,579	1,253	111	1,586	329	775	292	1,139	550	3,050	6,863

Table 7. Continued.

Habitat Type	Natural Resource Target	Strategic Habitat Area ID										
		12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Hard bottom	Hard bottom	39	0	0	46	72	383	0	65	1,203	0	2
SAV	High salinity SAV	0	0	0	0	0	0	37	0	0	3	221
Shell bottom	Intertidal shell bottom	0	0	4	0	0	0	413	0	0	291	1,269
	Subtidal shell bottom	0	0	479	0	0	0	211	0	0	34	501
SAV & shell bottom	SAV & shell bottom	0	0	0	0	0	0	14	0	0	1	93
Creeks & Rivers	Riverine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (>6ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
Shallow soft bottom	Palustrine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Palustrine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
	Estuarine soft bottom (0-3ft)	0	0	191	0	0	0	610	0	0	337	1,671
	Estuarine soft bottom (3-6ft)	0	0	0	0	0	0	109	0	0	23	170
	Estuarine soft bottom (ND)	0	0	4	0	0	0	1,237	0	0	335	1,575
	Marine soft bottom (0-3ft)	0	0	0	21	0	0	46	0	0	2	224
	Marine soft bottom (3-6ft)	0	0	0	19	0	0	1	0	0	2	78
	Marine soft bottom (ND)	0	0	0	0	0	0	4	0	0	3	17
Deep soft bottom	Estuarine soft bottom (>6ft)	0	0	0	0	0	0	150	0	0	23	112
	Marine soft bottom (>6ft)	156	98	0	208	91	234	0	32	492	13	71
Wetland	Emergent wetland	0	0	66	0	0	0	2,004	0	0	911	3,849
	Forested wetland	0	0	0	0	0	0	55	0	0	12	70
	Shrub & scrub wetland	0	0	1	0	0	0	47	0	0	21	58
Wetland shoreline	Wetland edge	0	0	10	0	0	0	652	0	0	397	1,676
Low-elevation upland	Low-elevation upland	0	0	0	11	0	0	74	0	0	31	52
Water column	Streams (low elevation)	0	0	0	0	0	0	4	0	0	2	2
Total Area		195	98	755	305	163	617	5,668	97	1,695	2,441	11,711

Table 7. Continued.

Habitat Type	Natural Resource Target	Strategic Habitat Area ID										
		12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
Hard bottom	Hard bottom	39	0	0	46	72	383	0	65	1,203	0	2
SAV	High salinity SAV	0	0	0	0	0	0	37	0	0	3	221
Shell bottom	Intertidal shell bottom	0	0	4	0	0	0	413	0	0	291	1,269
	Subtidal shell bottom	0	0	479	0	0	0	211	0	0	34	501
SAV & shell bottom	SAV & shell bottom	0	0	0	0	0	0	14	0	0	1	93
Creeks & Rivers	Riverine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (>6ft)	0	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
Shallow soft bottom	Palustrine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Palustrine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
	Estuarine soft bottom (0-3ft)	0	0	191	0	0	0	610	0	0	337	1,671
	Estuarine soft bottom (3-6ft)	0	0	0	0	0	0	109	0	0	23	170
	Estuarine soft bottom (ND)	0	0	4	0	0	0	1,237	0	0	335	1,575
	Marine soft bottom (0-3ft)	0	0	0	21	0	0	46	0	0	2	224
	Marine soft bottom (3-6ft)	0	0	0	19	0	0	1	0	0	2	78
	Marine soft bottom (ND)	0	0	0	0	0	0	4	0	0	3	17
Deep soft bottom	Estuarine soft bottom (>6ft)	0	0	0	0	0	0	150	0	0	23	112
	Marine soft bottom (>6ft)	156	98	0	208	91	234	0	32	492	13	71
Wetland	Emergent wetland	0	0	66	0	0	0	2,004	0	0	911	3,849
	Forested wetland	0	0	0	0	0	0	55	0	0	12	70
	Shrub & scrub wetland	0	0	1	0	0	0	47	0	0	21	58
Wetland shoreline	Wetland edge	0	0	10	0	0	0	652	0	0	397	1,676
Low-elevation upland	Low-elevation upland	0	0	0	11	0	0	74	0	0	31	52
Water column	Streams (low elevation)	0	0	0	0	0	0	4	0	0	2	2
Total Area		195	98	755	305	163	617	5,668	97	1,695	2,441	11,711

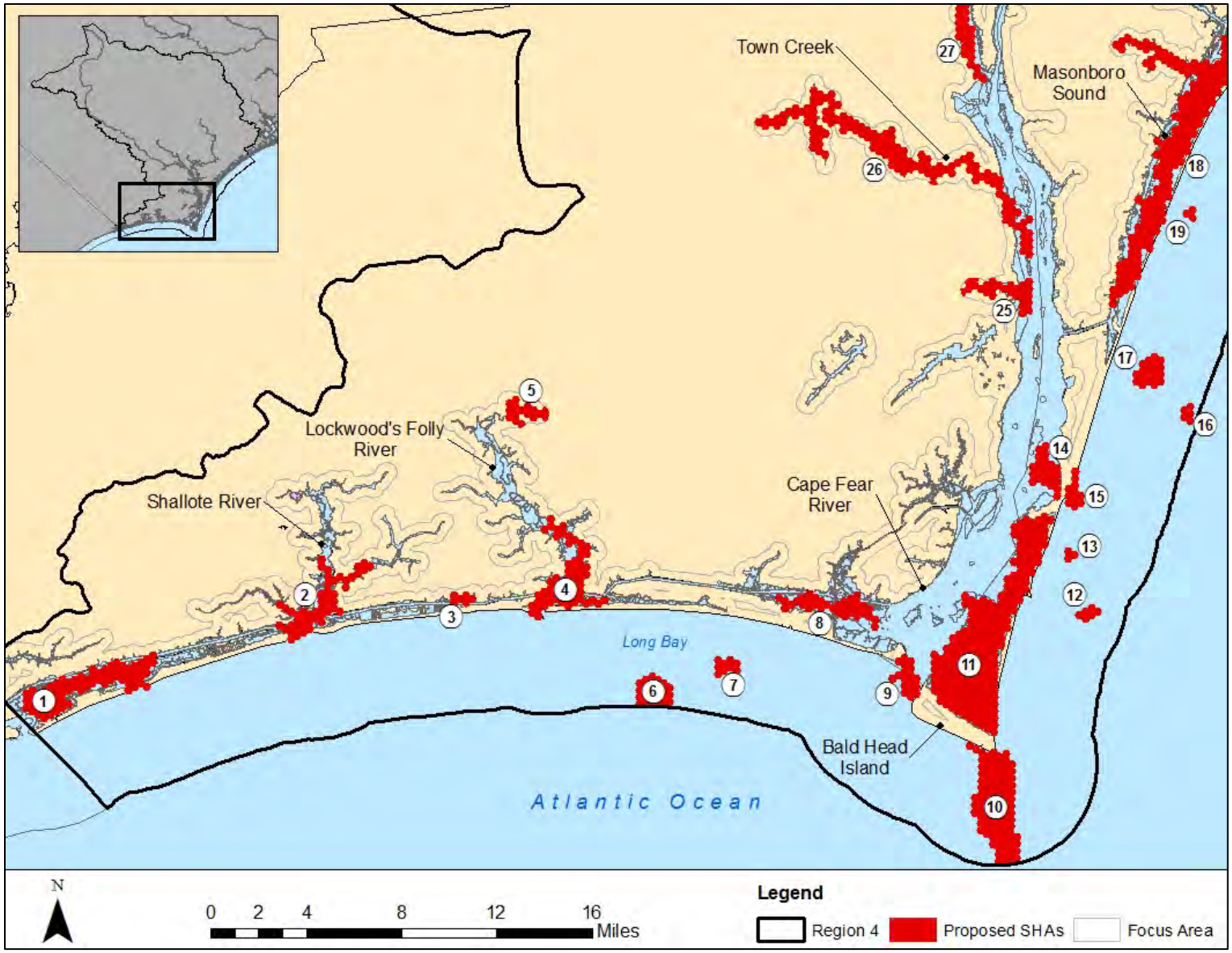
Table 7. Continued.

Habitat Type	Natural Resource Target	Strategic Habitat Area ID										
		23	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**
Hard bottom	Hard bottom	105	250	0	0	0	0	0	0	0	0	0
SAV	High salinity SAV	0	0	0	0	0	0	0	0	0	0	0
Shell bottom	Intertidal shell bottom	0	0	0	0	0	0	0	0	0	0	0
	Subtidal shell bottom	0	0	0	0	0	0	0	0	0	0	0
SAV & shell bottom	SAV & shell bottom	0	0	0	0	0	0	0	0	0	0	0
Creeks & Rivers	Riverine soft bottom (0-3ft)	0	0	121	265	0	0	0	0	0	0	0
	Riverine soft bottom (3-6ft)	0	0	14	29	0	0	0	0	0	0	0
	Riverine soft bottom (>6ft)	0	0	30	73	0	0	0	0	0	0	0
	Riverine soft bottom (ND)	0	0	23	207	1	15	40	58	274	69	372
Shallow soft bottom	Palustrine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Palustrine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
	Estuarine soft bottom (0-3ft)	0	0	0	3	30	0	0	0	0	0	0
	Estuarine soft bottom (3-6ft)	0	0	0	0	51	0	0	0	0	0	0
	Estuarine soft bottom (ND)	0	0	0	50	115	18	0	0	0	0	0
	Marine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0	0
	Marine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0	0
	Marine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0	0
Deep soft bottom	Estuarine soft bottom (>6ft)	0	0	0	0	154	0	0	0	0	0	0
	Marine soft bottom (>6ft)	0	302	0	0	0	0	0	0	0	0	0
Wetland	Emergent wetland	122	0	330	753	648	377	2	9	19	0	186
	Forested wetland	0	0	65	1,469	19	8	276	581	2,422	341	1,627
	Shrub & scrub wetland	0	0	74	268	32	0	11	0	5	0	19
Wetland shoreline	Wetland edge	0	0	56	268	63	63	29	27	168	27	129
Low-elevation upland	Low-elevation upland	0	0	2	27	9	3	0	1	2	0	6
Water column	Streams (low elevation)	0	0	6	39	2	4	5	2	14	2	6
Total Area		227	552	721	3,451	1,124	488	363	678	2,904	439	2,345

Table 7. Continued.

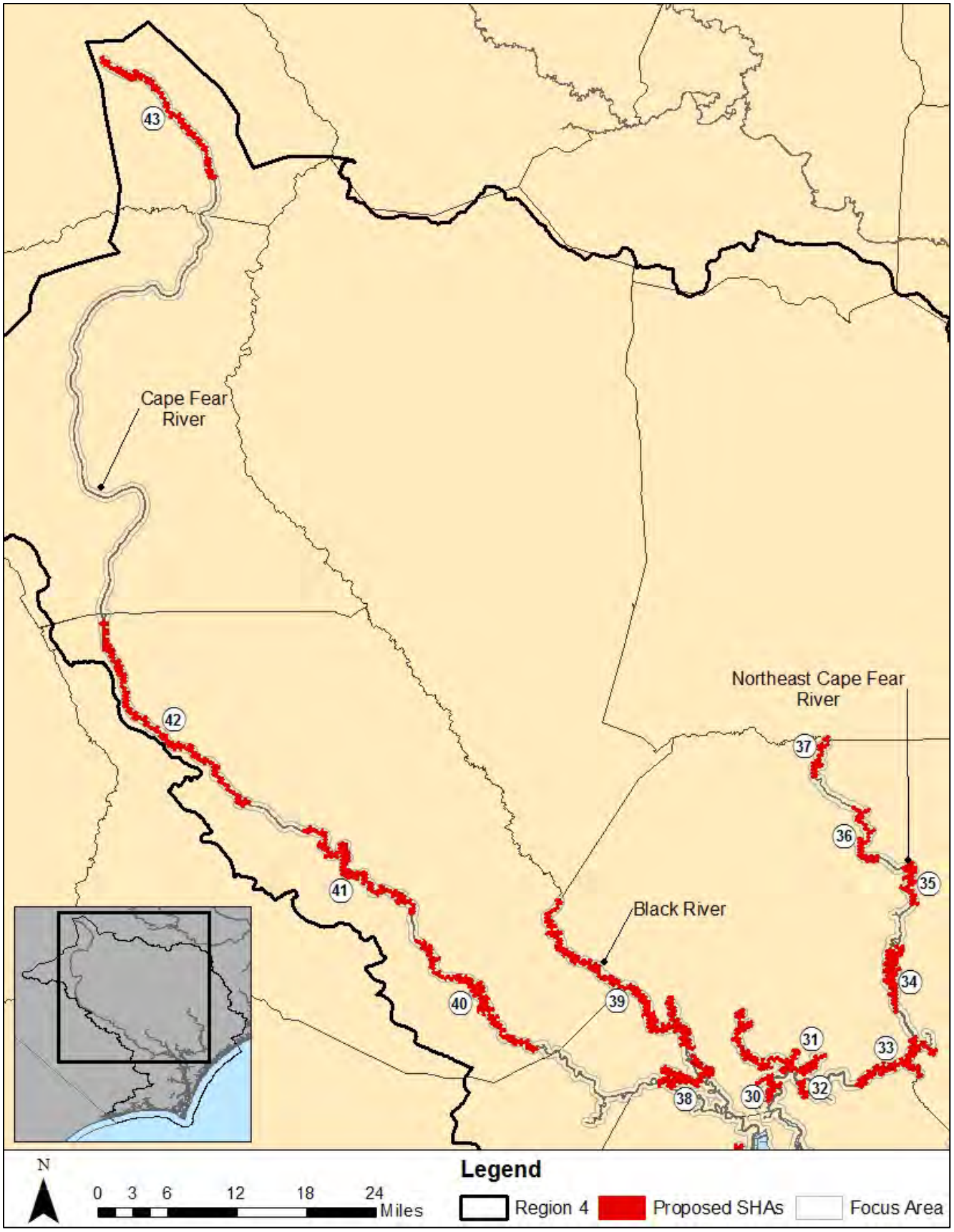
Habitat Type	Natural Resource Target	Strategic Habitat Area ID									
		34	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
Hard bottom	Hard bottom	0	0	0	0	0	0	0	0	0	0
SAV	High salinity SAV	0	0	0	0	0	0	0	0	0	0
Shell bottom	Intertidal shell bottom	0	0	0	0	0	0	0	0	0	0
	Subtidal shell bottom	0	0	0	0	0	0	0	0	0	0
SAV & shell bottom	SAV & shell bottom	0	0	0	0	0	0	0	0	0	0
Creeks & Rivers	Riverine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (>6ft)	0	0	0	0	0	0	0	0	0	0
	Riverine soft bottom (ND)	234	68	88	36	173	0	20	0	0	519
Shallow soft bottom	Palustrine soft bottom (0-3ft)	0	0	0	0	0	455	0	0	0	0
	Palustrine soft bottom (ND)	0	0	0	0	0	13	0	0	0	0
	Estuarine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0
	Estuarine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0
	Estuarine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0
	Marine soft bottom (0-3ft)	0	0	0	0	0	0	0	0	0	0
	Marine soft bottom (3-6ft)	0	0	0	0	0	0	0	0	0	0
	Marine soft bottom (ND)	0	0	0	0	0	0	0	0	0	0
Deep soft bottom	Estuarine soft bottom (>6ft)	0	0	0	0	0	0	0	0	0	0
	Marine soft bottom (>6ft)	0	0	0	0	0	0	0	0	0	0
Wetland	Emergent wetland	0	0	13	0	0	11	7	17	36	3
	Forested wetland	1,340	787	515	493	2,026	3,853	2,621	2,206	1,533	472
	Shrub & scrub wetland	1	2	0	0	0	0	25	132	104	0
Wetland shoreline	Wetland edge	147	88	57	59	119	370	0	0	0	0
Low-elevation upland	Low-elevation upland	16	4	53	11	2	37	0	0	0	0
Water column	Streams (low elevation)	2	11	13	9	6	43	7	6	6	8
Total Area		1,740	960	739	608	2,326	4,782	2,680	2,361	1,679	1,002

Map 6a. Region 4 Strategic Habitat Area (SHA) Nominations post-corroboration.



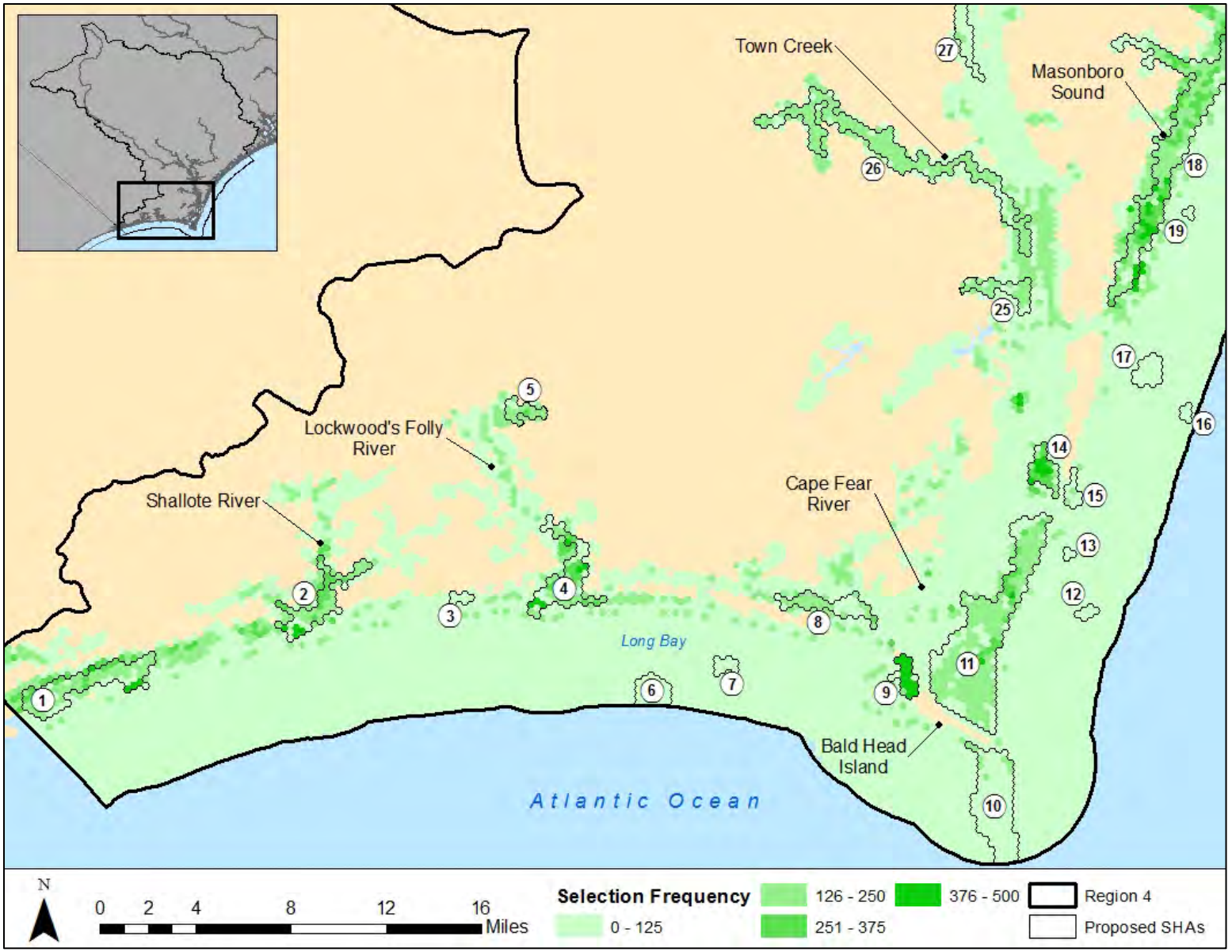
Map 6b. Region 4 Strategic Habitat Area (SHA) Nominations post-corroboration, #1-19 and 25-27.

Map 6c. Region 4 Strategic Habitat Area (SHA) Nominations post-corroboration, #16-34 and 38-39.

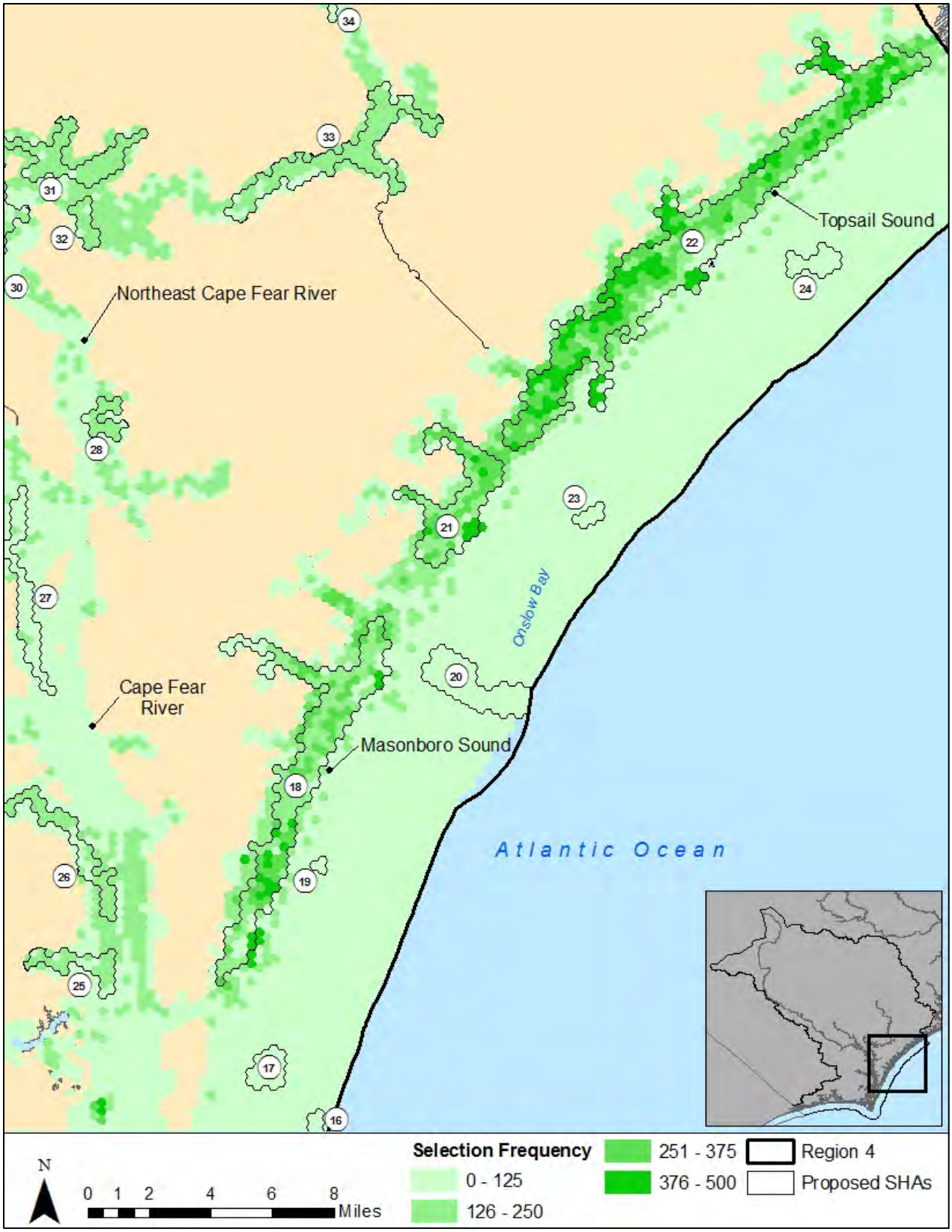


Map 6d. Region 4 Strategic Habitat Area (SHA) Nominations post-corroboration., #30-43.

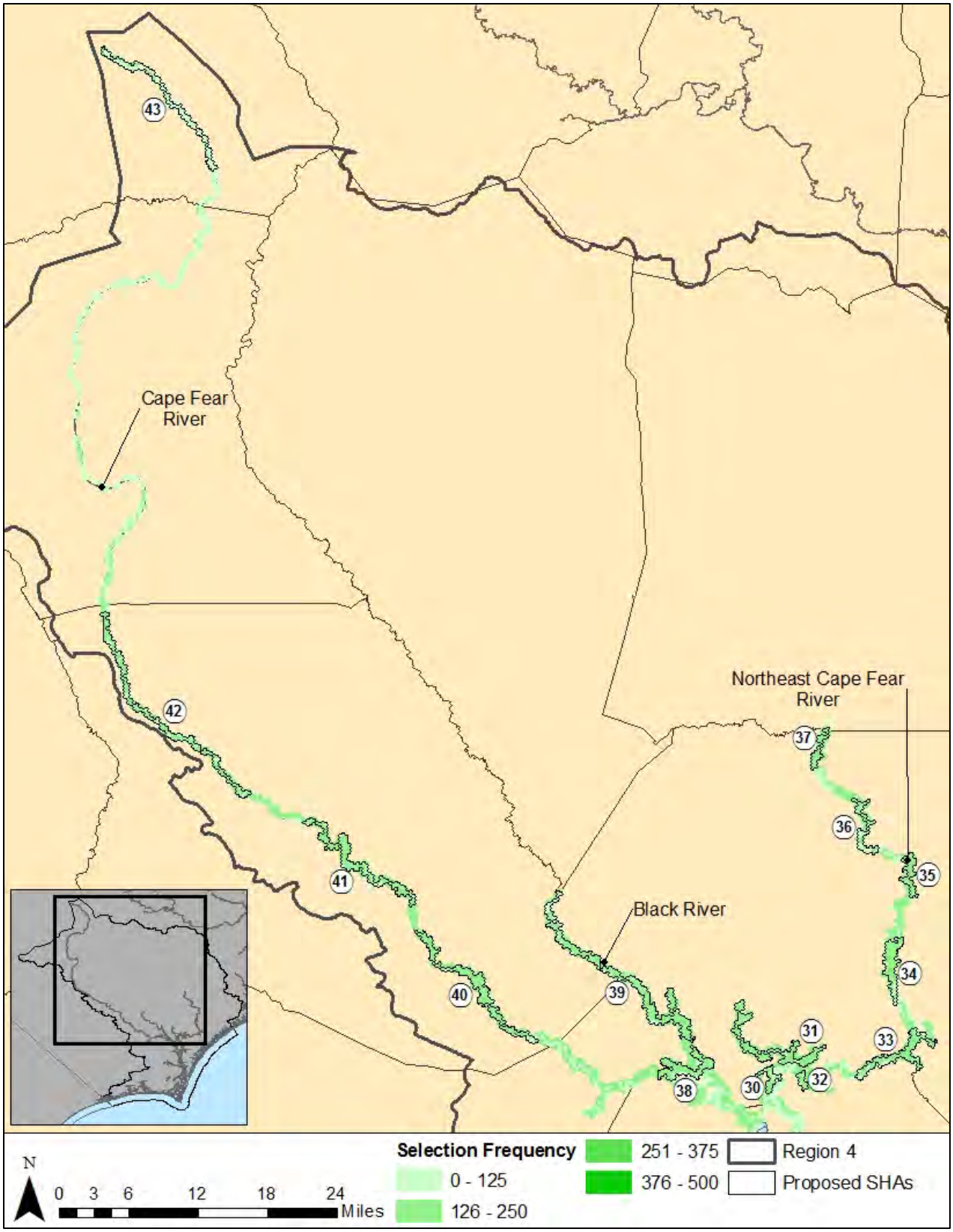
Map 7a. Selection frequencies of Region 4 Strategic Habitat Area (SHA) nominations post-corroboration.



Map 7b. Selection frequencies of Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, #1-18 and 25-27.

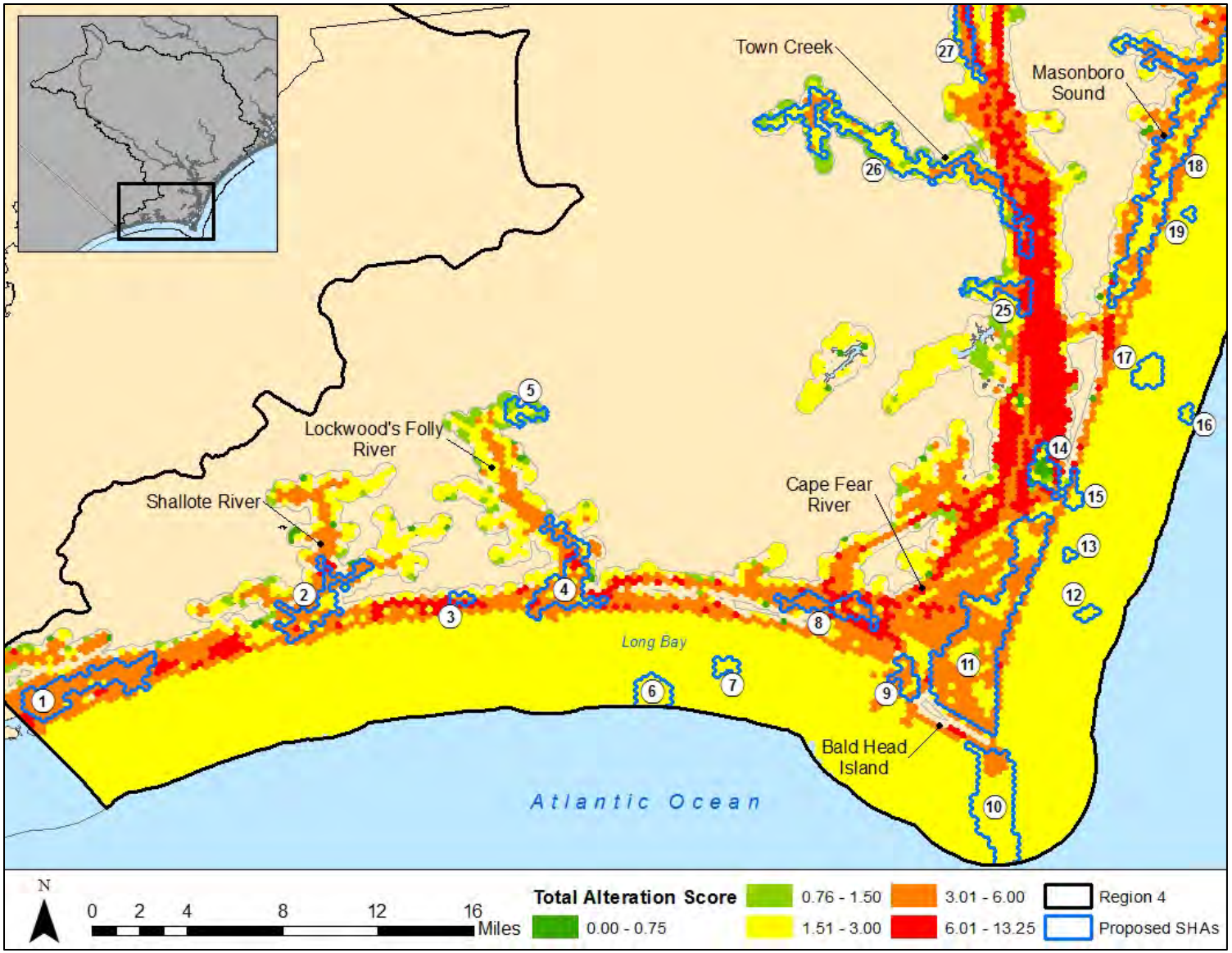


Map 7c. Selection frequencies of Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, #16-28 and 30-34.

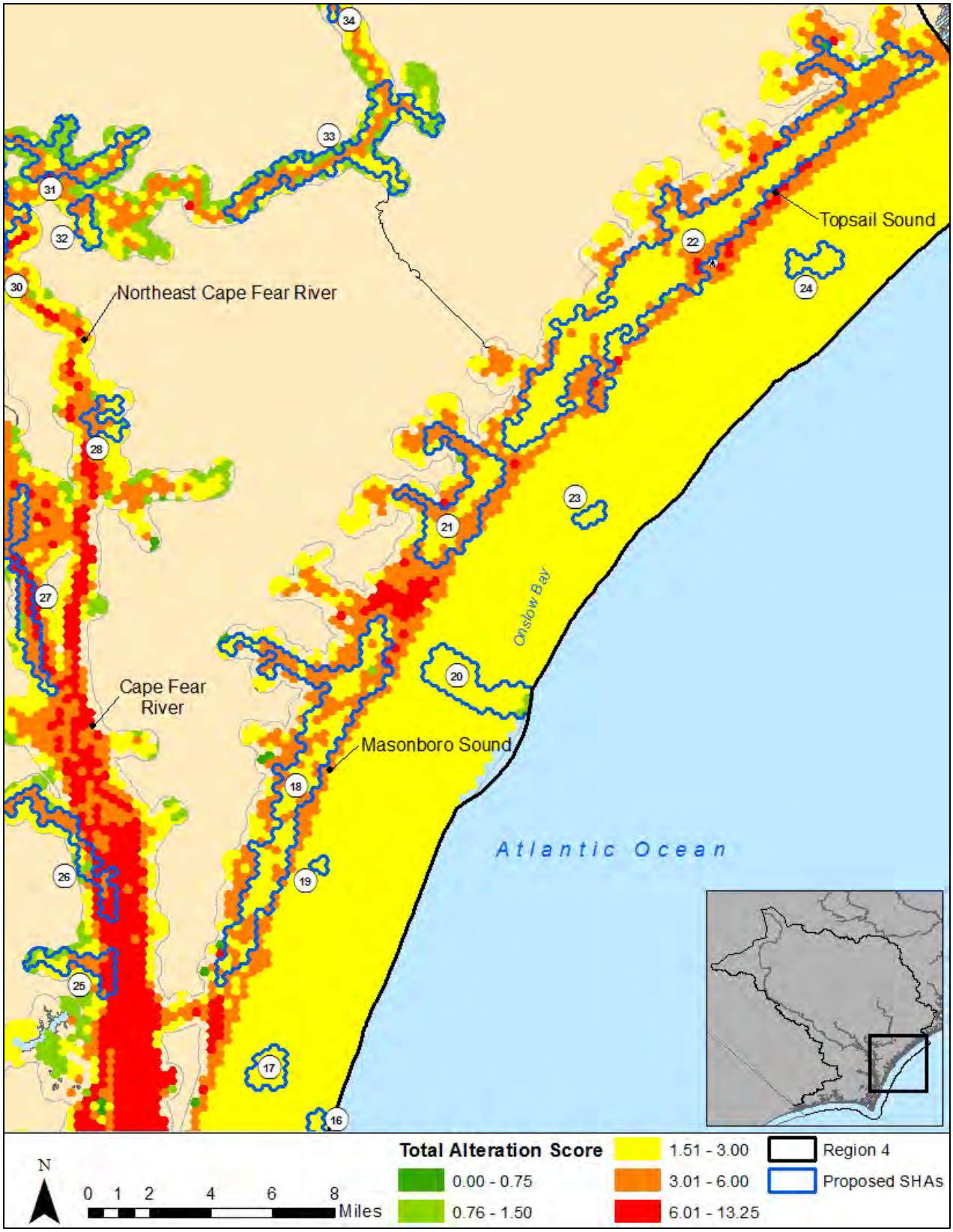


Map 7d. Selection frequencies of Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, #30-43.

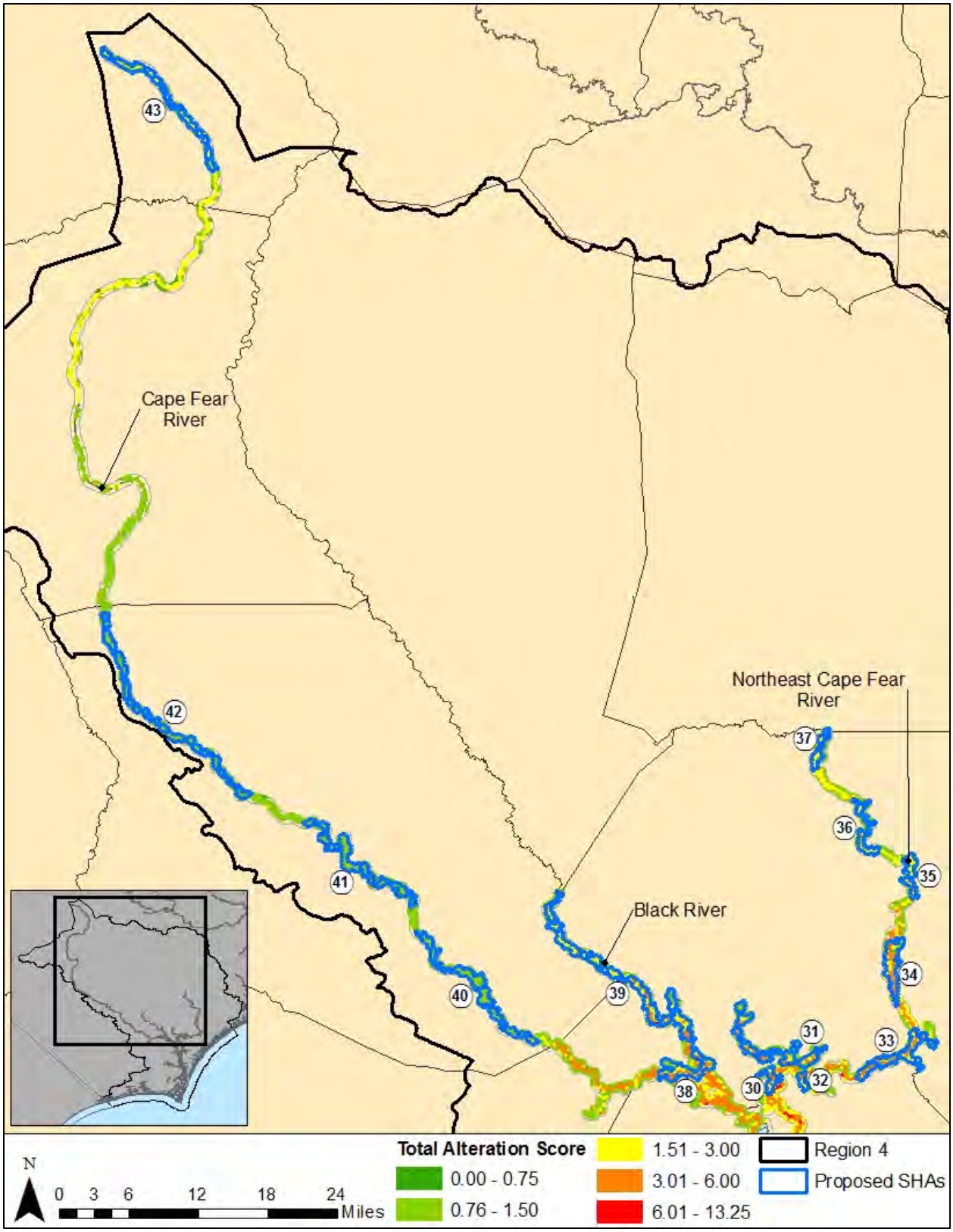
Map 8a. Alteration scores of Region 4 Strategic Habitat Area (SHA) nominations post-corroboration.



Map 8b. Total alteration scores for Region 4 with Strategic Habitat Area (SHA) nominations post-corroboration, #1-18 and 25-27. Higher values equate to greater degradation.



Map 8c. Total alteration scores for Region 4 with Strategic Habitat Area (SHA) nominations post-corroboration, #16-28 and 30-34. Higher values equate to greater degradation.



Map 8d. Total alteration scores for Region 4 with Strategic Habitat Area (SHA) nominations post-corroboration, #30-43. Higher values equate to greater degradation.

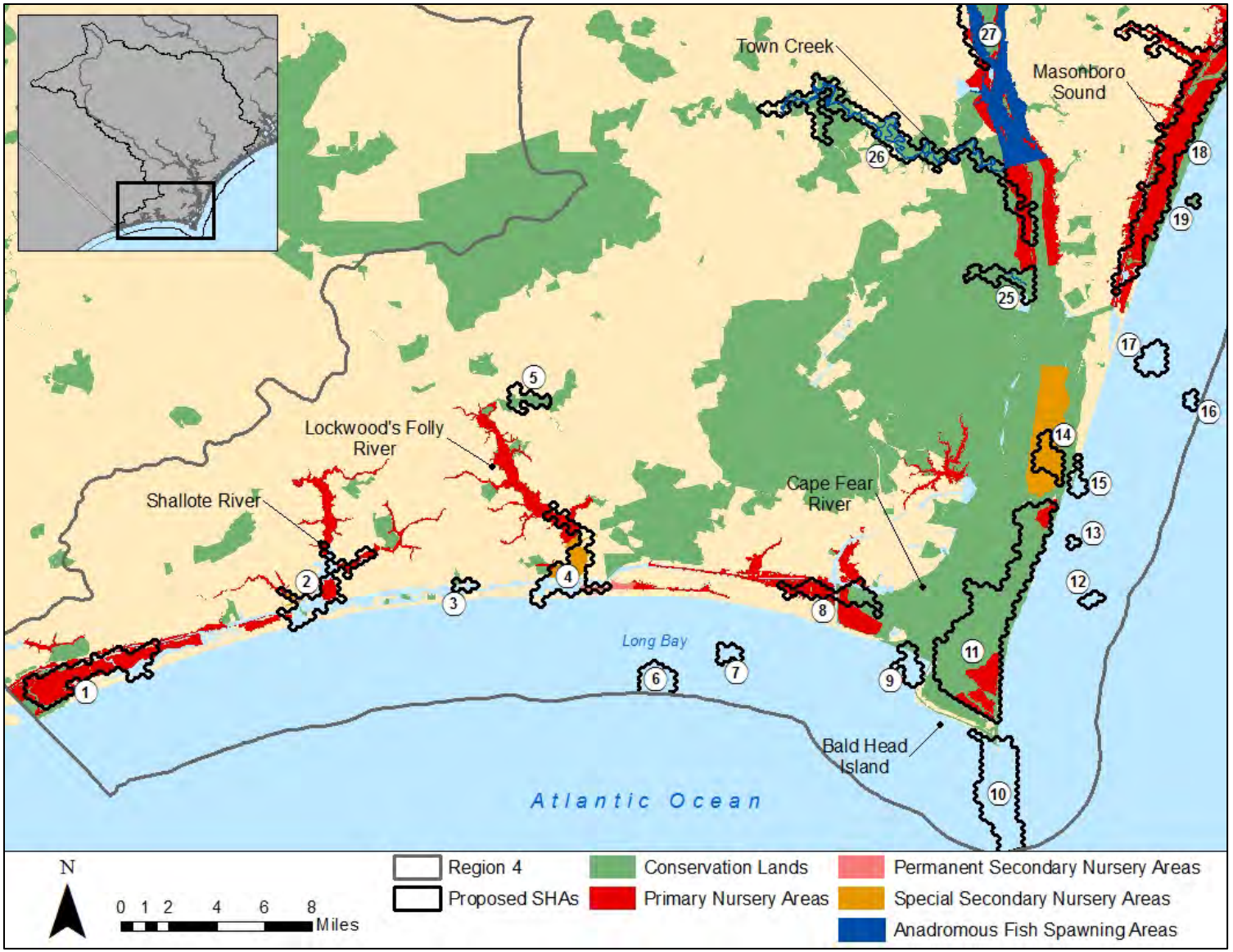
The final SHA selections form a network of priority areas for protection and enhancement ranging from the headwaters of the Cape Fear River to the grass beds and marsh lands of the sounds and inlets. Selections were scattered throughout the area and concentrated in the sounds, tidal creeks, and river headwaters. The advisory committee considered these selections to be appropriate since it is a critical habitat for the majority of the priority species, is a unique habitat feature of North Carolina that is known to contribute significantly to the diversity of fish life in the region, and is a habitat easily lost from physical disturbance (dredging) or water quality degradation. Shell bottom was also set with high representation levels due to their ecological and fishery importance in the area. A large amount of subtidal shell bottom (74%) and intertidal oysters (67.5%) were selected.

Maintaining open shellfish harvest waters is a priority for this region. There are only a few mainland tidal creeks that remain partially open to shellfish harvest including Virginia, Topsail, and Pages creeks and Lockwoods Folly and Shallotte rivers. These areas were selected in the SHA nomination process and should be prioritized for water quality and habitat protections, restoration, and enhancement.

Region 4 has an abundance of state and federally protected lands bordering coastal waters (Maps 9a-d). Of the 74,451 acres selected as SHAs, 74.8% (55,717 acres) already have some level of protection. Of these protections, 42.5% (31,623 acres) of SHAs occur on lands managed for conservation (state, federal, local), 25.8% (19,220 acres) are in MFC designated Primary Nursery Areas (PNAs), 0.4% (272 acres) are in Permanent Secondary Nursery Areas (PSNAs), and 6.2% (4,602 acres) are designated Anadromous Fish Spawning Areas (AFSAs). Some of the larger conservation lands along the coast include Lea Island, Zeke Island, and Masonboro NERRs, and along the rivers, Black River Preserve, Bladen Lake State Forest, and Holly Shelter. Strategic Habitat Areas within protected conservation lands are basically already protected from degradation associated with development, but can be impacted from water-based activities or water quality degradation. The remaining 25.2% (18,734 acres) represent SHA nominations of various conditions that are currently vulnerable to land and/or water based threats.

Region 4 has been the focus of many anadromous fish studies and restoration activities. Efforts are underway to create anadromous fish passage around the three lock and dams on the Cape Fear River mainstem. Protection, restoration, and enhancement of riparian wetlands and water quality in the SHAs along the river will further enhance conditions needed to sustain all life stages of anadromous fish in Region 4.

Map 9a. Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, noting occurrence of Marine Fisheries Commission (MFC) designated nursery areas and state, federal, and private (land trust) conservation lands.



Map 9b. Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, #1-18 and 25-27, noting occurrence of Marine Fisheries Commission (MFC) designated nursery areas and state, federal, and private (land trust) conservation lands.

Map 9c. Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, #16-28 and 30-34, noting occurrence of Marine Fisheries Commission (MFC) designated nursery areas and state, federal, and private (land trust) conservation lands.

Map 9d. Region 4 Strategic Habitat Area (SHA) nominations post-corroboration, #30-43, noting occurrence of Marine Fisheries Commission (MFC) designated nursery areas and state, federal, and private (land trust) conservation lands.

5 FINAL STRATEGIC HABITAT AREA NOMINATIONS

Strategic Habitat Areas are described below beginning in at the South Carolina line and moving up to Topsail Sound and the Surf City bridge and then up the Cape Fear River system. Strategic Habitat Areas with average alteration scores less than 2.00 and selection frequencies greater than 200 (on a scale of 0-500) represent sites with the least extent of alteration and high ecosystem value. In some cases, areas without these criteria were still selected as SHAs due to other outstanding features.

The final SHA nominations are listed below grouped by area and are not in sequential order (Tables 8-13). Acreage, prominent habitat, and corroborating data are noted. Impaired waters rated as Category 5 require a total maximum daily load (TMDL), while those rated as Category 4 do not. Impairment can be due to loss of one or more water quality uses including shellfish harvest, aquatic life, fish consumption, recreation, or water supply.

Water quality classifications include:

- High Quality Waters (HQWs) – waters which are rated excellent based on biological and physical/chemical characteristics through DWR monitoring or special studies, primary nursery areas designated by the MFC, and other functional nursery areas designated by the MFC).
- Outstanding Resource Waters (ORWs) – a subset of HQWs, intended to protect unique and special waters having excellent water quality and being of exceptional state or national ecological or recreational significance. ORWs must be rated excellent by DWR and have one of the following; outstanding fish habitat and fisheries, unusually high level of water-based recreation or potential for such kind of recreation, some special designation such as North Carolina Natural and Scenic River or National Wildlife Refuge, important component of state or national park or forest or special ecological or scientific significance).
- Class SA Waters – a subset of HQW, waters that are used for commercial shellfish harvest or marketing purposes.
- Class SB Waters (SB) - tidal salt waters protected for primary recreation, including swimming, skin diving, water skiing, and similar uses involving human body contact.
- Class SC Waters – waters protected for secondary recreation such as fishing, boating, and other activities involving minimal skin contact; fish and noncommercial shellfish consumption; aquatic life propagation and survival; and wildlife.

Following the SHA nomination descriptions, maps 10-34 show the location, NRTS, and corroborating data for each SHA.

5.1 Brunswick County Waters

Table 8. Descriptions and corroborating data for Region 4 Strategic Habitat Area (SHA) nominations in Brunswick county waters (SHA nominations #1-11).

SHA #1 (Map 10)	Sunset Beach
Description	Sunset Beach, Bird Island, Bull, Cooter, and parts of Jinks creeks, and Tubbs Inlet
Acres	2,579
Prominent Habitats	Emergent wetlands, riparian wetland, and estuarine soft bottom (0-3ft)
Ecological Designations	PNA
Conservation Lands	Bird Island Coastal Reserve
Water Quality Ratings	Mostly impaired (Cat 5) and some supporting
Water Quality Classifications	SA and HQW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES, marinas, trawling, and development
Average Total Alteration Score	4.09
Average Selection Frequency	200

SHA #2 (Map 11)	Shallotte Inlet
Description	Shallotte Inlet, mouth of Shallotte River, and Saucepan and Shallotte creeks
Acres	1,253
Prominent Habitats	Emergent wetland, estuarine soft bottom (0-3ft), and intertidal shell bottom
Ecological Designations	PNA and SSNA
Conservation Lands	North Carolina Agricultural Foundation Preserve
Water Quality Ratings	Mostly impaired (Cat 4&5) and some supporting
Water Quality Classifications	SA and HQW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES, marinas, trawling, and drained
Average Total Alteration Score	3.49
Average Selection Frequency	216

SHA #3 (Map 12)	Holden Beach
Description	West of bridge at Holden Beach
Acres	114
Prominent Habitats	Emergent wetlands
Ecological Designations	None
Conservation Lands	Secession maritime forest
Water Quality Ratings	Impaired (Cat 5)
Water Quality Classifications	SA and HQW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES and marinas
Average Total Alteration Score	4.99
Average Selection Frequency	69

SHA #4 (Map 12)	Lockwoods Folly Inlet and River
Description	Lockwoods Folly Inlet, mouth of Lockwoods Folly River to Rourks Landing and Montgomery Slough
Acres	1,588
Prominent Habitats	Emergent wetlands and estuarine soft bottom (0-3ft)
Ecological Designations	PSNA, SSNA, and PNA
Conservation Lands	Stanly Road Coastal Fringe Forest and Lockwoods Folly River Tidal Wetlands
Water Quality Ratings	Mostly impaired (Cat 4 & 5) and some supporting
Water Quality Classifications	SA and HQW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES, marina, trawling, and drained
Average Total Alteration Score	4.05
Average Selection Frequency	206

SHA #5 (Map 13)	Lockwoods Folly River
Description	Lockwoods Folly River northeast of Supply
Acres	328
Prominent Habitats	Forested wetland
Ecological Designations	PSNA and SSNA
Conservation Lands	Lockwoods Folly River Tidal Wetlands
Water Quality Ratings	Some supporting
Water Quality Classifications	SA and HQW
Fish Data	None
Prominent Alterations	Major NPDES
Average Total Alteration Score	1.56
Average Selection Frequency	170

SHA #6 (Map 14)	Artificial Reef 430
Description	8.3 nm from Cape Fear River sea buoy, 6.7 nm from Oak Island Light, 3.8 nm from Lockwood's Folly Inlet sea buoy
Acres	776
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Trawling and major NPDES
Average Total Alteration Score	1.97
Average Selection Frequency	None

SHA #7 (Map 14)	Yaupon Beach Reef – Artificial Reef 425
Description	6.3 nm from Lockwoods Folly Inlet, 3.8 nm from Oak Island Light, and 7.4 nm from Cape Fear River sea buoy
Acres	293
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Trawling and major NPDES
Average Total Alteration Score	2.00
Average Selection Frequency	None

SHA #8 (Map 15)	Caswell Beach
Description	East of Hickory Point, parts of Elizabeth River, and Denis and Dutchman creeks
Acres	1,139
Prominent Habitats	Emergent wetlands and estuarine soft bottom (0-3ft)
Ecological Designations	PNA
Conservation Lands	Lower Cape Fear River Aquatic Habitat, North Carolina Submerged Lands, and North Carolina Coastal Land Trust Preserve
Water Quality Ratings	Impaired (Cat 5)
Water Quality Classifications	SA and HQW
Fish Data	DMF Programs 120, 510, and 915
Prominent Alterations	Major NPDES, marinas, trawling, and drained
Average Total Alteration Score	5.17
Average Selection Frequency	139

SHA #9 (Maps 15 and 17)	Cape Fear River Inlet
Description	Cape Fear River Inlet
Acres	550
Prominent Habitats	Estuarine and marine soft bottom (>6ft)
Ecological Designations	PNA
Conservation Lands	Portions of Bald Head Island, Fort Caswell Dunes and Marshes, and Lower Cape Fear River Aquatic Habitat
Water Quality Ratings	Some supporting
Water Quality Classifications	SA and HQW
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	3.59
Average Selection Frequency	411

SHA #10 (Map 16)	Frying Pan Shoal
Description	Frying Pan shoal off Bald Head Island
Acres	1,050
Prominent Habitats	Marine soft bottom (>6ft)
Ecological Designations	Essential Fish Habitat and Habitat of Particular Concern
Conservation Lands	Bald Head Island
Water Quality Ratings	Some supporting
Water Quality Classifications	SA and HQW
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.33
Average Selection Frequency	None

SHA #11 (Maps 16 and 17)	Bald Head Island
Description	Bald Head Island to Fort Fisher State Recreation Area
Acres	6,864
Prominent Habitats	Emergent wetland and estuarine soft bottom (0-3ft)
Ecological Designations	TNPA and PNA
Conservation Lands	Bald Head Island State Natural Area, Zeke's Island Estuarine Sanctuary, Fort Fisher State Recreation Area, and Military Ocean Terminal Sunny Point
Water Quality Ratings	Mostly supporting and some impaired (Cat 5)
Water Quality Classifications	SA and HQW
Fish Data	DMF Programs 120, 510, and 915
Prominent Alterations	Major NPDES, drainage, trawling, and minor NPDES
Average Total Alteration Score	3.19
Average Selection Frequency	163

5.2 New Hanover and Pender County Waters

Table 9. Descriptions and corroborating data for Region 4 Strategic Habitat Area (SHA) nominations in New Hanover and Pender county waters (SHA nominations #12-24).

SHA #12 (Map 17)	Hard bottom off Fort Fisher Beach State Park
Description	Hard bottom off Fort Fisher Beach State Park
Acres	195
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.00
Average Selection Frequency	None

SHA #13 (Map 17)	Sheepshead Rock
Description	8.7 nm from Carolina Beach Inlet buoy
Acres	98
Prominent Habitats	Soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.04
Average Selection Frequency	None

SHA #14 (Map 18)	Cape Fear River at Sunny Point
Description	Cape Fear river behind Fort Fisher, adjacent to Sunny point ocean terminal
Acres	755
Prominent Habitats	Subtidal shell bottom and estuarine soft bottom (0-3ft)
Ecological Designations	SSNA
Conservation Lands	Lower Cape Fear River aquatic habitat, MOTSU Buffer zone natural area, and Military Ocean Terminal Sunny Point
Water Quality Ratings	Some impaired (Cat 5)
Water Quality Classifications	SC
Fish Data	DMF Programs 120, 510, and 915
Prominent Alterations	Major NPDES, marinas, trawling, and minor NPDES
Average Total Alteration Score	2.62
Average Selection Frequency	303

SHA #15 (Map 18)	Fort Fisher Cocquina Outcrop
Description	Fort Fisher Cocquina outcrop
Acres	304
Prominent Habitats	Marine soft bottom (>6ft) and hard bottom
Ecological Designations	None
Conservation Lands	MOTSU buffer zone natural area, Fort Fisher Cocquina outcrop, and Fort Fisher State Historic Site
Water Quality Ratings	Some Supporting
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	3.12
Average Selection Frequency	None

SHA #16 (Map 18)	AR – 378B
Description	4.3 nm from Carolina Beach Inlet sea buoy
Acres	163
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.00
Average Selection Frequency	None

SHA #17 (Map 18)	Phillip Wolfe Reef – AR-378
Description	3.2 nm from Carolina Beach Inlet buoy
Acres	618
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.00
Average Selection Frequency	None

SHA #18 (Map 19)	Masonboro Island
Description	Masonboro Island including Hewletts Creek
Acres	5,667
Prominent Habitats	Emergent wetland and estuarine soft bottom (0-3ft) and (ND)
Ecological Designations	PNA
Conservation Lands	Masonboro Island National Estuarine Research Reserve, Masonboro Island State Natural Area, and New Hanover Conservation Lands
Water Quality Ratings	Some supporting and some impaired (Cat 5)
Water Quality Classifications	SA, HQW, and ORW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Marinas and major NPDES
Average Total Alteration Score	3.11
Average Selection Frequency	221

SHA #19 (Map 19)	Masonboro Outcrop
Description	3.6 nm from the Carolina Beach Inlet buoy
Acres	97
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	Masonboro outcrop
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.02
Average Selection Frequency	None

SHA #20 (Map 19)	Meares Harris – AR-370
Description	2.3 nm from Masonboro Inlet sea buoy
Acres	1,696
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	1.93
Average Selection Frequency	None

SHA #21 (Map 20)	North Wrightsville Beach
Description	Howe and Pages creeks, and connecting ICW
Acres	2,442
Prominent Habitats	Emergent wetlands, wetland edge, and estuarine soft bottom(0-3ft and ND)
Ecological Designations	PNA, PSNA, and TNPA
Conservation Lands	Howe and Pages creeks natural areas and Figure Eight Island marsh
Water Quality Ratings	Some supporting and some impaired (Cat 5)
Water Quality Classifications	SA, ORW, and HQW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES, marina, trawling, drained, and development
Average Total Alteration Score	3.28
Average Selection Frequency	251

SHA #22 (Map 21)	Topsail Beach
Description	Topsail Beach including Futch Creek, Virginia Creek, Rich Inlet, and New Topsail Inlet
Acres	11,711
Prominent Habitats	Emergent wetlands, wetland edge, and estuarine soft bottom
Ecological Designations	PNA, PSNA, and TNPA
Conservation Lands	Figure Eight Island marsh, Futch and Foy creeks natural areas, Lea-Hutaff Island natural areas, Topsail Sound Maritime Forests
Water Quality Ratings	Mostly supporting and some impaired (Cat 5)
Water Quality Classifications	SA, ORW, and HQW
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES, marinas, and trawling
Average Total Alteration Score	2.81
Average Selection Frequency	302

SHA #23 (Map 20)	Billy Murrel Reef – AR-364
Description	6.1 nm from Masonboro Inlet sea buoy and 6.5 nm from New Topsail Inlet sea buoy
Acres	228
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.00
Average Selection Frequency	None

SHA #24 (Map 21)	Topsail Reef – AR-360
Description	2 nm from New Topsail Inlet sea buoy
Acres	553
Prominent Habitats	Hard bottom and marine soft bottom (>6ft)
Ecological Designations	None
Conservation Lands	Topsail outcrop
Water Quality Ratings	None
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and trawling
Average Total Alteration Score	2.00
Average Selection Frequency	None

5.3 Cape Fear River

Table 10. Descriptions and corroborating data for Region 4 Strategic Habitat Area (SHA) nominations on the main stem of the Cape Fear River (SHA nominations #25, 26, 29, 38, 40-43).

SHA #25 (Map 22)	Cape Fear River – Lilliput Creek
Description	Lilliput Creek just north of Sunny point military terminal
Acres	272
Prominent Habitats	Emergent wetlands and riverine soft bottom (0-3ft)
Ecological Designations	PNA and AFSA
Conservation Lands	Blue Pond/Allen Creek, Orton Sandhills and Limesinks, and Lower Cape Fear River Aquatic Habitat
Water Quality Ratings	Mostly no data and some impaired (Cat 5)
Water Quality Classifications	SC
Fish Data	DMF Programs 510 and 915
Prominent Alterations	Major NPDES and drained
Average Total Alteration Score	4.41
Average Selection Frequency	149

SHA #26 (Map 22)	Cape Fear River – Town Creek
Description	Town Creek including western portion of Cape Fear River to Sand Hill Creek
Acres	3,451
Prominent Habitats	Forested wetland and emergent wetland
Ecological Designations	PNA and AFSA
Conservation Lands	Lower Cape Fear River aquatic habitat, Pleasant Oaks/ Goose Landing Plantations, Town Creek marshes and swamp, North Carolina Coastal Land Trust Easement, Brunswick County Open Space, and North Carolina Clean Water Management Trust Fund Easement
Water Quality Ratings	Mostly no data and some impaired (Cat 5)
Water Quality Classifications	SC
Fish Data	DMF Programs 120, 510, and 915 and WRC annual spawning stock survey
Prominent Alterations	Major NPDES and drained
Average Total Alteration Score	3.05
Average Selection Frequency	155

SHA #29 (Map 24)	Cape Fear River – Indian Creek
Description	Cape Fear River at mouth of Indian Creek to convergence of Otter Branch and Mulberry Branch
Acres	364
Prominent Habitats	Forested wetlands
Ecological Designations	PNA and AFSA
Conservation Lands	None
Water Quality Ratings	Mostly no data and some supporting
Water Quality Classifications	None
Fish Data	DMF Program 120 and WRC IBI sampling
Prominent Alterations	Major NPDES
Average Total Alteration Score	2.37
Average Selection Frequency	182

SHA #38 (Map 29)	Cape Fear River Lowlands
Description	Cape Fear River including Lyon creek, Crossway Creek and Lyon Thorofare
Acres	2,327
Prominent Habitats	Forested wetland
Ecological Designations	PNA and AFSA
Conservation Lands	Lower Black River Swamp and Cape Fear River Wetlands Game Land
Water Quality Ratings	Mostly no data and some supporting
Water Quality Classifications	None
Fish Data	DMF Program 120 and WRC IBI sampling
Prominent Alterations	Major NPDES and marinas
Average Total Alteration Score	2.40
Average Selection Frequency	160

SHA #40 (Map 31)	Cape Fear River – Kelly
Description	Cape Fear River near Beaverdam Creek and Kelly
Acres	2,680
Prominent Habitats	Forested wetlands
Ecological Designations	PNA and AFSA
Conservation Lands	Cape Fear River Lowlands, Steep Run Swamp, Cape Fear River Kelly Bottomlands, Cape Fear River/ Whitehall Floodplain Forest, North Carolina Coastal Land Trust Easement, Whitehall Plantation Game Land, and Bladen Lakes State Forest
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	WRC IBI sampling and annual spawning stock survey
Prominent Alterations	Major NPDES
Average Total Alteration Score	1.04
Average Selection Frequency	165

SHA #41 (Map 32)	Cape Fear River – Elizabethtown
Description	Cape Fear River including Pemberton Creek and mouth of Mulford Creek
Acres	2,360
Prominent Habitats	Forested wetlands
Ecological Designations	AFSA
Conservation Lands	Cape Fear Sloughs, Walkers Bluff, and Sugar Loaf Springs
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	WRC IBI sampling
Prominent Alterations	Major NPDES
Average Total Alteration Score	0.98
Average Selection Frequency	153

SHA #42 (Map 33)	Cape Fear River – Tarheel
Description	South of Fayetteville on the Cape Fear River
Acres	1,678
Prominent Habitats	Forested wetlands
Ecological Designations	AFSA,
Conservation Lands	Cape Fear River Terraces and North Carolina Coastal Land Trust Preserve
Water Quality Ratings	Mostly supporting
Water Quality Classifications	None
Fish Data	WRC IBI sampling and annual spawning stock survey
Prominent Alterations	Major NPDES
Average Total Alteration Score	1.00
Average Selection Frequency	144

SHA #43 (Map 34)	Cape Fear River – Lillington
Description	North of Fayetteville on the Cape Fear River
Acres	1,002
Prominent Habitats	Riverine soft bottom and forested wetlands
Ecological Designations	AFSA
Conservation Lands	Cape Fear River Canebrakes, Byrd Farm Industrial Park Natural Area, Upper Cape Fear River Aquatic Habitat, and Cape Fear River Park
Water Quality Ratings	Mostly impaired (Cat 5) and some supporting
Water Quality Classifications	None
Fish Data	WRC IBI sampling and annual spawning stock survey
Prominent Alterations	Major NPDES and minor NPDES
Average Total Alteration Score	1.84
Average Selection Frequency	71

5.4 Brunswick River

Table 11. Descriptions and corroborating data for Region 4 Strategic Habitat Area (SHA) nomination on the Brunswick River (SHA nomination #27).

SHA #27 (Map 23)	Brunswick River
Description	Begins south of Eagle Island along western shoreline of Belville and Leland to parts of Alligator Creek and adjacent wetlands
Acres	1,123
Prominent Habitats	Emergent wetlands
Ecological Designations	PNA and AFSA
Conservation Lands	Lower Cape Fear River Aquatic Habitat, Brunswick River/Cape Fear River Marshes, Brunswick County Open Space, and Eagles Island Natural Area
Water Quality Ratings	Mostly impaired (Cat 5) and some no data
Water Quality Classifications	SC
Fish Data	DMF Programs 120 and 510
Prominent Alterations	Major NPDES, minor NPDES, and drained
Average Total Alteration Score	4.92
Average Selection Frequency	84

5.5 Northeast Cape Fear River

Table 12. Descriptions and corroborating data for Region 4 Strategic Habitat Area (SHA) nomination on the Northeast Cape Fear River (SHA nominations #28, 30-37).

SHA #28 (Map 24)	Northeast Cape Fear River – Ness Creek
Description	North of Wilmington near Wrightsboro and Ness creek
Acres	488
Prominent Habitats	Emergent wetlands
Ecological Designations	PNA and AFSA
Conservation Lands	Northeast Cape Fear River Floodplain
Water Quality Ratings	Some no data and some impaired (Cat 5)
Water Quality Classifications	SC
Fish Data	None
Prominent Alterations	Major NPDES and drained
Average Total Alteration Score	3.03
Average Selection Frequency	162

SHA #30 (Map 25)	Northeast Cape Fear River – Cowpen Branch
Description	Northeast Cape Fear River including Cowpen Branch
Acres	678
Prominent Habitats	Forested wetland
Ecological Designations	PNA and AFSA
Conservation Lands	Northeast Cape Fear River Floodplain
Water Quality Ratings	Some no data and some supporting
Water Quality Classifications	None
Fish Data	DMF Program 120
Prominent Alterations	Major NPDES
Average Total Alteration Score	2.31
Average Selection Frequency	150

SHA #31 (Map 25)	Northeast Cape Fear River – Long Creek
Description	Northeast Cape Fear River including Long, Morgans, and Turkey creeks
Acres	2,904
Prominent Habitats	Forested wetland
Ecological Designations	PNA and AFSA
Conservation Lands	Northeast Cape Fear River floodplain and Cape Fear River Wetlands Game Land
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	DMF Program 120
Prominent Alterations	Major NPDES, marinas, and shellfish closure
Average Total Alteration Score	2.31
Average Selection Frequency	161

SHA #32 (Map 25)	Northeast Cape Fear River – Prince George Creek
Description	Northeast Cape Fear River and mouth of Prince George Creek
Acres	439
Prominent Habitats	Forested wetland
Ecological Designations	PNA and AFSA
Conservation Lands	Northeast Cape Fear River Floodplain and Cape Fear River Wetlands Game Land
Water Quality Ratings	Some supporting and some no data
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and marinas
Average Total Alteration Score	3.15
Average Selection Frequency	153

SHA #33 (Map 26)	Northeast Cape Fear River – Castle Hayne
Description	Northeast Cape Fear River with portions of Island Creek and Merricks Creek
Acres	2,344
Prominent Habitats	Forested wetland and riverine soft bottom (ND)
Ecological Designations	PNA and AFSA
Conservation Lands	Northeast Cape Fear River Floodplain, Rocky Point Sandhills, North Carolina Coastal Land Trust Preserve and Easement
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	DMF Program 120
Prominent Alterations	Major NPDES, marinas, shellfish closure, and drained
Average Total Alteration Score	2.67
Average Selection Frequency	150

SHA #34 (Map 26)	Northeast Cape Fear River – Rocky Point
Description	Northeast Cape Fear River with portions of Pike, Mcintre and Lillington creeks
Acres	1,741
Prominent Habitats	Forested wetland
Ecological Designations	PNA and AFSA
Conservation Lands	Northeast Cape Fear River Floodplain and Cape Fear River Wetlands Game Land
Water Quality Ratings	Mostly supporting, some no data, and some impaired (Cat 5)
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES, marinas, and shellfish closure
Average Total Alteration Score	2.86
Average Selection Frequency	149

SHA #35 (Map 27)	Northeast Cape Fear River – Ashes Creek
Description	Northeast Cape Fear River with Ashes Creek
Acres	461
Prominent Habitats	Forested wetland
Ecological Designations	AFSA
Conservation Lands	Northeast Cape Fear River Floodplain, Holly Shelter Game Land, and North Carolina Coastal Land Trust Easement
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and marinas
Average Total Alteration Score	2.20
Average Selection Frequency	178

SHA #36 (Map 27 and 28)	Northeast Cape Fear River – Watermelon Run
Description	Northeast Cape Fear River at Watermelon Run
Acres	741
Prominent Habitats	Forested wetland
Ecological Designations	AFSA
Conservation Lands	None
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and marina
Average Total Alteration Score	2.30
Average Selection Frequency	129

SHA #37 (Map 28)	Northeast Cape Fear River – Duplin/Pender County Line
Description	Northeast Cape Fear River at the Duplin/Pender county line
Acres	607
Prominent Habitats	Forested wetland
Ecological Designations	None
Conservation Lands	None
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	None
Prominent Alterations	Major NPDES and marinas
Average Total Alteration Score	2.14
Average Selection Frequency	184

5.6 Black River

Table 13. Descriptions and corroborating data for Region 4 Strategic Habitat Area (SHA) nomination on the Black River (SHA nomination #39).

SHA #39 (Map 30)	Black River
Description	Black River including mouth of Moores Creek
Acres	4,783
Prominent Habitats	Forested wetland
Ecological Designations	AFSA
Conservation Lands	Lower Black River Swamp, Black River Cypress Swamp, Upper Black River Bottomlands, Cape Fear River Wetlands Game Land, and Black River Preserve
Water Quality Ratings	Mostly supporting and some no data
Water Quality Classifications	None
Fish Data	WRC IBI sampling
Prominent Alterations	Major NPDES, marinas, and shellfish closure
Average Total Alteration Score	2.33
Average Selection Frequency	158

6 MAPS OF FINAL INDIVIDUAL STRATEGIC HABITAT AREAS

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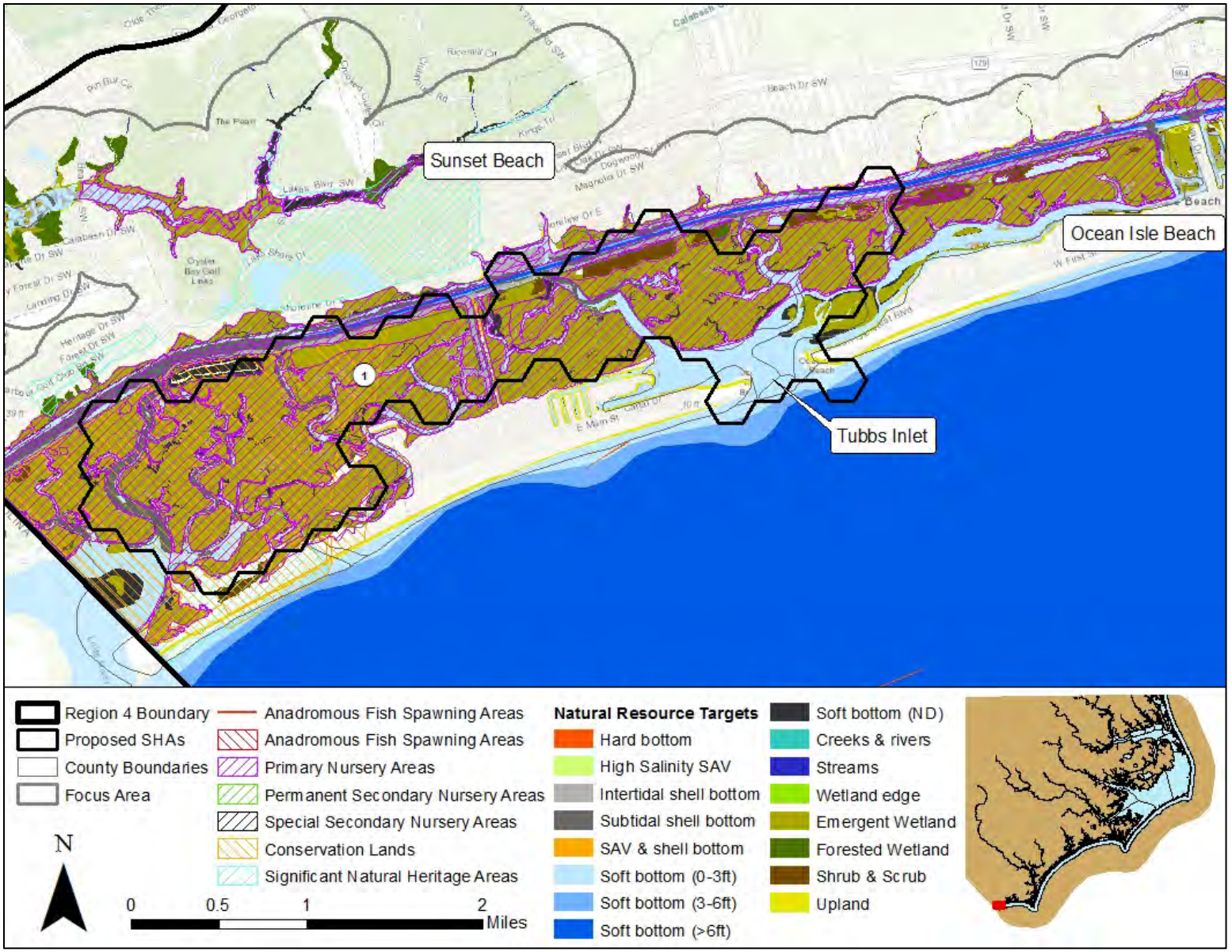
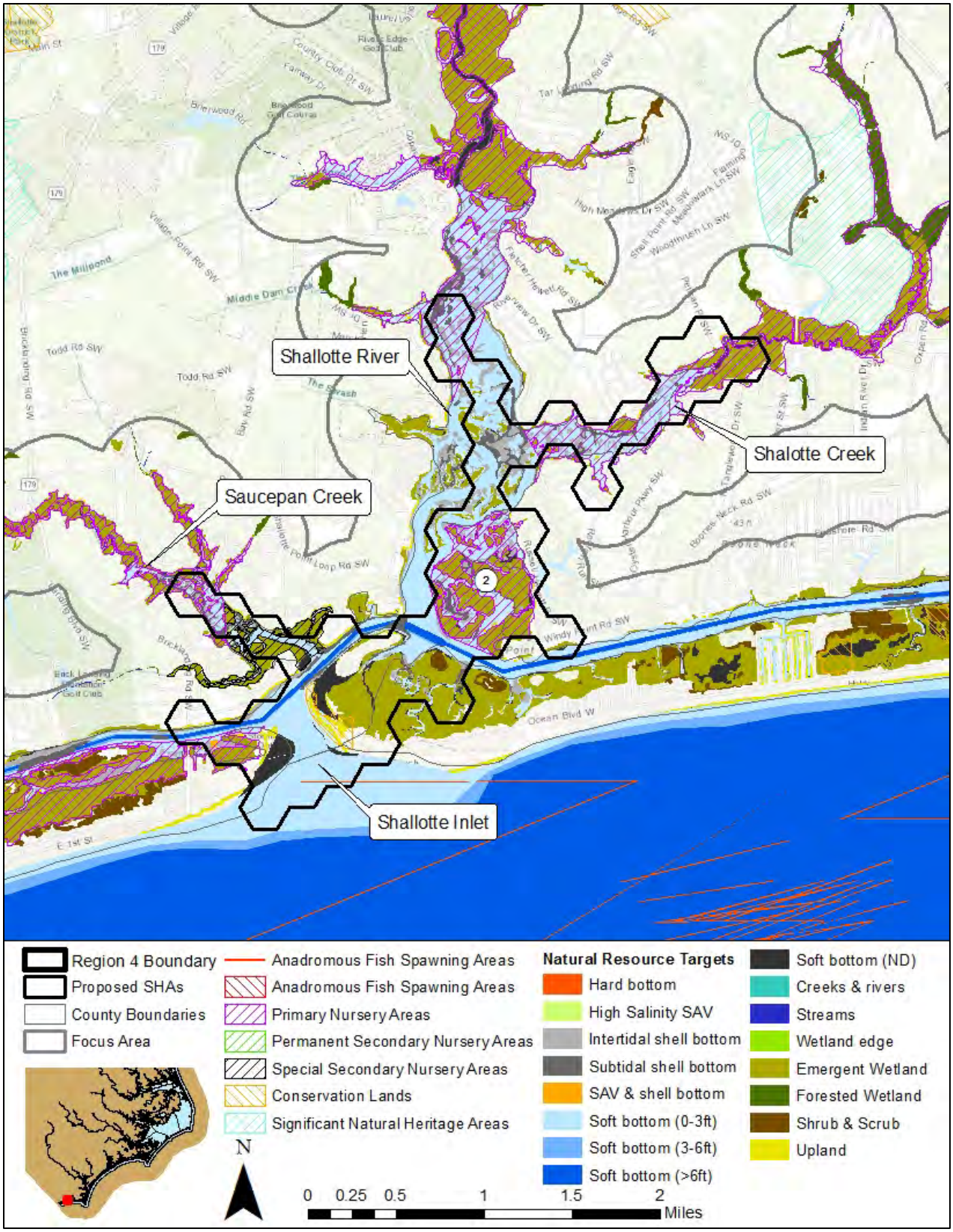
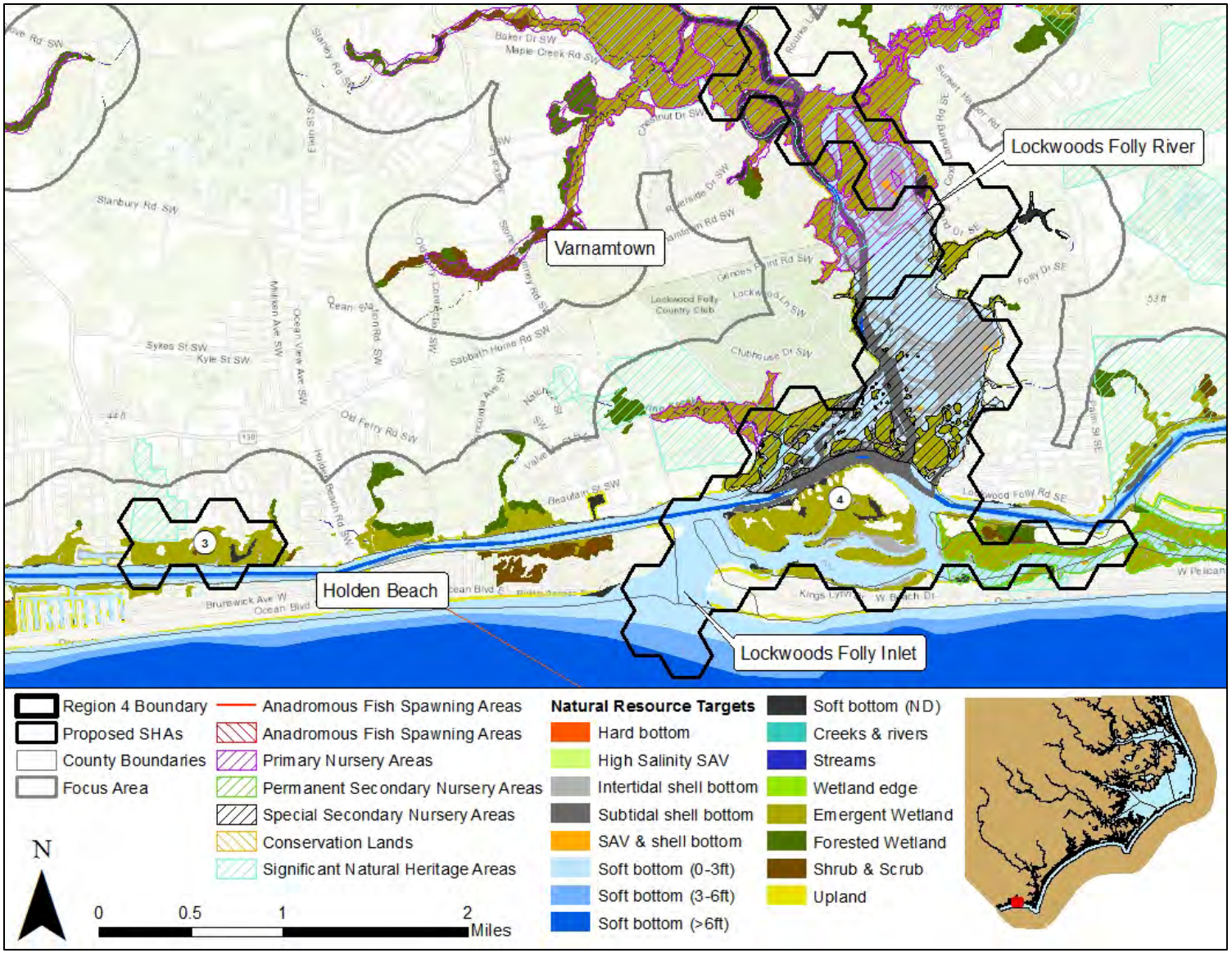


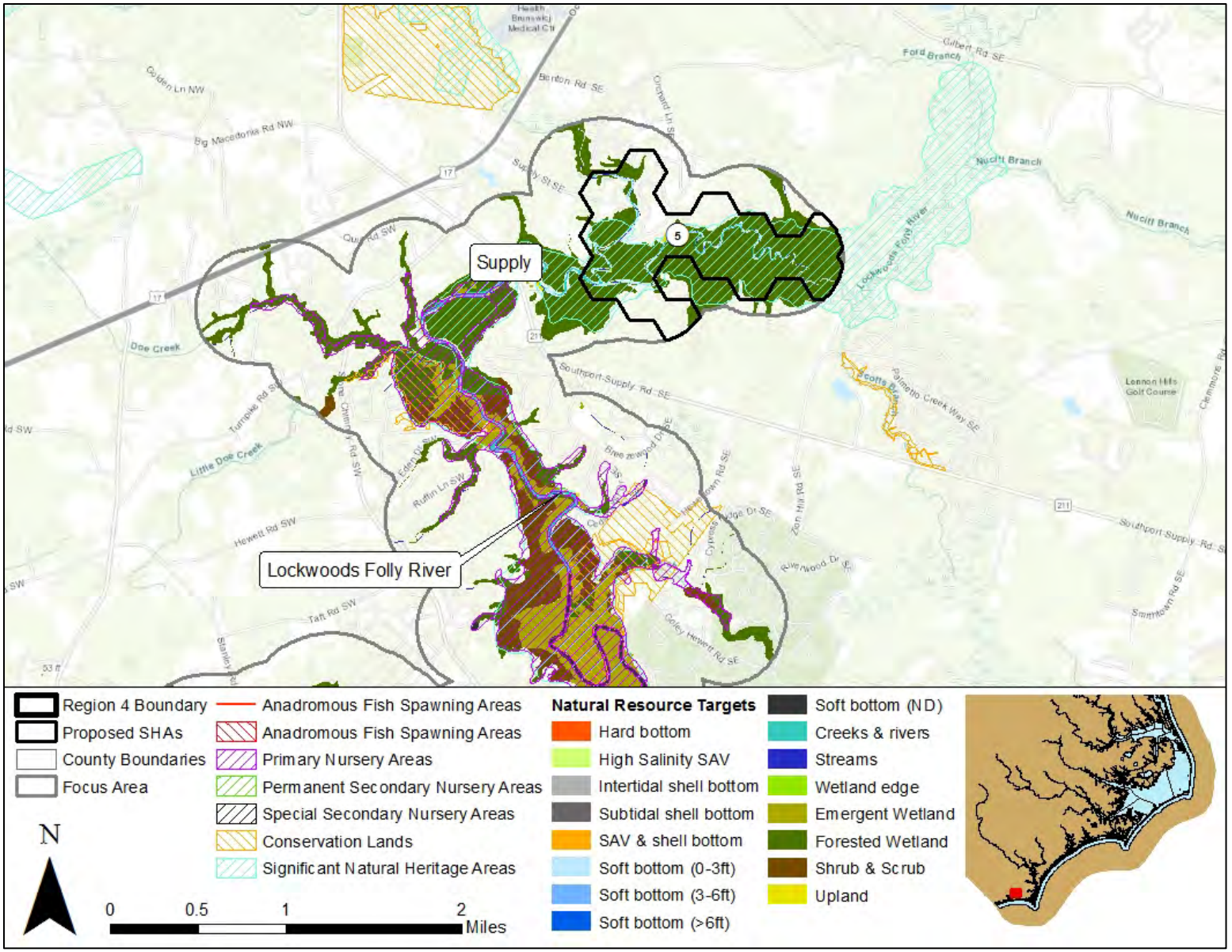
Map 10. Draft Strategic Habitat Area (SHA) nomination #1, Sunset Beach – Bird Island to Tubbs Inlet.



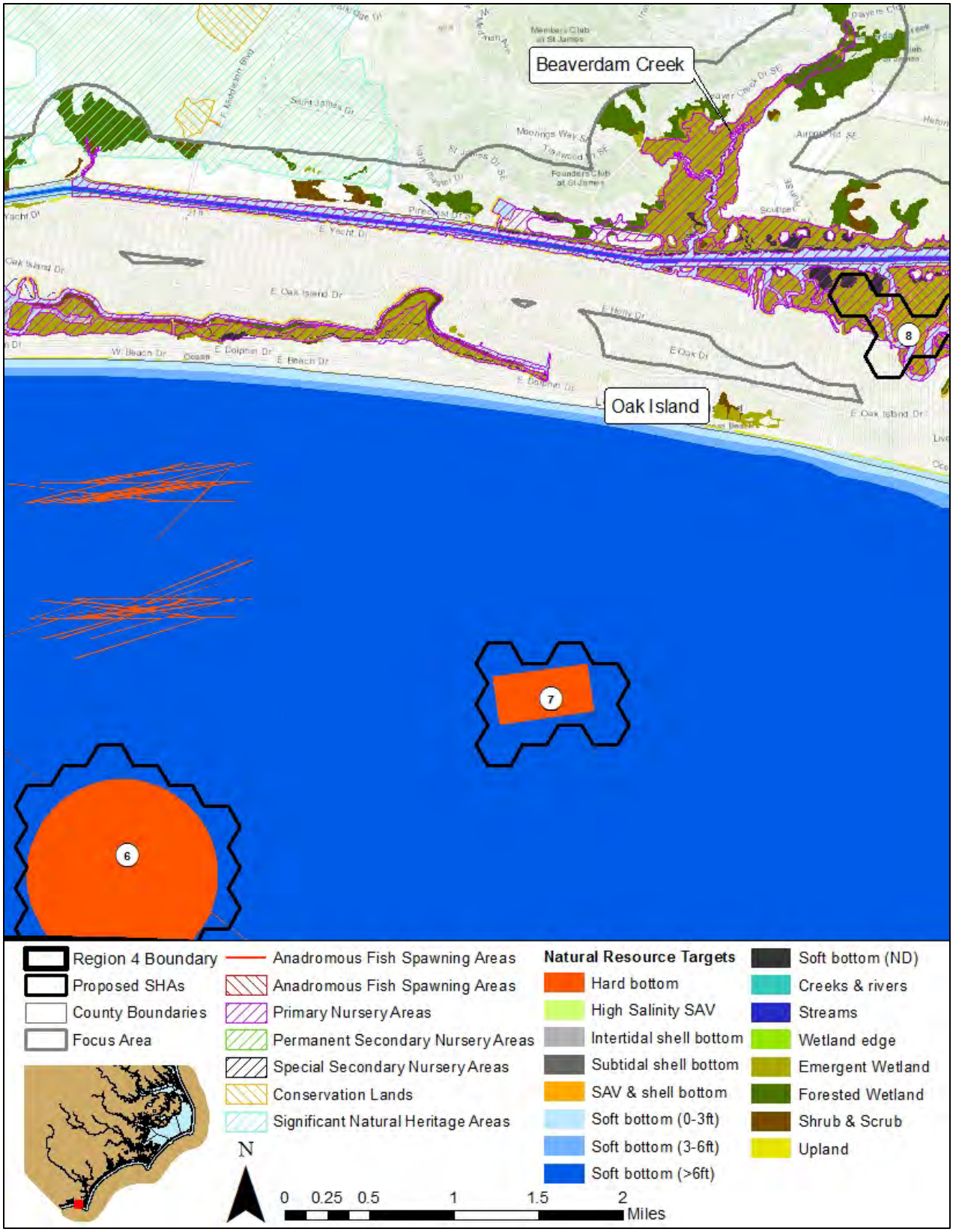
Map 11. Draft Strategic Habitat Area (SHA) nomination #2 – Shallotte Inlet, mouth of Shallotte River, and Shalotte Creek.



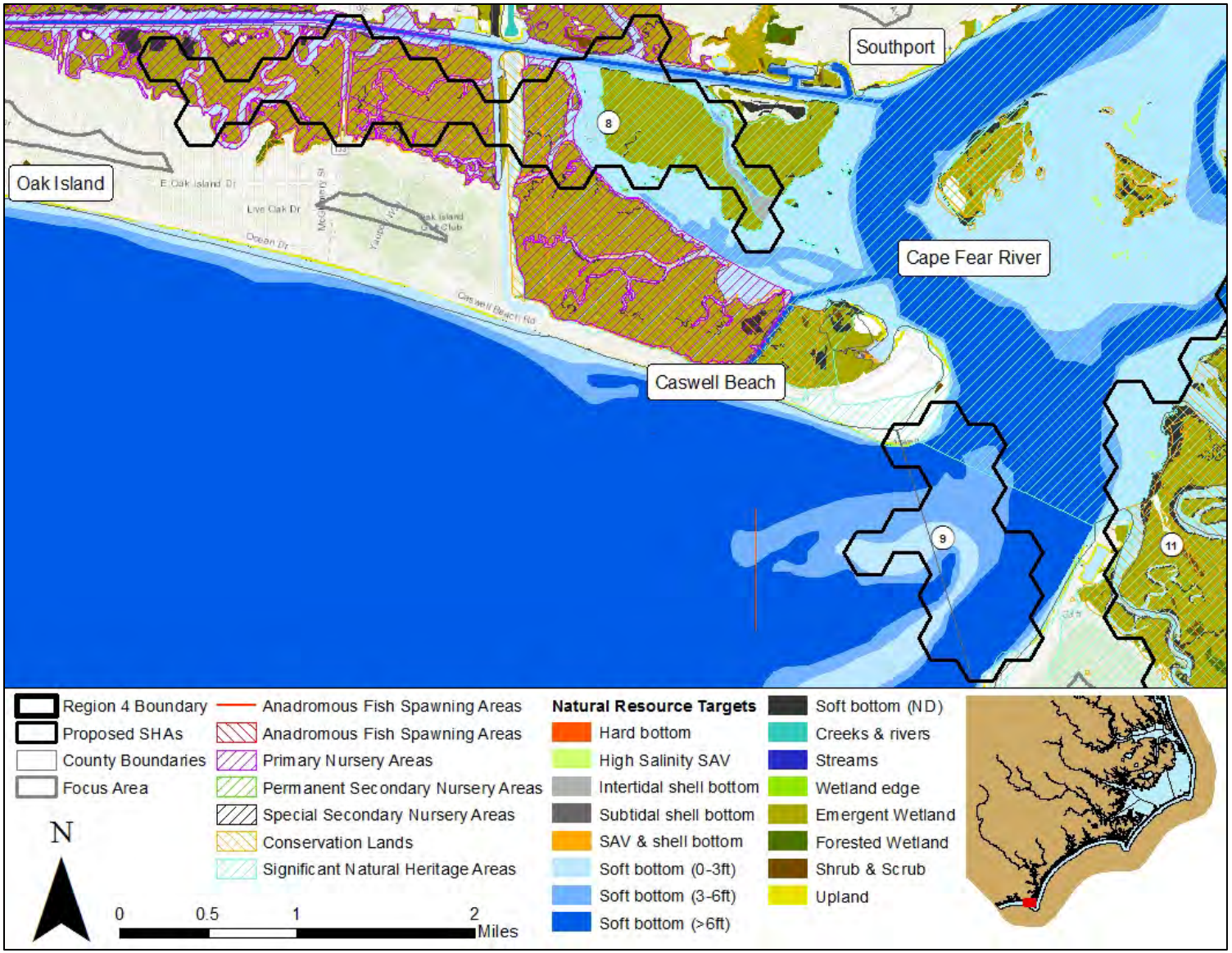
Map 12. Draft Strategic Habitat Area (SHA) nominations #3 – Holden Beach and #4 – Lockwoods Folly Inlet, mouth of Lockwoods Folly River to Rourks Landing and Montgomery Slough.



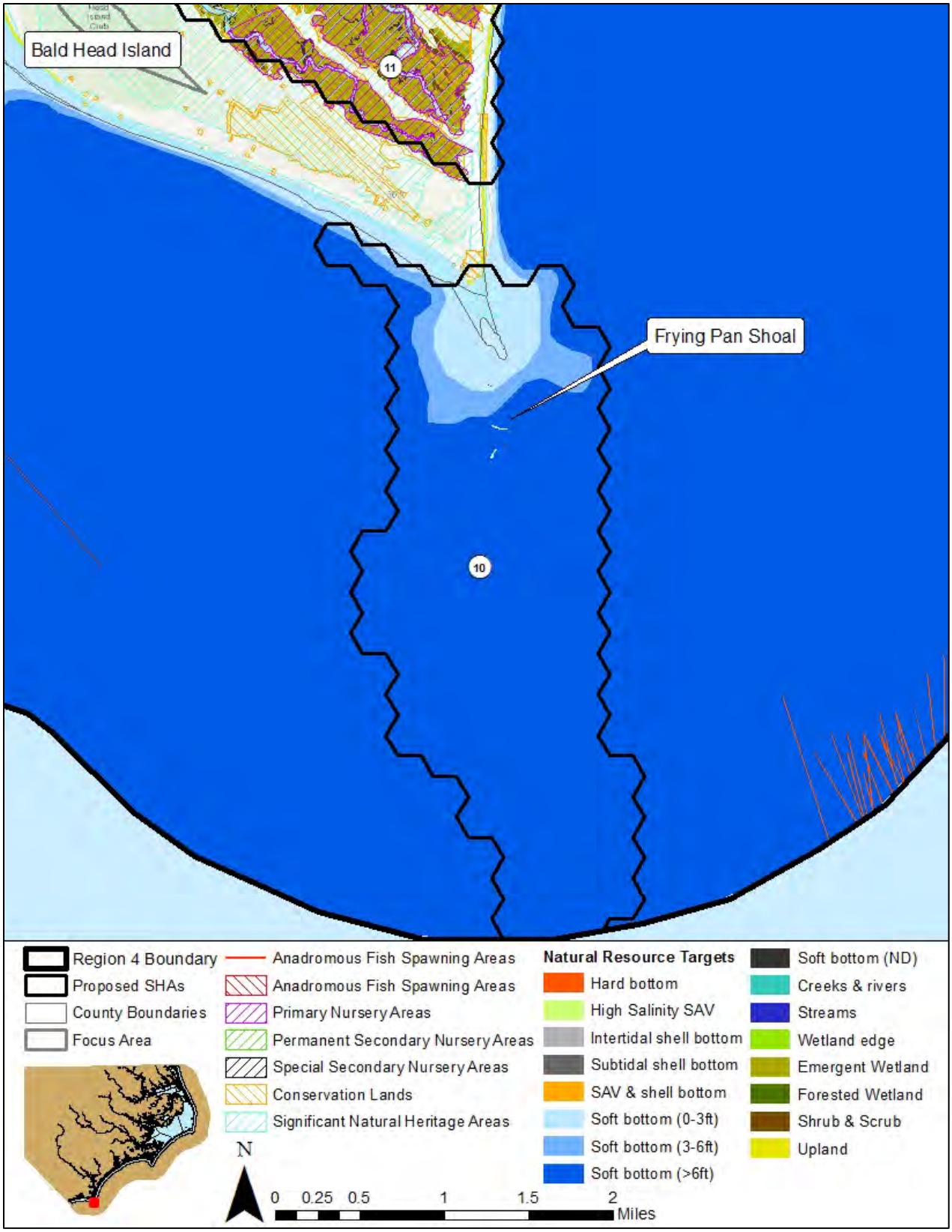
Map 13. Draft Strategic Habitat Area (SHA) nomination #5 – Lockwoods Folly River northeast of Supply.



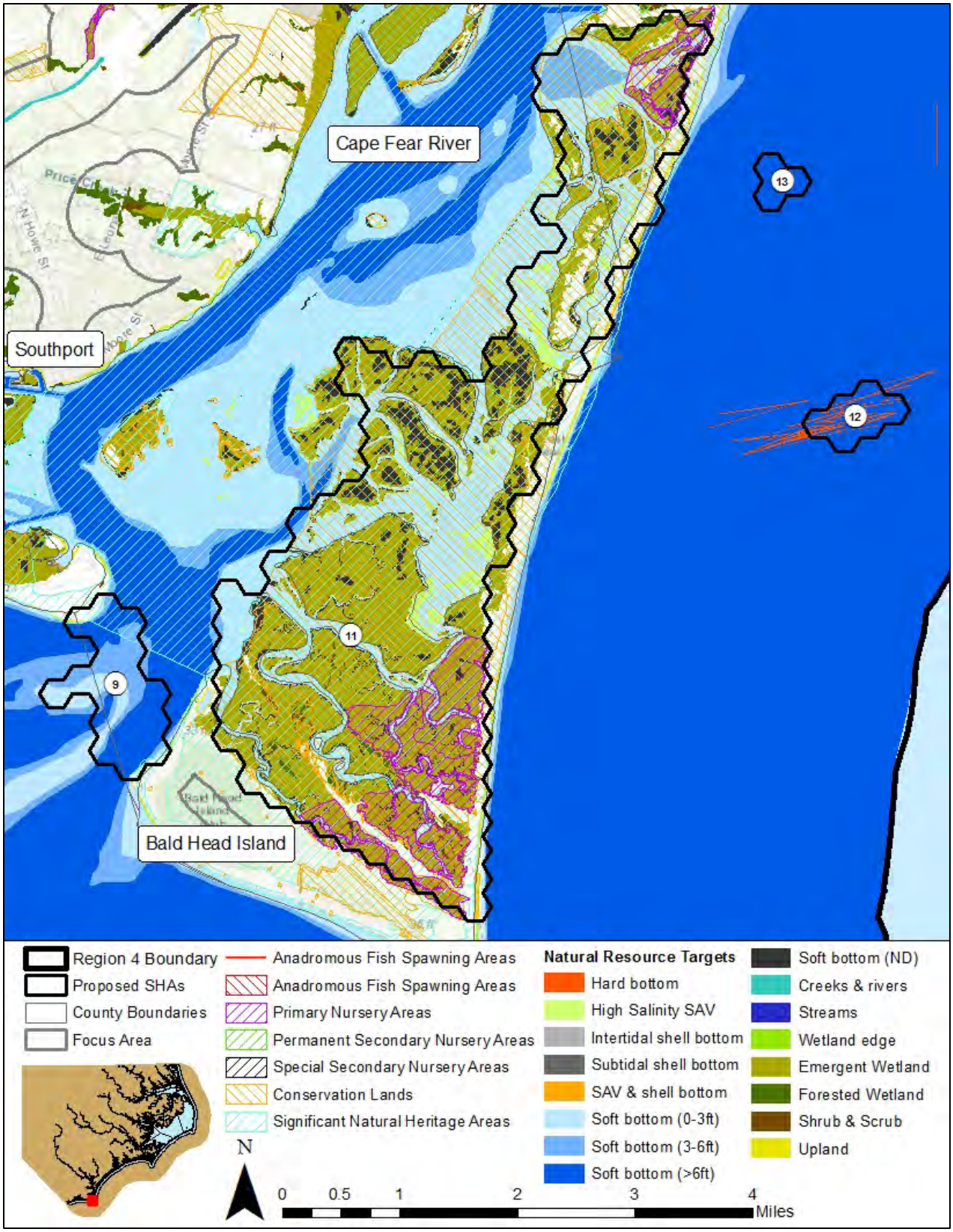
Map 14. Draft Strategic Habitat Area (SHA) nominations #6 – Artificial Reef 430, #7 – Yaupon Beach reef, Artificial Reef 425, and part of #8 – Caswell Beach.



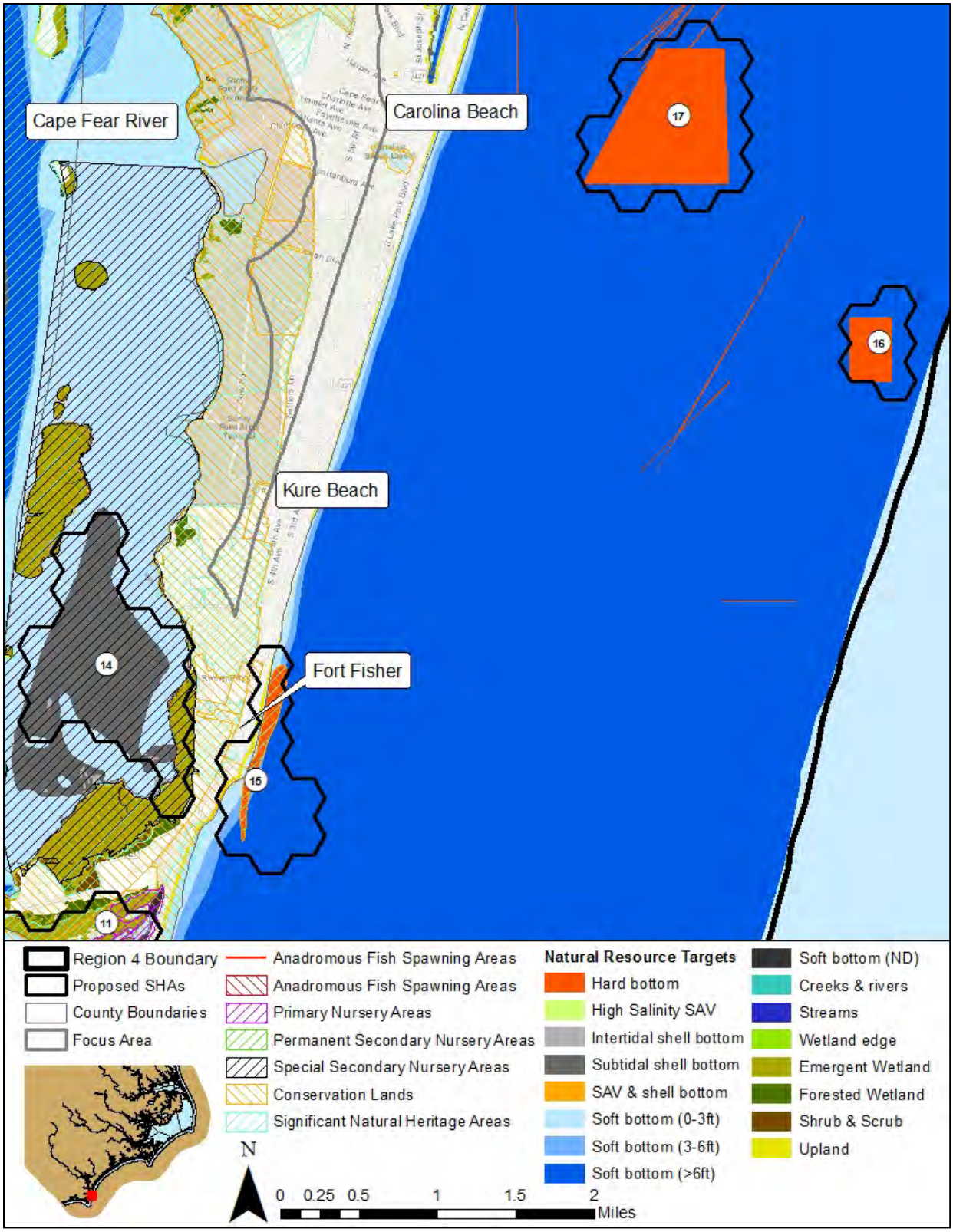
Map 15. Draft Strategic Habitat Area (SHA) nominations #8 – Caswell Beach and #9 – Cape Fear River Inlet and part of #11 – Bald Head Island.



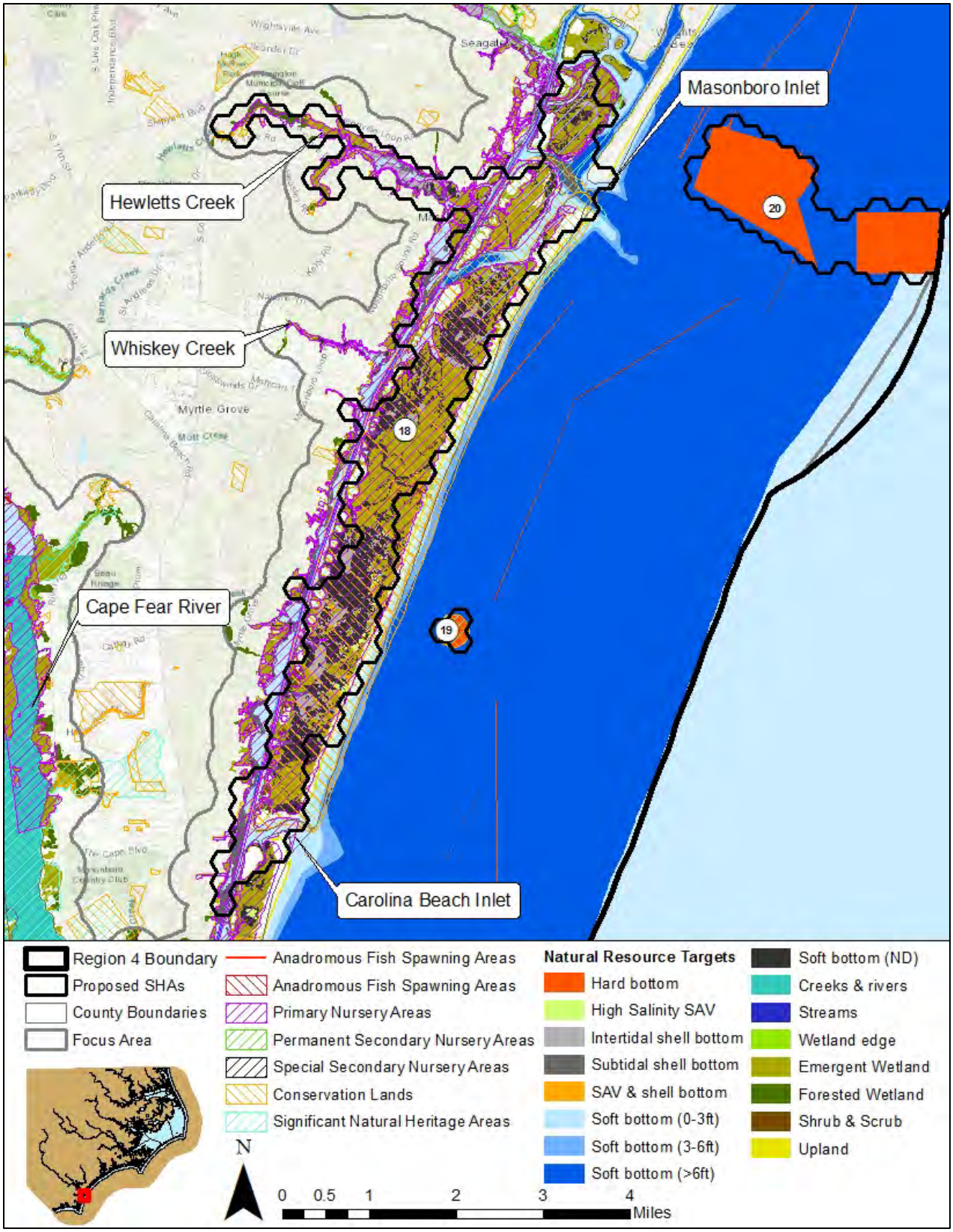
Map 16. Draft Strategic Habitat Area (SHA) nominations #10 – Frying Pan Shoal and parts of #9 – Cape Fear River Inlet and #11 – Bald Head Island.



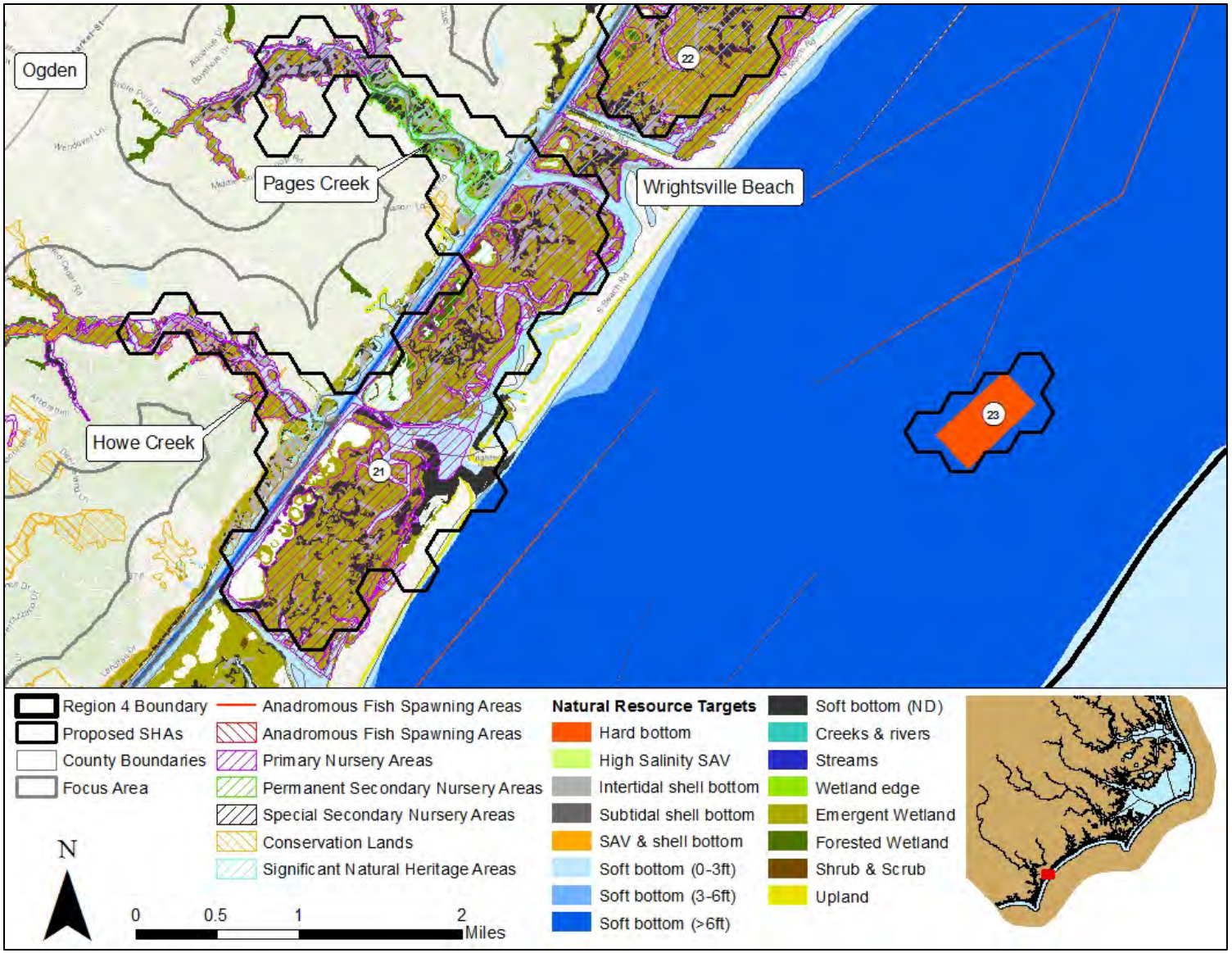
Map 17. Draft Strategic Habitat Area (SHA) nominations #9 – Cape Fear River Inlet, #11 – Bald Head Island, #12 – hard bottom off Fort Fisher, and #13 – Sheepshead Rock.



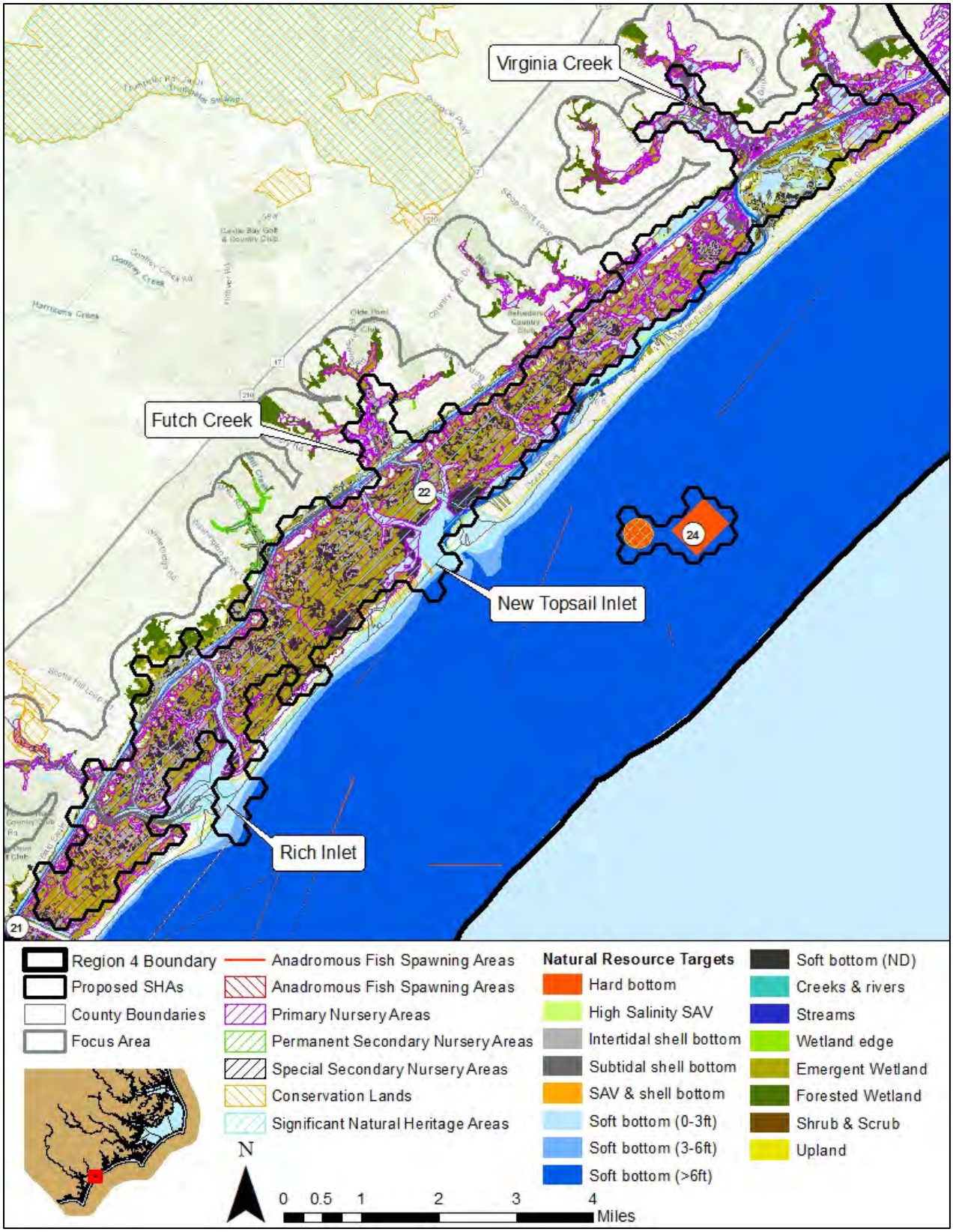
Map 18. Draft Strategic Habitat Area (SHA) nominations #14 – Cape Fear River at Sunny Point, #15 – Fort Fisher Cocquina Outcrop, #16 – Artificial Reef 378B, and #17 – Phillip Wolfe Reef, Artificial Reef 378.



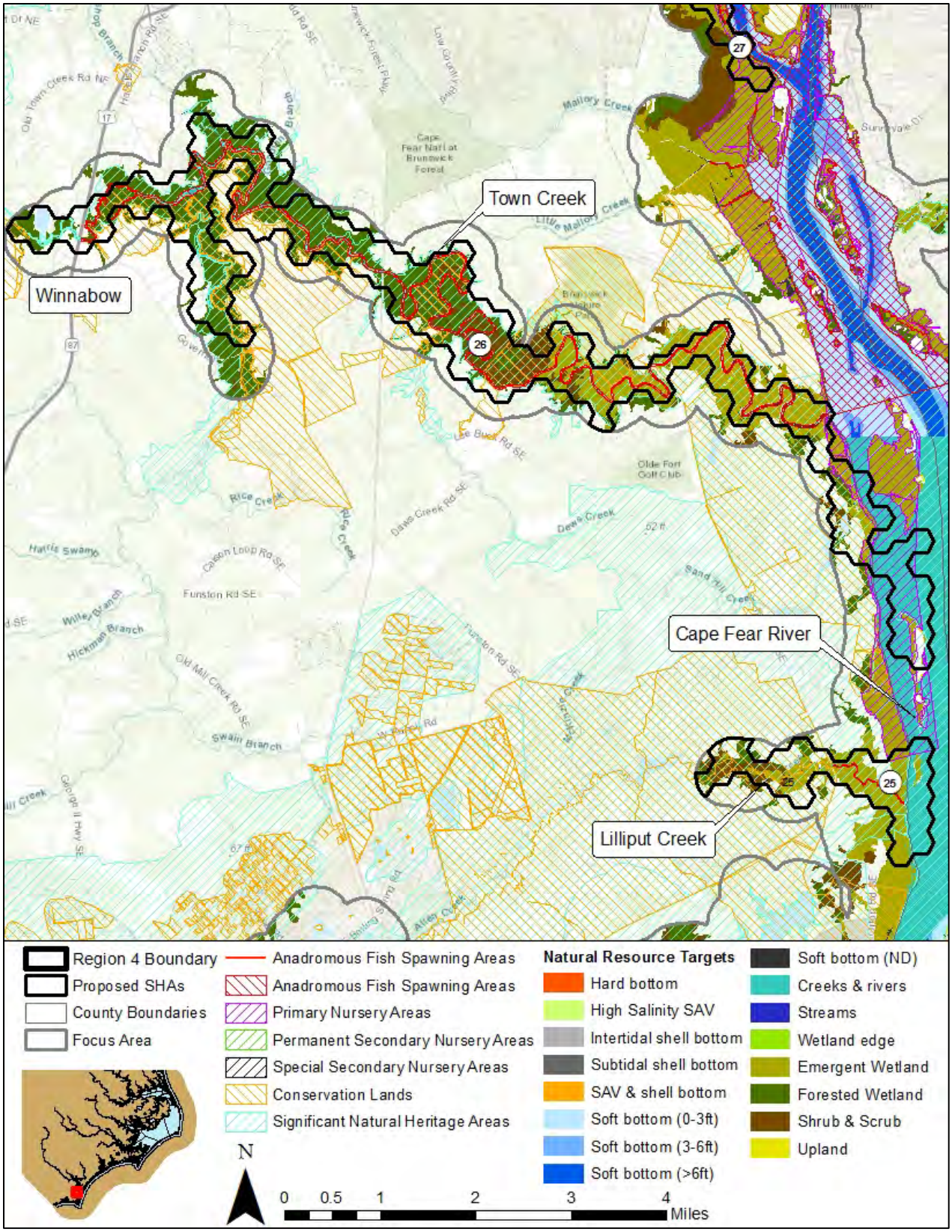
Map 19. Draft Strategic Habitat Area (SHA) nominations #18 – Masonboro Island and Whiskey and Hewletts Creek, #19 – Masonboro Outcrop, #20 – Meares Harris, Artificial Reef 370.



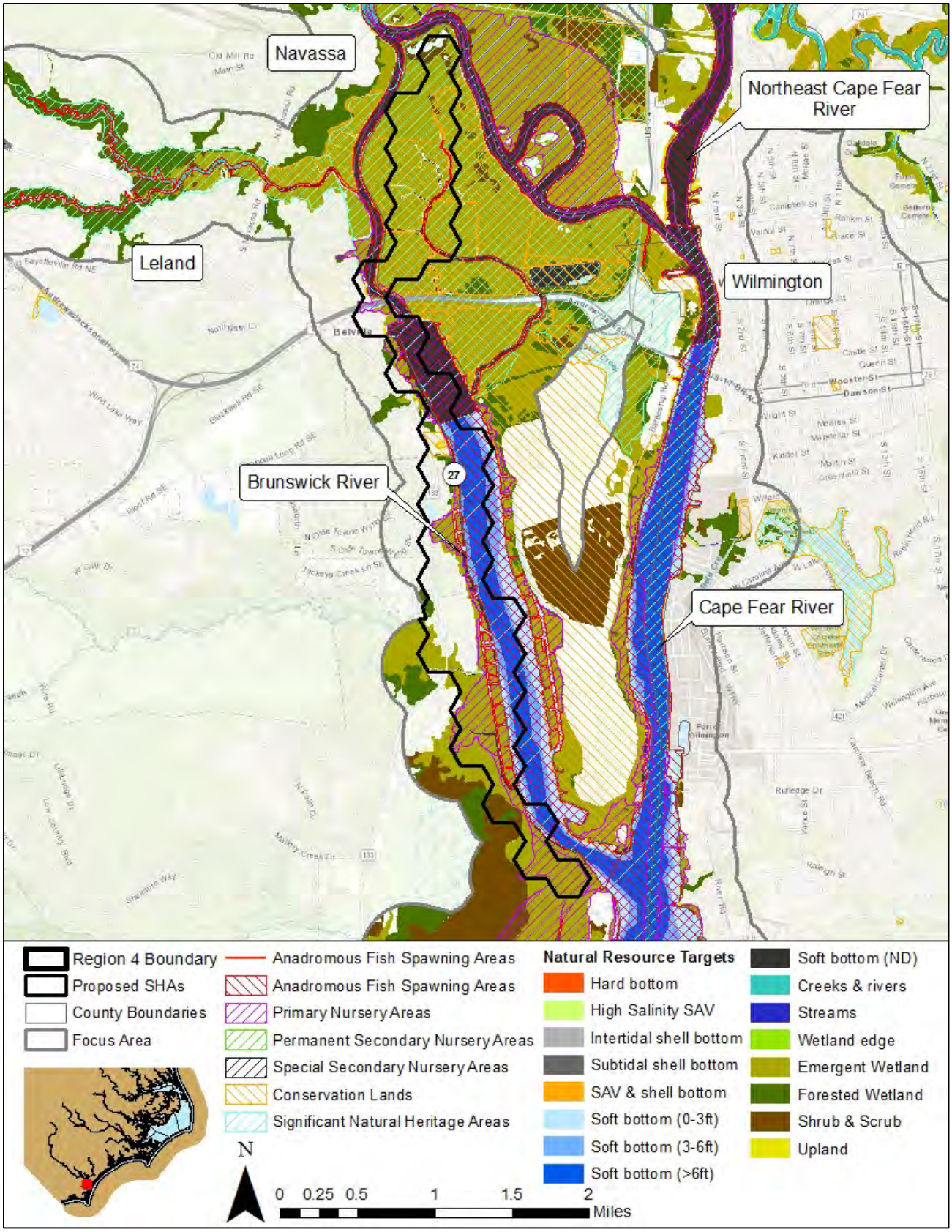
Map 20. Draft Strategic Habitat Area (SHA) nominations #21 – Wrightsville Beach including Howe and Pages creeks, #23 – Billy Murrel Reef, Artificial Reef 364, and part of #22 – Topsail Beach.



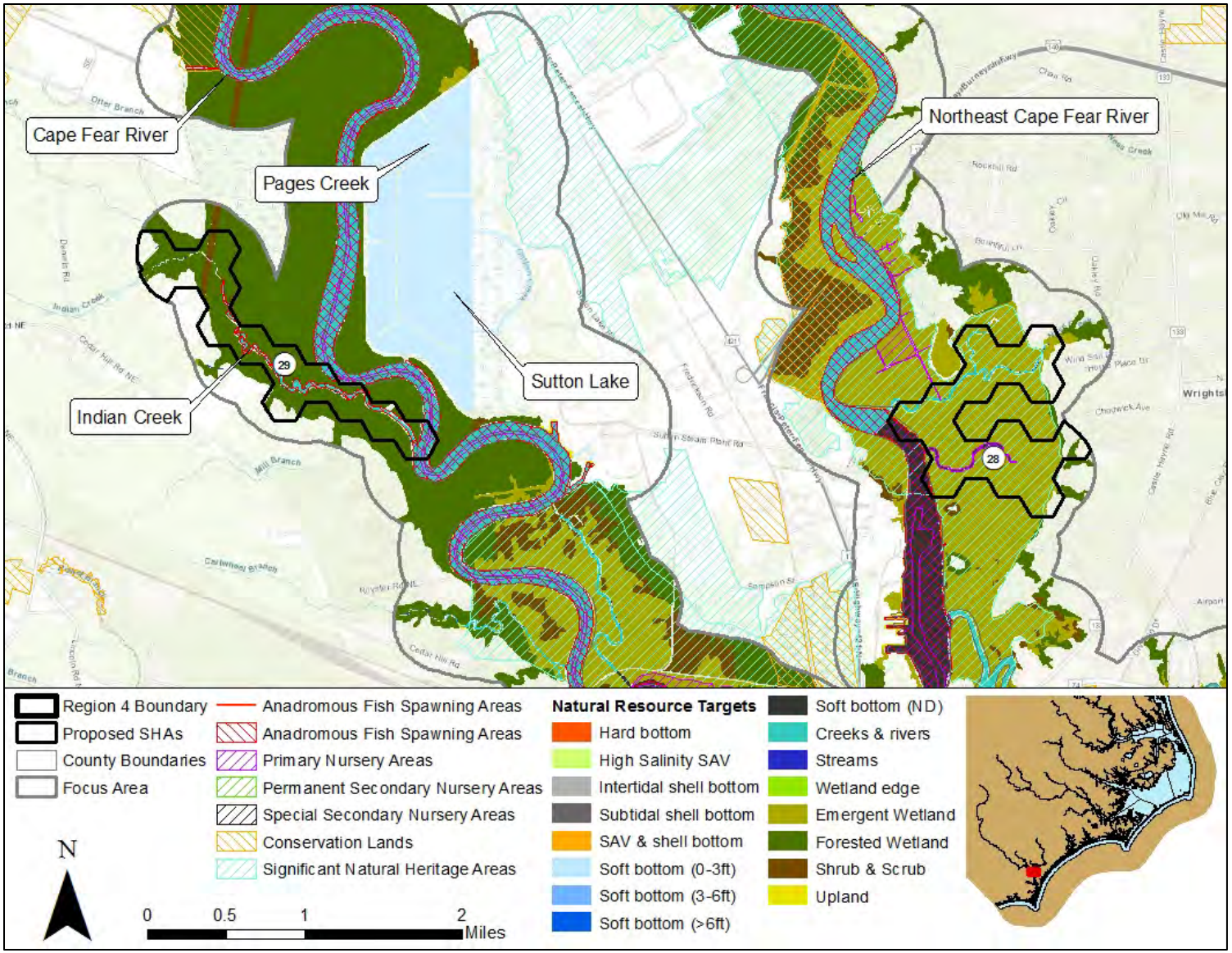
Map 21. Draft Strategic Habitat Area (SHA) nominations #22 – Topsail Beach including Futch and Virginia creeks and Rich and New Topsail inlet and #24 – Topsail Reef, Artificial Reef 360.



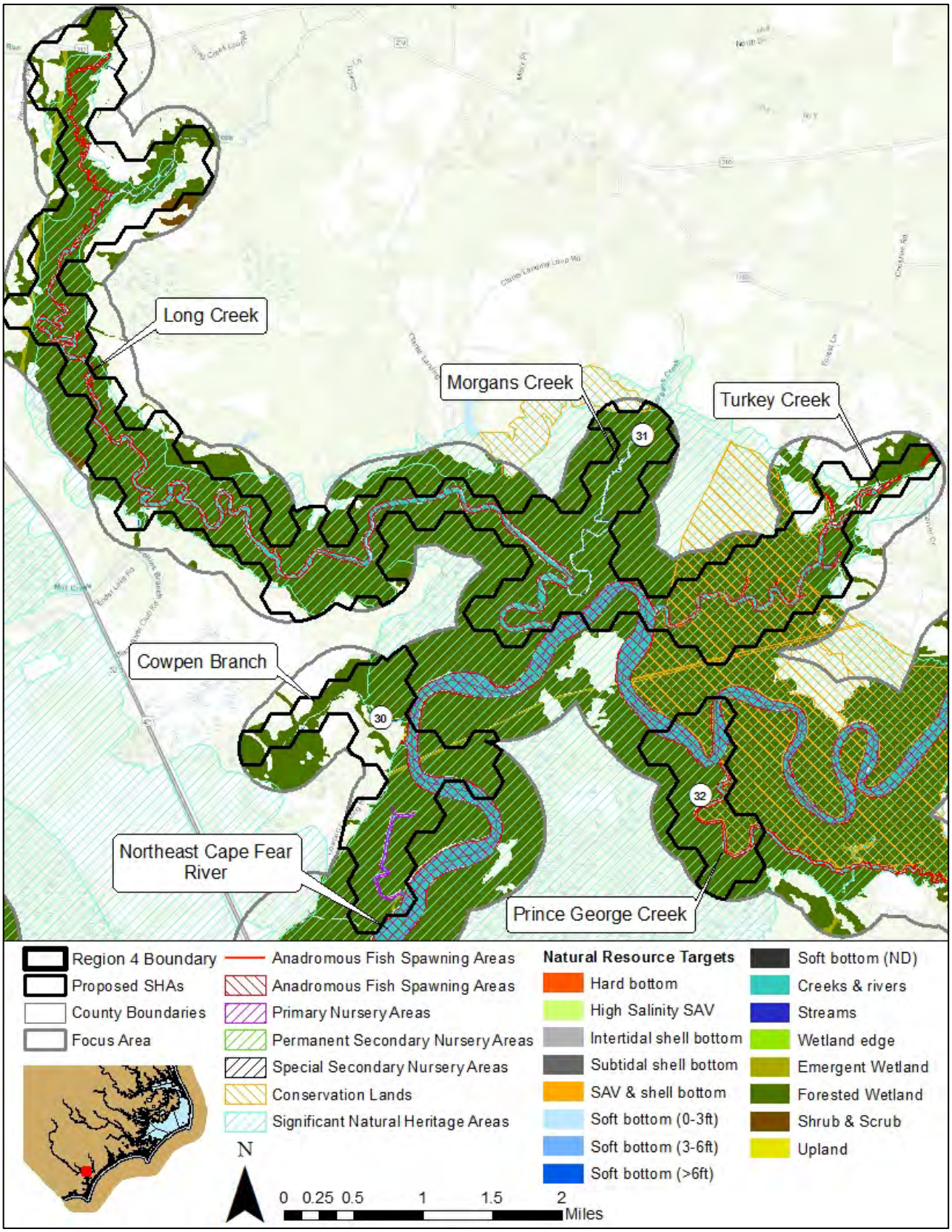
Map 22. Draft Strategic Habitat Area (SHA) nominations #25 – Cape Fear River, Lilliput Creek and #26 – Cape Fear River, Town Creek.



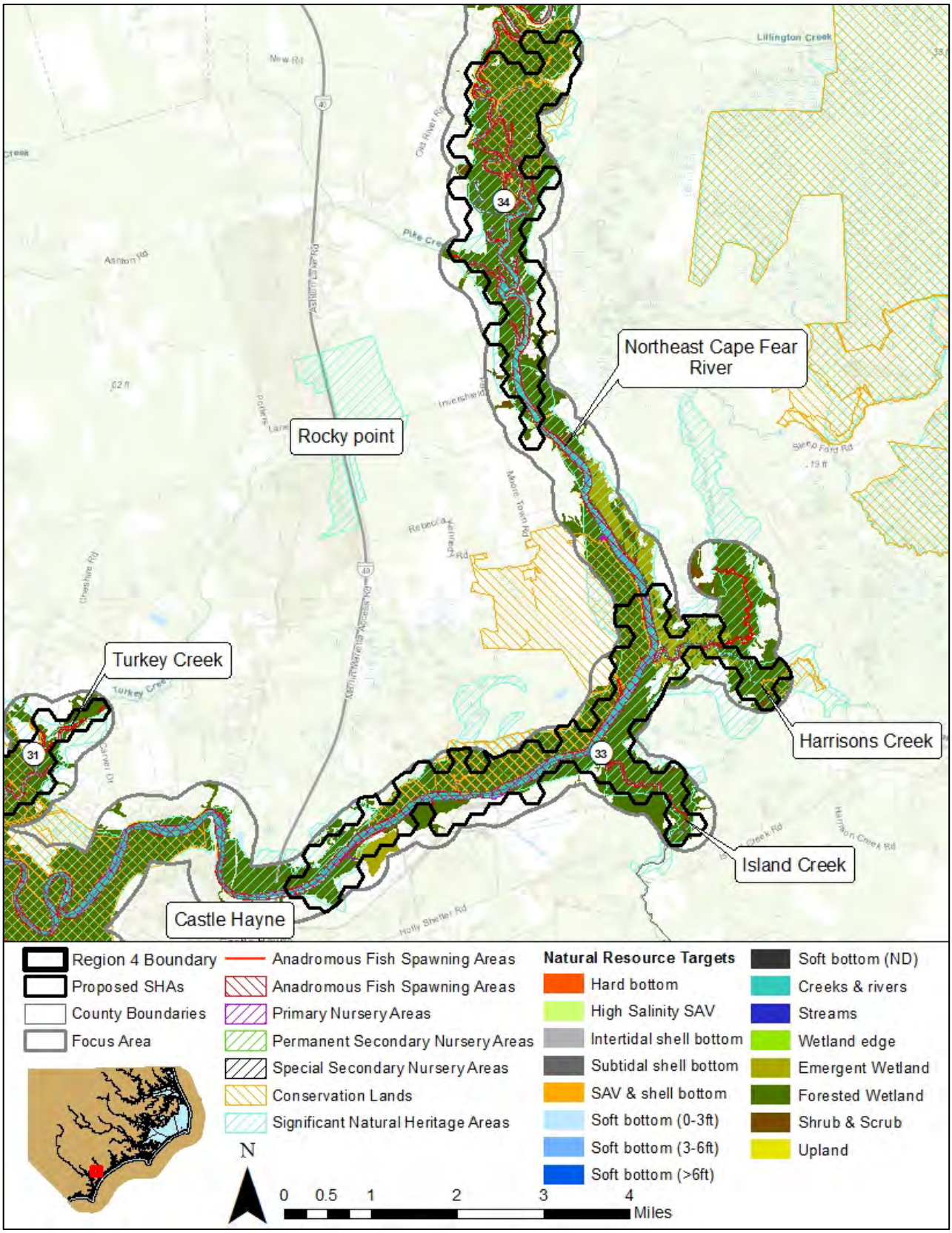
Map 23. Draft Strategic Habitat Area (SHA) nomination #27 – Brunswick River.



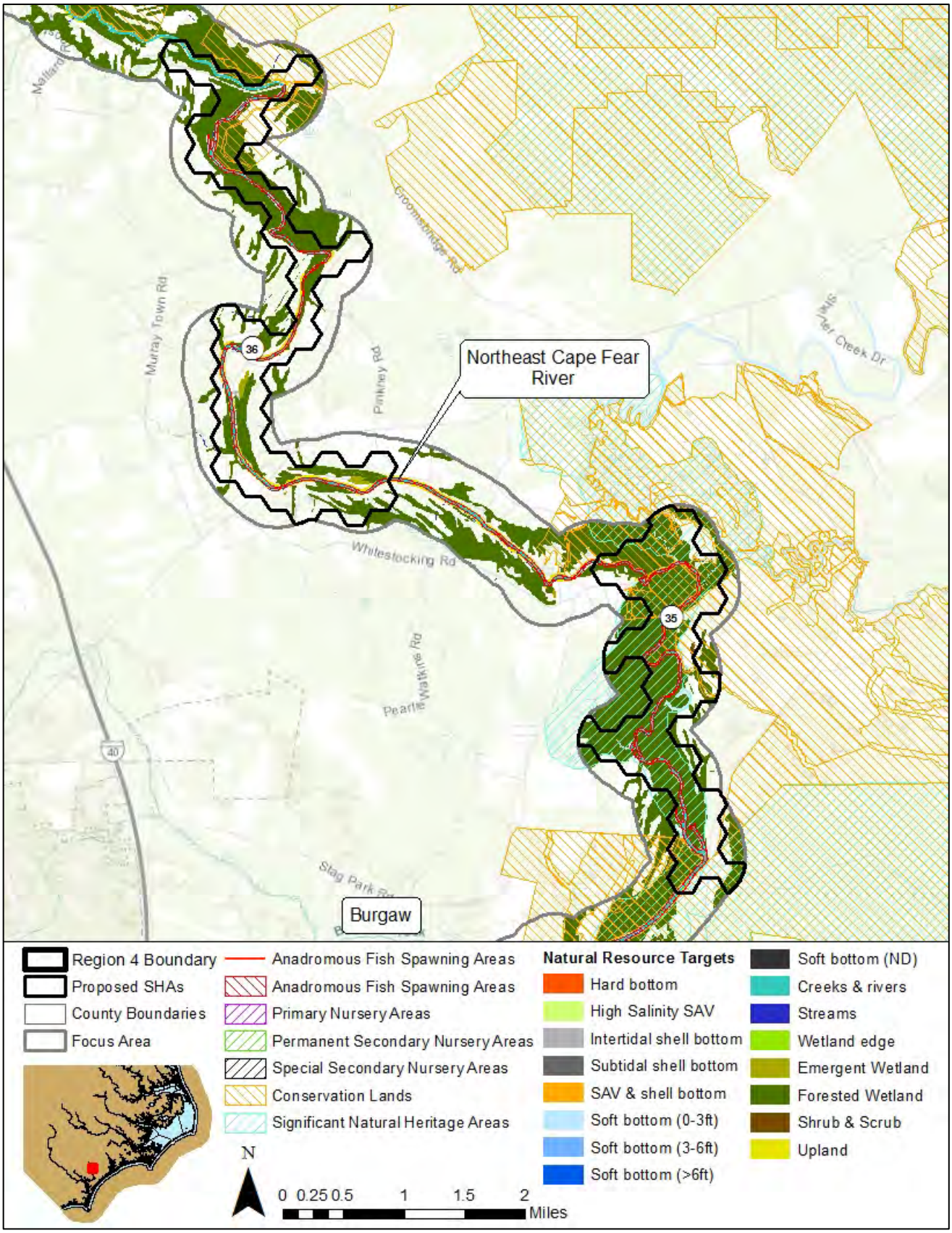
Map 24. Draft Strategic Habitat Area (SHA) nominations #28 – Northeast Cape Fear River, Ness Creek and #29 Cape Fear River, Indian Creek.



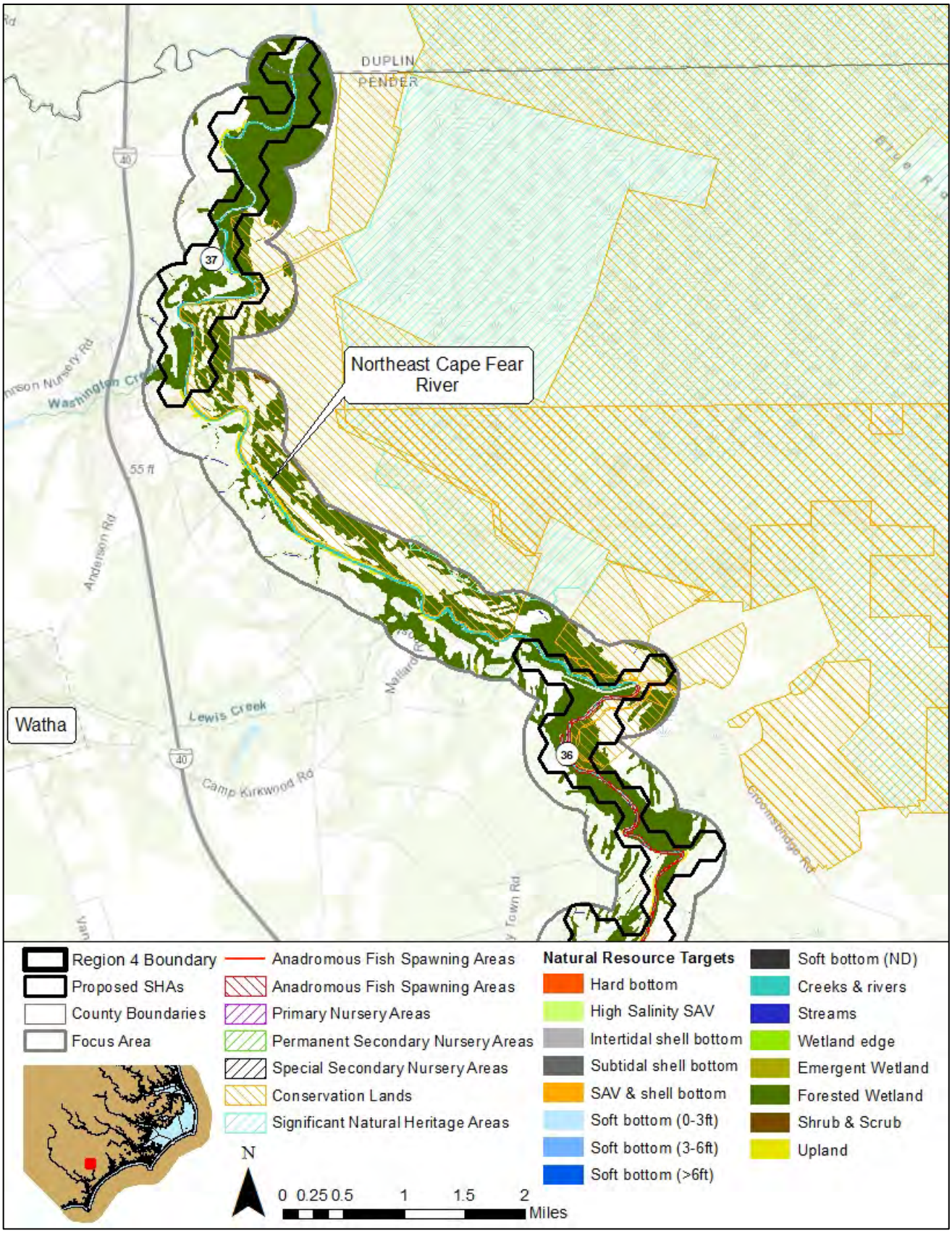
Map 25. Draft Strategic Habitat Area (SHA) nominations #30 – Northeast Cape Fear River, Cowpen Branch, #31 Northeast Cape Fear River, Long, Morgans, and Turkey creeks, and #32 – Northeast Cape Fear River – Prince George Creek.



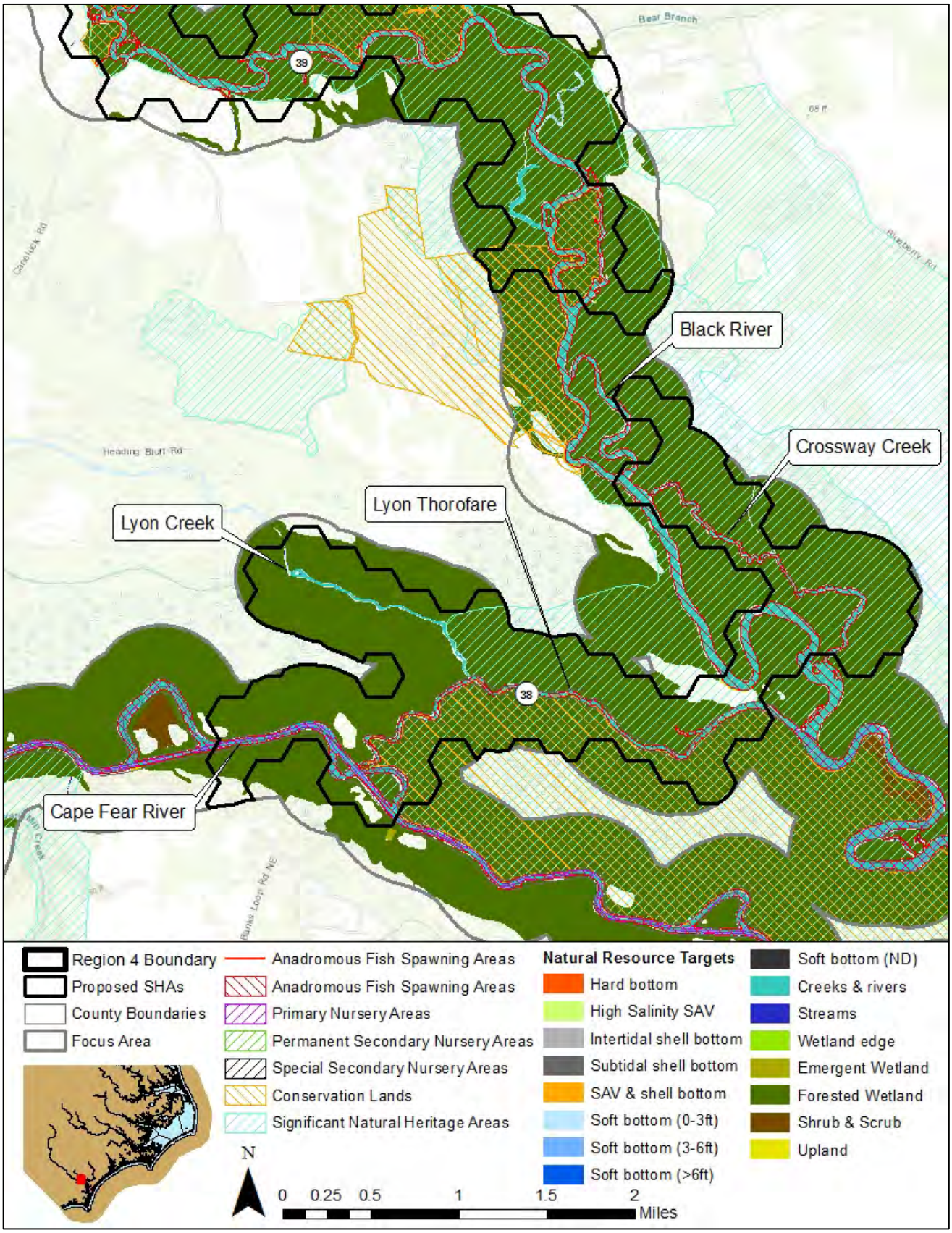
Map 26. Draft Strategic Habitat Area (SHA) nominations #33 – Northeast Cape Fear River, near Castle Hayne including Island and Harrisons creeks and #34 – Northeast Cape Fear River, near Rocky Point.



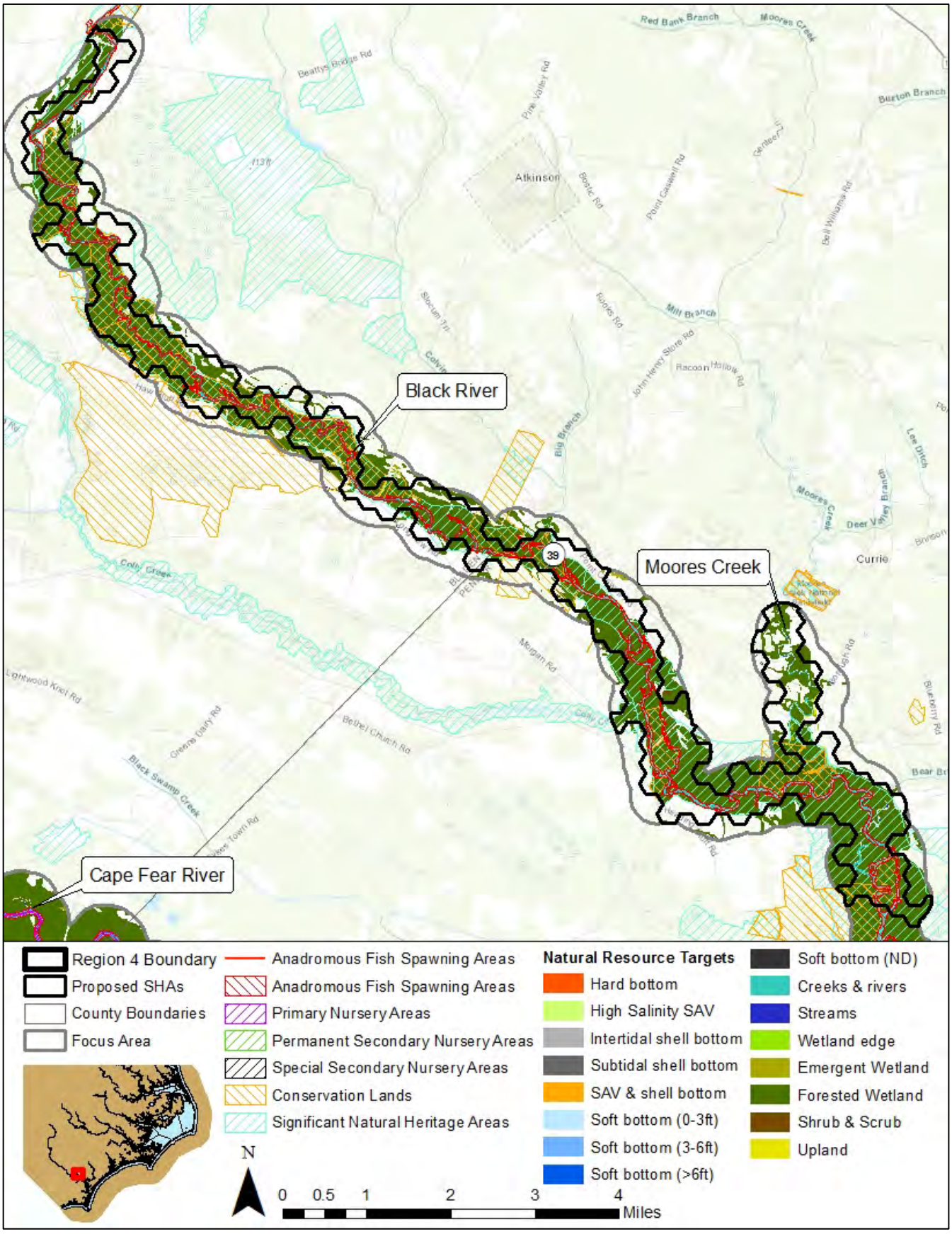
Map 27. Draft Strategic Habitat Area (SHA) nominations #35 – Northeast Cape Fear River, Ashes Creeks and #36 – Northeast Cape Fear River, Watermelon Run.



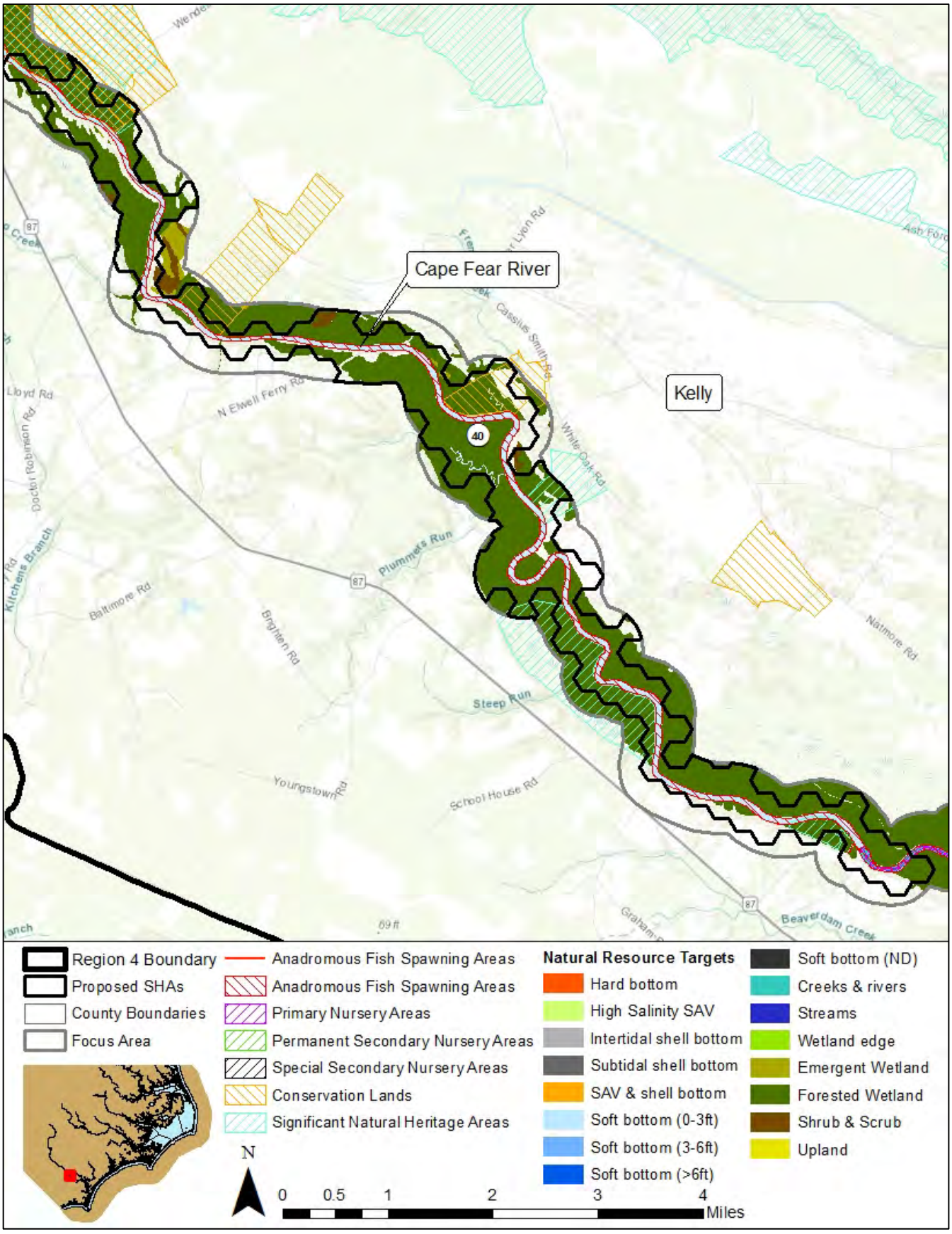
Map 28. Draft Strategic Habitat Area (SHA) nominations #37 – Northeast Cape Fear River, Duplin/Pender County line and part of #36 – Northeast Cape Fear River, Watermelon Run.



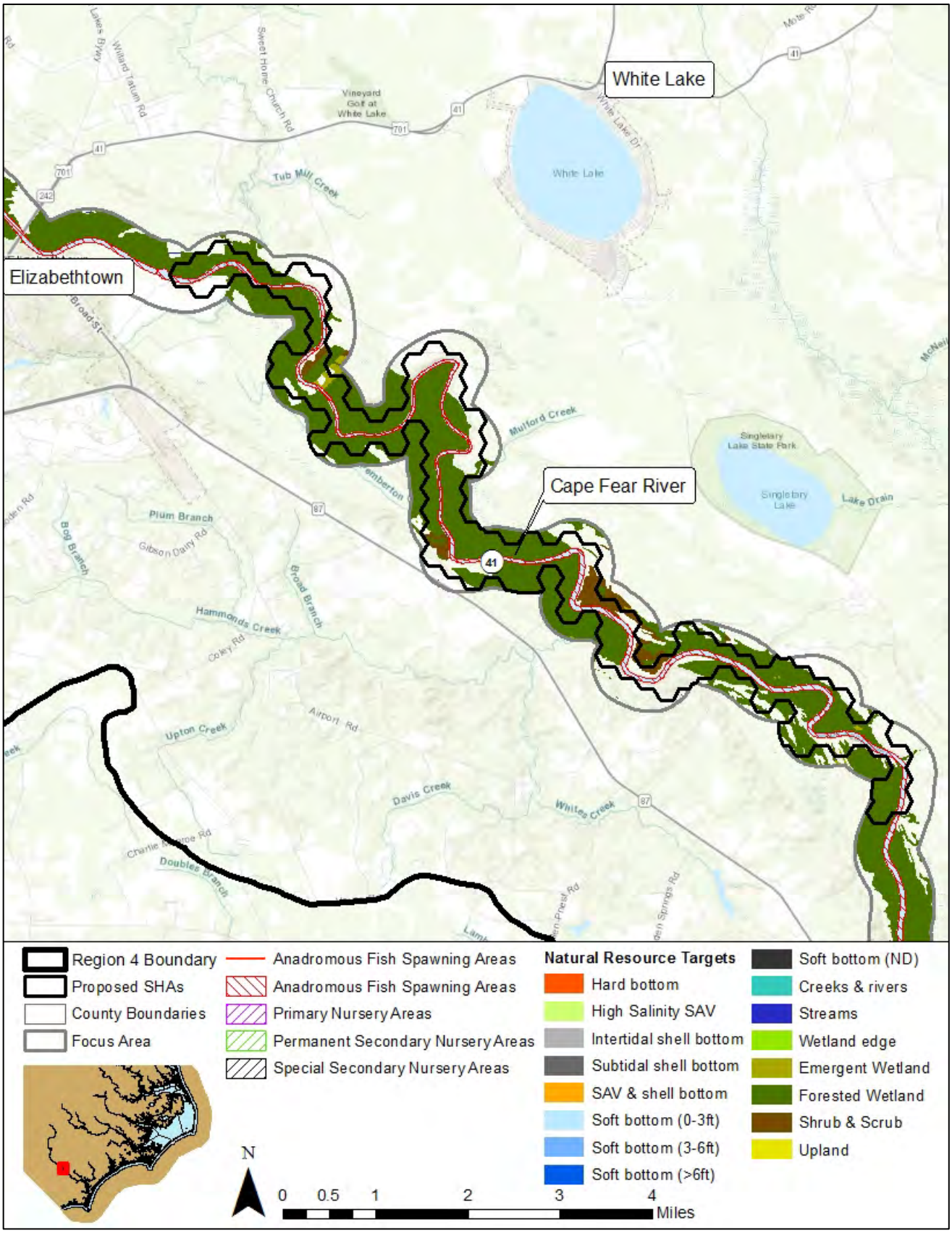
Map 29. Draft Strategic Habitat Area (SHA) nominations #38 – Cape Fear River lowlands, Lyon and Crossway creeks and Lyon Thorofare and part of #39- Black River, Moores Creek..



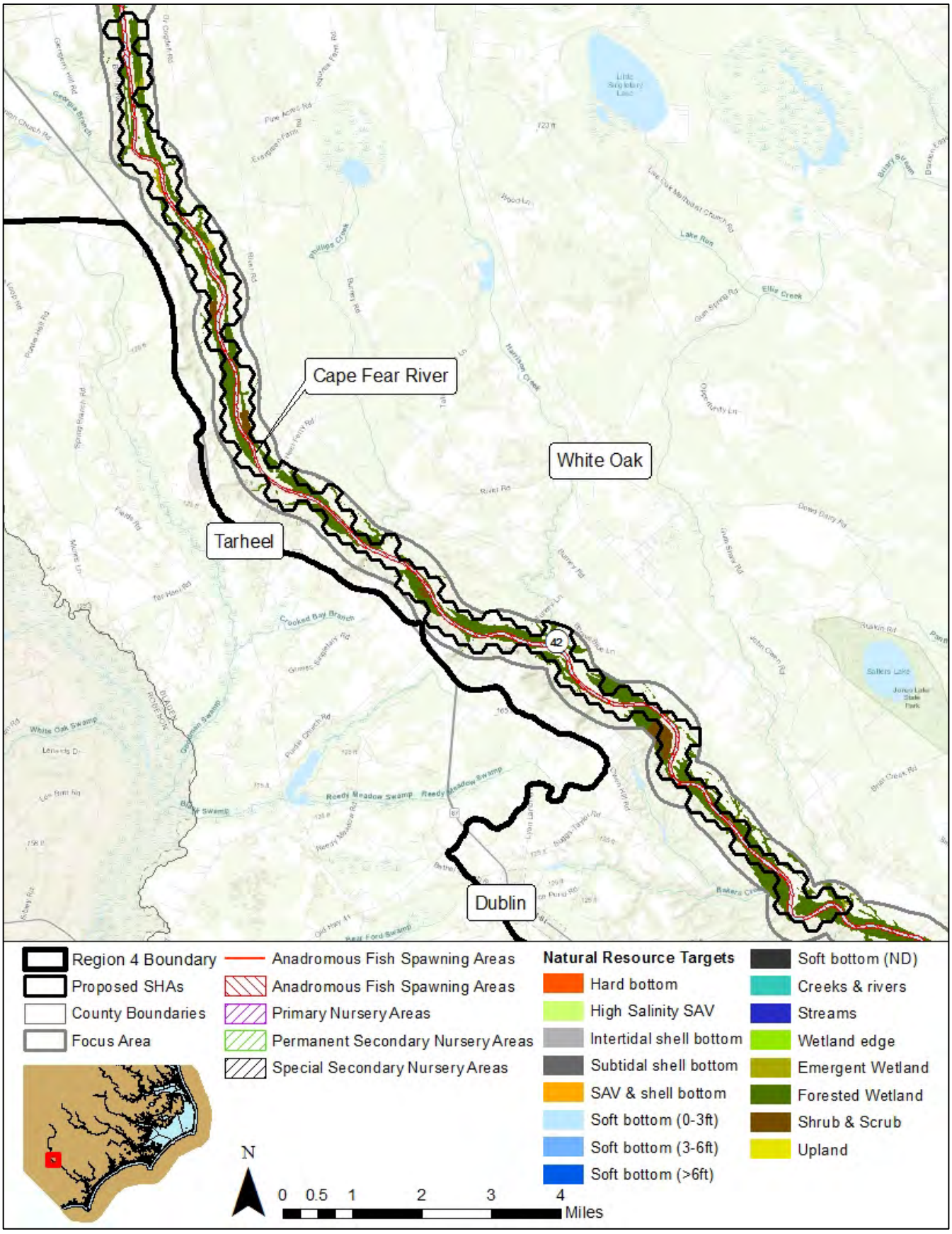
Map 30. Draft Strategic Habitat Area (SHA) nomination #39 – Black River, Moores Creek.



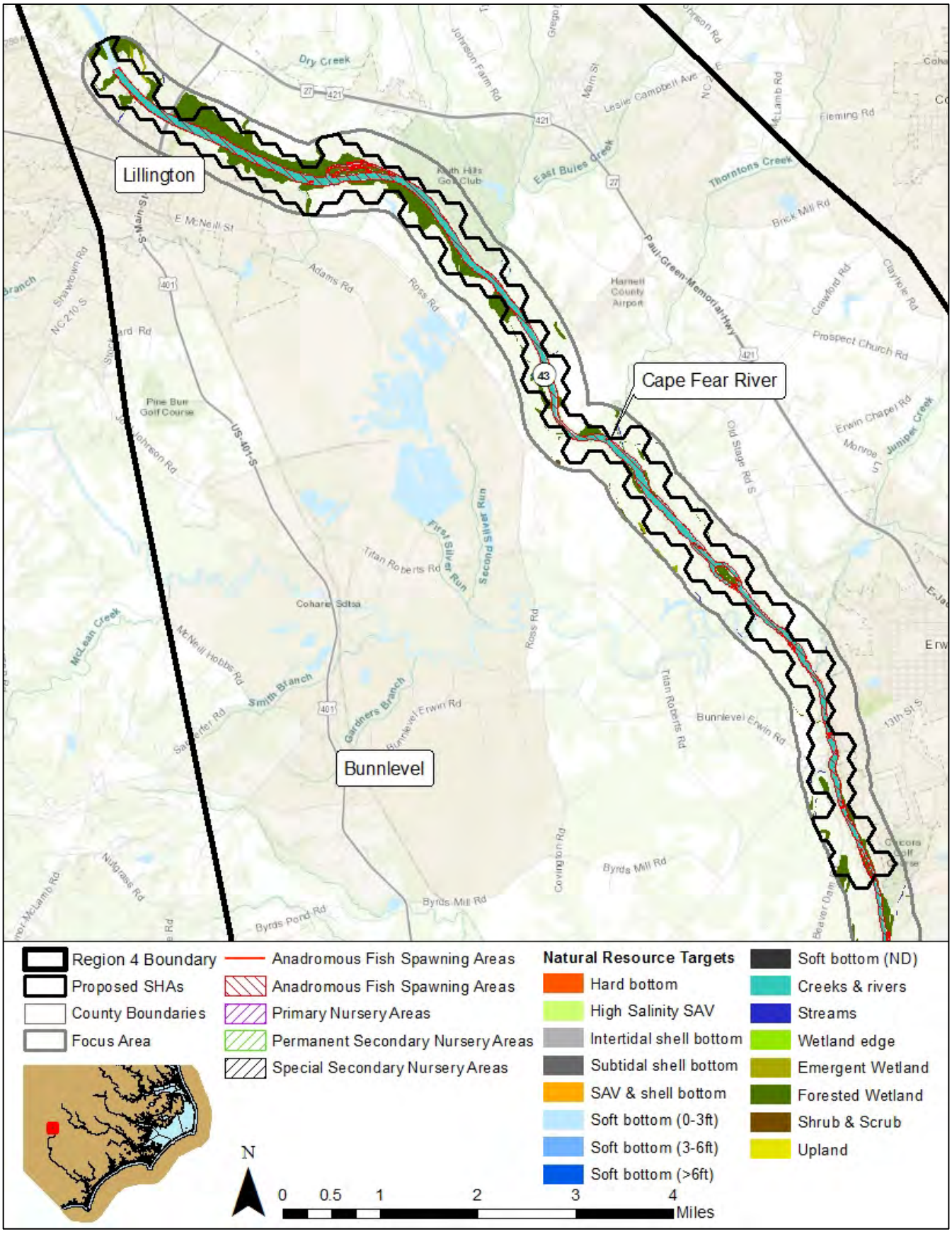
Map 31. Draft Strategic Habitat Area (SHA) nomination #40 – Cape Fear River near Kelly.



Map 32. Draft Strategic Habitat Area (SHA) nomination #41 – Cape Fear River below Elizabethtown.



Map 33. Draft Strategic Habitat Area (SHA) nomination #42 – Cape Fear River at Tarheel.



Map 34. Draft Strategic Habitat Area (SHA) nomination #43 – Cape Fear River at Lillington.

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8 APPENDIX A: NATURAL RESOURCE TARGETS AND CALCULATING TOTAL ALTERATION

Alteration scores are calculated for each hexagon and take into account the following factors:

1. **S**everity of an alteration factor/threat to each natural resource target (**S** rating).

2. **E**xtent that an alteration factor/threat affects each natural resource target (**E** rating)

3. **P**ortion of total natural resource targets in hexagon consisting of natural resource target X (**P** rating).

Severity (**S**) ratings in were based on the individual habitat ratings for each threat listed in the threats table of the Coastal Habitat Protection Plan (CHPP) (Street et al. 2005, p. 486) and approved by the Marine Fisheries Commission, Coastal Resources Commission, Environmental Management Commission, and N.C. Department of Environment and Natural Resources in 2004. This rating ranges from 0 (no impact) to 3 (high impact) and estimates the potential impact of each alteration factor on each natural resource target or habitat type in the assessment. For water-based alteration factors (i.e., trawling or dredging), the rating in the CHPP (Street et al. 2005, p. 486) was directly applied. For land-based alteration factors (i.e., developed land use or agricultural land cover), an adjusted **S** rating is applied to all hexagons within a U.S. Geological Survey-designated hydrologic unit (HU). This adjusted **S** rating scales the intensity of activity to the maximum occurring within the region. To do this, first the relative intensity of the alteration is computed for each HU within the region by dividing by the maximum value occurring in the region. These values are then multiplied by the severity ratings given in Table 3 of the main report to get the adjusted severity for each particular alteration factor and habitat combination in each hexagon.

An example is shown in Table A.1. For example, if the severity rating for agricultural land use on the submerged aquatic vegetation (SAV) natural resource target or habitat type is 2, and the hexagon lies within an HU with 40% cropland coverage and the maximum percent cover in the study area is 50% (resulting in an alteration intensity of 0.8), the resulting **S** rating for that hexagon would be 2 x 0.80 or 1.60 (Table A.1).

Table A.1. Example calculation of the adjusted **S** (severity) value for land-based factors.

HU	Hexagon	% Agricultural Land Use	Scaled Intensity	Adjusted S
1	A	0	0	2 x 0 or 0
1	B	0	0	2 x 0 or 0
1	C	0	0	2 x 0 or 0
2	D	40	0.8	2 x 0.8 or 1.60
3	E	50 (maximum)	1.0	2 x 1.0 or 2.0
3	F	50 (maximum)	1.0	2 x 1.0 or 2.0

Extent (**E**) ratings were determined by calculating the percent of the habitat within the hexagon that is affected by the factor. For water-based factors (i.e. dredging), the threat may only overlap

with a portion of the habitat present. For land-based alteration factors calculated at the HU level, the **E** rating is simply 1 (complete overlap) for hexagons fully within a hydrologic unit.

Portion (**P**) ratings are calculated as the number of acres for a particular natural resource targets divided by the total acres for all natural resource targets present within the hexagon of interest.

The total alteration of each habitat in a hexagon with one alteration factor is determined by multiplying S, E and P ratings: **Habitat X weight rating = S x E x P** (Figure **B-1**).

For example: a hexagon has one alteration factor – dredged channels, and contains 21 acres (70%) soft bottom and 9 acres of SAV (Figure A.1, Table A.2). Within the 9 acres of SAV, trawling is allowed over 0% (E=0.0). The S rating of dredging on SAV is 2 (moderate) and the portion of SAV among targets in the hexagon is 30% or 0.3. The final rating for SAV would be S (2) x E (0.0) x P (0.7) = 0.0. Within the 21 acres of soft bottom, dredging is allowed over 20% (E = 0.2). The portion (P) of the soft bottom among targets in the hexagon is 70% or 0.7. The S rating for dredging on soft bottom is 1. The final rating for soft bottom is S(1) x E(0.2) x P(0.7) = 0.14. The total alteration of the hexagon would be 0.14 (0.00 + 0.14).

Figure A-1. Diagram depicting how alteration weightings are applied within a hexagon containing multiple targets. Hexagon A contains 70% soft bottom, 30% SAV, and a dredged channel through soft bottom.

Table A.2. Calculation of hexagon alteration with only one alteration factor, but which occurs in some portion of two habitat types. S=severity, E=extent, P=portion

Hexagon	Natural Resource Target	Total area (acres)	$S^{dredging}$	$E^{dredging}$	P	SxExP	Total Weight
Hexagon A	SAV	9	2	0.0	0.30	0.00	0.14
	Soft Bottom	21	1	0.2	0.70	0.14	

When more than one alteration factor is present within a hexagon, the weight for each habitat (all factors) is determined by summing the S x E of each factor and multiplying by the percent of that habitat comprising the targets (P). The habitat alterations are summed to obtain one total alteration value for each cell (Table **A.3**).

Table A.3. Example of calculations to determine total alteration level of one hexagon with multiple alterations and habitats occur.

Factors		S x E			
		Shallow Soft Bottom	Soft Bottom (ND)	Wetland	Upland
HU-based Alterations (land-based alterations)	Animal Operations	0	0	0	0
	Shellfish Closures	0.73	0.02	0	0
	Major NPDES	0	0	0	0
	Minor NPDES	0	0	0	0
	Agricultural Land Use	0.06	0.06	0.06	0.06
	Developed Land Use	0.54	0.54	0.54	0.54
Area-based Alterations (water-based alterations)	Drained	0	0	2	0
	Canals and Boat Basins	1	0.23	0	0
	Bridge Constrictions	0	0	0	0
	Impounded	0	0	0	0
	Docks & Bridges	0	0	0	0
	Dredged	0	0	0	0
	Marinas	1.45	0.041	0	0
	Clam Harvest	0	0	0	0
	Trawl Opened	0	0	0	0
	Bulkhead	0	0	0	0
	Culvert	0	0	0	0
	Riprap	0	0	0	0
SUM		3.78	0.891	2.603	0.603
Fraction of Targets (P)		156.59 (0.07)	464.99 (0.21)	99.02 (0.045)	1495.81 (0.6748)
Sum x P		0.26	0.187	0.117	0.407
Total Alteration Score For Hexagon A					0.97

8.1 Processing Details

For the Region 4 analysis, the alteration calculations were completed using a combination of ArcGIS tools and R scripts. This approach was useful because it allowed the alteration scores to be quickly recalculated as changes were made throughout the SHA process. While the processing models and scripts are currently specific to the data found in this region, they could easily be adapted for the analyses in the following regions.

The process began by building a geodatabase of alteration data layers. Some manipulation was required to create the input layers for the alteration score. Tools were created using ArcGIS

ModelBuilder with ArcGIS version 10.3. ModelBuilder allows the user to combine multiple tools and then execute them as a single process. The benefit to this approach was that it made the process transparent and easy to repeat.

The first step in creating the alteration score is to create the alterations habitat dataset. This is stored in the field ALT_HABITA in the following steps. Below is a table showing the relationship between NRT types for Region 4 and the habitat types for alteration.

Table A.4. Habitat categories used to apply unique alteration ratings.

Natural Resource Targets	Alteration Habitat Type	GIS Layer Type	Notes
Hard Bottom	Hard Bottom	Polygon	Selected post-analysis by SHA AC.
High Salinity SAV	SAV	Polygon	
Low Salinity SAV			None within Region 4
Intertidal Shell Bottom	Shell Bottom	Polygon	
Subtidal Shell Bottom			
SAV & Shell Bottom	SAV & Shell Bottom	Polygon	
Riverine Soft Bottom (0-3ft)	Creeks and Rivers	Polygon	
Riverine Soft Bottom (3-6ft)			
Riverine Soft Bottom (ND)			
Estuarine Soft Bottom (0-3ft)	Shallow Soft Bottom	Polygon	
Palustrine Soft Bottom (0-3ft)			
Marine Soft Bottom (0-3ft)			
Estuarine Soft Bottom (3-6ft)			
Palustrine Soft Bottom (3-6ft)			
Marine Soft Bottom (3-6ft)			
Estuarine Soft Bottom (>6ft)			
Marine Soft Bottom (>6ft)			
Marine Soft Bottom (ND)	Deep Soft Bottom	Polygon	
Estuarine Soft Bottom (ND)			
Palustrine Soft Bottom (ND)	Soft Bottom (ND)	Polygon	
Emergent Wetlands			
Forested Wetlands			
Scrub/Shrub Wetlands			
Low Elevation Uplands	Wetlands	Polygon	
Streams (low elevation)			
Wetland Shoreline/Edge	Uplands	Polygon	
	Streams	Polygon	
	Wetland Edge	Polygon	

It is assumed that a dataset of NRT habitat types has the ALT_HABITA field populated before

the alteration score calculations can begin. Begin by dissolving the Natural Resource Target data layers by the ALT_HABITA field to get a feature class of alteration habitats. The following describes the tools provided in the alterations toolbox. It is divided into three toolsets, which are numbered and in all caps below. Tool names are in bold, under the corresponding toolset.

8.2 Data Processing

These are miscellaneous tools that were used to create some of the inputs to alteration factors. They can be reused if needed but are provided more for convenience.

8.2.1 Aggregate point features by HU

Assigns the frequency of a point feature to the corresponding hydrologic unit in a polygon feature class of hydrologic units. Needs a HU feature class and the point feature to aggregate. This tool allows the user to choose the field or fields to aggregate. The output file contains the frequency of these fields and is named to match the names of the input fields the tool aggregates.

8.2.2 Aggregate marinas by HU

Counts the number of slips at marinas in each hydrologic unit and joins the result to a shapefile of hydrologic units. A marina is defined as a facility with greater than 10 slips.

8.2.3 Calculate marinas per shoreline

Calculates the 'marinas per shoreline metric' by calculating the number of slips per linear unit of shoreline for each hydrologic unit and joining it to the hydrologic unit feature class. This tool uses the results of the previous tool (Aggregate marinas by HU) as inputs. The output has the number of slips per meter of shoreline in a HU in the field 'slips_per_m'.

8.3 Extent Calculations

These tools generate the extent files needed as the inputs for the R scripts. Outputs are saved as DBF tables and currently written to a folder called 'data'. Field maps are given below for all of the output tables. Currently, they are organized by the aspect of habitat they affect; therefore, there is a separate tool for land-based alterations, physical conversions, and water-based alterations. This was done for Regions 3 and 4 because in Region 2, it was thought that the alteration scores were calculated the same way for each group of alterations. This ended up not being true. In future versions, it might make sense to rearrange these into linear and polygon extent calculations for the purposes of the alteration score calculation.

8.3.1 Land-based Extent (Hydrologic Unit-based Alteration Assessment)

This tool takes the land-based alterations that need to be joined to a hydrologic unit file for the purpose of analysis and creates a master table of alterations by hydrologic unit. The alteration factors that are assessed at the hydrologic unit level are (1) minor national pollutant discharge elimination systems, (2) animal operations, (3) agricultural land use, and (4) developed land use. The tool also creates a table giving the amount of each hydrologic unit in each hexagon; which is used to calculate the land-based alteration scores for hexagons that cross hydrologic unit

boundaries.

INPUTS:

1. Each land-based alteration factor of interest, aggregated by the hydrologic unit. All of these are polygon feature classes.
2. Alteration habitats feature class
3. Hexagon boundaries, with a unique ID
4. Hydrologic unit boundaries with a unique ID

OUTPUTS:

1. **hu_alt_factors20170612.csv**: gives the amount of each alteration factor present by hydrologic unit

Field Name	Description
HU_12	USGS 12-digit hydrologic unit code.
hu_area	Area of hydrologic unit measures in square meters.
maj_NPDES	Number of major NPDES sites per hydrologic unit.
min_NPDES	Number of minor NPDES sites per hydrologic unit.
Cat_Swine_anops	Number of cattle and swine operations per hydrologic unit.
Poultry_anops	Number of poultry operations per hydrologic unit.
ag_use	Relativized proportion of agricultural land use per hydrologic unit.
dev_use	Relativized proportion of developed land per hydrologic unit.

2. **hu_by_hex20170612.csv:** calculates the areas of each hydrologic unit present within a given hexagon assessment unit (for all hexagon assessment units) and the max area of the hydrologic unit in each hexagon assessment unit. This is used to calculate scores for hexagons that cross hydrologic unit boundaries.

Field Name	Description
Unique_ID	Hexagon assessment unit unique identifier.
HU_12	USGS 12-digit hydrologic unit code.
hu_area	Total area of hydrologic unit measured in square meters.
hex_area	Area of hydrologic unit within each hexagon unit measured in square
MAX_HEX_AR	The maximum area of a given hydrologic unit within a single hexagon

3. **shellfish_by_hex20170612.dbf:** gives the area of each hexagon that is comprised of closed shellfish waters and the habitats that the closed areas intersect.

Field Name	Description
Unique_ID	Hexagon assessment unit unique identifier.
ALT_HABITA	Habitat type affected by alteration.
shell_area	Area, measured in square meters, of closed shellfish areas that intersect each

8.3.2 Water-based extent

This tool creates the habitat per hexagon and lines per hexagon tables that are used in all of the following R scripts.

INPUTS:

1. Polygon feature classes of the areas affected by water-based alteration factors:
    a. Drained wetland areas
    b. Dredged areas
    c. Impounded areas
    d. Canals and boat basins
    e. Bridge constrictions
    f. Docks and bridges
    g. Trawling
    h. Marinas assessed by shellfish growing areas (SGAs)
    i. Clam harvesting areas
    j. Seawalls
    k. Riprap
    l. Ditched areas
    m. Culvert obstructed areas
    n. Shellfish closures
2. Alteration habitats polygon feature classes
3. Hexagon assessment unit feature class

OUTPUTS:

1. **hab_alt_by_hex20170612.csv** - Each line represents a unique combination of hexagon assessment unit, habitat type, and alteration factor type. The output is a table that gives presence (1) or absence (0) of each alteration factor for each area described in the table. The field alt_area gives the area of each overlapping feature.

Field Name	Description
ALT_HABITA	Habitat type for alteration.
canal_bb	Identifies the alteration present. One (1) for presence and zero (0) for absence.
brdge_cons	
impounded	
docks_br	
dredged	
drained	
mar_SGA	
clam_harv	
culverts	
trawl_perm	
Unique_ID	Hexagon assessment unit unique identifier.

alt_area	Area of alteration factor and habitat overlap, measured in square meters.

2. **lines_by_hex_table20170612.csv** – gives a list of the linear feature types (wetland shoreline/edge, streams) found in each hexagon and the length of each feature within the hexagon, measured in meters.

Field Name	Description
Unique_ID	Hexagon assessment unit unique identifier.
ALT_HABITA	Linear habitat type for alteration.
length_new	Length, measured in meters, of each habitat type within each hexagon

3. **lines_by_ditch_by_hex20170612.csv –** Gives the proportion of linear habitat affected by ditching in each hexagon.

Field Name	Description
Unique_ID	Hexagon assessment unit unique identifier.
ALT_HABITA	Habitat type for alteration (linear features)
length_new	Length of habitat within hexagon unit, in meters.
ditched	Presence (1) or absence (0) of ditching.
ditch_le	Length of ditched segments, measured in meters.
prop_ditch	Proportion of habitat type, per hexagon, that is affected by ditching.

4. **seawalls_by_hex20170612.csv** – Gives the amount of seawalls in each hexagon.

Field Name	Description
ALT_HABITA	Linear alteration type.
Unique_ID	Hexagon assessment unit unique identifier.
wall_len	Length of the bulkhead (seawall), in meters.

5. **riprap_by_hex20170612.csv –** Gives the length of riprap in each hexagon and its associated linear habitat type affected.

Field Name	Description
Unique_ID	Hexagon assessment unit unique identifier.
ALT_HABITA	Linear habitat type.
riprap_le	Length of riprap affecting habitat within each hexagon, measured in

6. **streams_by_culvert_by_hex20170612.csv –** Gives the total length of streams within hexagons affected by culverts.

Field Name	Description
Unique_ID	Hexagon assessment unit unique identifier.
ALT_HABITA	Habitat type for alteration (only stream habitat type).

strm_leng	Length of stream habitat type per hexagon, measured in meters.

7. **shoreline_by_hex20170612.csv** – lists the shorelines found in each hexagon

Field Name	Description
ALT_HABITA	Linear alteration shoreline habitat type (wetland edge or non-wetland
Unique_ID	Hexagon assessment unit unique identifier.
shoreline	Length of shoreline in hexagon assessment unit, in meters.

8. **hab_by_hex20170612.csv –** Gives a table of habitat types and area (in square meters) within each hexagon assessment unit.

Field Name	Description
ALT_HABITA	Habitat type for alteration.
Unique_ID	Hexagon assessment unit unique identifier.
hab_area	Area of each habitat type within hexagon assessment unit.

8.3.3 R Tools for use in calculating alterations

These tools take the outputs of the previous steps (the steps performed in ArcGIS) and use them to combine the severity, extent, and portion into a complete alteration score for each hexagon. There are three separate scripts to calculate the severity by extent ratings: one each for the physical, water-based, and land-based alteration groups. The outputs from these scripts are then combined into the total alteration score in one final script (alteration scores.r). Input and output file locations are in the top portions of all scripts and can be easily changed to match where the data is stored. All scripts require a csv file of the severity ratings in order to calculate the severities for each alteration/habitat combination in each hexagon. This file gives the severity (0-3) for each alteration/habitat combination. Alterations and habitats that do not overlap are assigned a value of 0 for the purpose of calculating the scores. Column names are alteration factors and row names are alteration habitat types.

Names are case sensitive and must match those that are in the output tables from the Arc scripts. Columns do not have to be in any particular order; the scripts will select the correct ones.

Each script file has two sections: a top section labeled “INPUTS” and a lower portion labeled “CALCULATIONS. In order to use these for different files, it will be necessary to open them and change the directories listed under the inputs section to match the correct file locations. The working directory needs to be set to the alteration folder. All files except for the csv of habitat severities are outputs of the ArcGIS tools described in the previous sections. Each input section contains a list of the alterations included in each script. In order to add other alterations in future analyses, these lists would need to be amended with the field names of the new alterations. Corresponding columns would need to be added to the alterations by habitat tables giving the extent of each alteration in each hydrologic unit or hexagon and consistent with their current format. In addition, the severity for new alterations would need to be added to the alteration severity file.

8.3.3.1 Water Based Severity Extent Calculation.r

Input files:

1. Table listing the overlapping area-based alterations and habitat combinations per hexagon with the following fields (**hab_alt_by_hex20170612.csv**):
    a. **ALT_HABITA** – alteration habitat type, must be one of the following: "*creeks and rivers*", "*deep soft bottom*", "*shallow soft bottom*", "*SAV and shell bottom*", "*SAV*" , "*shell bottom*", "*soft bottom (ND)", "upland*", "*wetland*".
    b. **Unique_ID** – unique hexagon assessment unit identifier.
    c. **alt_area** – area of habitat intersection by the alteration factor in each hexagon.
    d. Fields for any polygon based alterations considered. Currently, they include the following: "*canal_bb*", "*brdge_cons*", "i*mpounded*", "*docks_br*", "*dredged*", "*drained*", "*marinas*", "*major_npdes*", "*trawl"*
        i. Each row gives the presence/absence (1/0) of one specific factor for each hexagon.
        ii. Each hexagon has multiple rows, one for each habitat type x factor combination.
2. Table listing the overlapping line-based alterations and linear habitat combinations per hexagon with the following fields **(alt_lines_by_hex20170612.csv)**:
    a. **ALT_HABITA** – alteration habitat type, must be one of the following: "S*tream" and "Wetland Edge"*.
    b. **Unique_ID** – unique hexagon assessment unit identifier.
    c. **alt_length** – area of habitat intersection by the alteration factor in each hexagon.
    d. Fields for any linear-based alterations considered. Currently, they include the following: "*canal_bb*", "*brdge_cons*", "i*mpounded*", "*docks_br*", "*dredged*", "*drained*", "*marinas*", "*major_npdes*", "*trawl*".
        i. Each row gives the presence/absence (1/0) of one specific factor for each hexagon.
        ii. Each hexagon has multiple rows, one for each habitat type x factor combination.
3. Table giving amount of each polygon habitat in each hexagon with the following fields (**hab_by_hex20170612.csv**):
    a. **ALT_HABITA** – alteration habitat type.
    b. **Unique_ID** – unique hexagon identifier.
    c. **hab_area** – total area of particular habitat type within a hexagon.
4. Table giving amount of each linear habitat in each hexagon with the following fields (**lines_by_hex20170612.csv**):
    a. **ALT_HABITA** – alteration habitat type.
    b. **Unique_ID** – unique hexagon identifier.
    c. **length_new** – total area of particular habitat type within a hexagon.
5. Alteration severity table (**alteration_factor_weighting_water20170515.csv**):
    a. **ALT_HABITA** – habitat types (rows).
    b. Alteration list – must match names exactly as they appear in the R alteration file (columns).
6. Seawalls by hexagon (**seawalls_by_hex20170612.csv**):
    a. **ALT_HABITA** –linear habitat types for alteration (wetland and non-wetland shoreline).
    b. **Unique_ID** – hexagon assessment unit unique identifier.

   c. **wall_len** – length of seawall in hexagon.
7. Length of streams with an amount ditched attribute (**lines_by_ditched_by_hex20170612.csv**). Necessary attributes:
   a. **Unique_ID** – hexagon assessment unit unique identifier.
   b. **ALT_HABITA** – linear habitat type for alteration (streams only).
   c. **ditch_le** – total length of ditched feature within each hexagon, measured in meters.
   d. **prop_ditched** – proportion of total stream length that is ditched.
   e. **length_new** – total amount of linear habitat type within each hexagon, measured in meters.
8. Length of streams with an attribute signifying the amount affected by culverts (**streams_by_culvert_by_hex20170612.csv**). Necessary attributes:
   a. **Unique_ID** – hexagon assessment unit unique identifier.
   b. **ALT_HABITA** – habitat type for alteration (streams only).
   c. **culv_len** – length of culvert-affected features, measured in meters.
9. Length of shoreline affected by riprap (**riprap_by_hex20170612.csv**). Necessary attributes:
   a. **Unique_ID** – hexagon assessment unit unique identifier.
   b. **ALT_HABITA** – habitat type for alteration (non-wetland shoreline only).
   c. **riprap_le** – length of riprap-affected shoreline, measured in meters.

Output files:

1. Severity multiplied by extent for all water based factors for each hexagon, in dbf and csv form:
   a. **WBSE_20170612.csv**
   b. **WBSE_20170612.dbf**

8.3.3.2 Land Based Severity Extent Calculations.r

Input files:

1. Table of factors for each hydrologic unit (**hu_alt_factors_table20170612.dbf**):
   a. **HU_12** – US Geological survey hydrologic unit code.
   b. **hu_area** – area of hydrologic unit in meters squared.
   c. *Scaled* values for the affected amount for each hydrologic unit:
      i. **min_npdes** – number of sites per hydrologic unit (includes aquaculture facilities) divided by the maximum number of sites in a hydrologic unit to create a scaled ratio.
      ii. **Cat_Swine_anops** – Number of cattle and swine operations per hydrologic unit divided by the maximum number of sites in a hydrologic unit to create a scaled ratio.
      iii. **Poultry_anops** – Number of poultry operations per hydrologic unit divided by the maximum number of sites in a hydrologic unit to create a scaled ratio.
      iv. **dev_use** – proportion of area of each hydrologic unit in the developed land use class.
      v. **ag_use** – proportion of area of each hydrologic unit in the agricultural land use class.

2. Table giving amount of each polygon habitat in each hexagon (**hab_by_hex20170612.csv**). The necessary attributes include:
    a. **ALT_HABITA** – polygon habitat type for alteration.
    b. **Unique_ID** – hexagon assessment unit unique identifier.
    c. **hab_area** – area of habitat in meters squared.
3. Table identifying which hydrologic unit a hexagon is in (if a hexagon has more than one hydrologic unit it will have more than one line) (**hu_by_hex20170612.csv**):
    a. **Unique_ID** – hexagon assessment unit unique identifier.
    b. **HU_12** – US Geological Survey hydrologic unit code.
    c. **hu_area** – area of each hydrologic unit.
    d. **hex_area** – area of each hexagon assessment unit unique identifier.
    e. **FREQUENCY**- number of HU's a hexagon intersects.
    f. **MAX_HEX_AR –** maximum area of hexagon in one hydrologic unit.
4. Alteration severity table (**alteration_factor_weighting_land20170515.csv**)
    a. **ALT_HABITA** – habitat types (rows).
    b. Alteration list – must match names exactly as they appear in the R alteration file (columns).
5. Intersection of closed shellfish areas with habitats in the study area (**shellfish_by_hex20170612.csv**). Necessary attributes.
    a. **ALT_HABITA** – alteration habitat type.
    b. **Unique_ID** – hexagon assessment unit unique identifier.
    c. **shell_area** – area of overlap between closed shellfish areas and alteration habitat types.

Output file:

1. **lbse_20170612.csv**
2. **lbse_20170612.dbf**

8.3.3.3 Alteration Scores.r

Combines the outputs of the previous scripts into a final alteration score file.

Inputs:

1. Severity by extent for water-based alterations (**wbse_20170612.csv**)
2. Severity by extent for land-based alterations (**lbse_20170612.csv**).
   Note: this is already aggregated so that there's one row per hexagon whereas the other severity by extent file is not.
3. Table giving amount of each polygon habitat in each hexagon (**hab_by_hex_table_no_marine.csv**)
    a. **ALT_HABITA** – alteration habitat type
    b. **Unique_ID** – hexagon assessment unit unique identifier
    c. **hab_area** – area of habitat features, measured in meters squared
4. Length of lines in each hexagon (**lines_by_hex_table.csv**)
    a. **ALT_HABITA** – linear habitat type for alteration
    b. **Unique_ID** – hexagon assessment unit unique identifier

c. **length_new** – length of feature, in meters

Outputs:

1. **AltScore_by_Hex20170613.csv** - combined alteration scores for all hexagons. Attributes:
   a. **ID** – hexagon assessment unit unique identifier.
   b. **R4_alt_score** – alteration score
2. **hab_scores20170612.csv** – alteration scores broken down by habitat type per hexagon. One line per hexagon gives the severity * extent * portion for each habitat type in each hexagon.
3. **ind_scores_20170612.csv** - alteration scores broken down by alteration factor by hexagon. One line per hexagon gives the severity * extent * portion for each alteration factor for each hexagon.

9 APPENDIX B: PREPARING THE MARXAN FILES

The Marxan documentation and good practices handbook are both comprehensive and can assist in designing and carrying out an analysis. As the documentation is quite thorough, the intent of this appendix is to give specific details about this analysis and not a complete set of instructions for using Marxan. For this analysis, the program was used in its stand-alone form and the input files prepared using ArcGIS, Excel and R. User interfaces such as Zonae Cogito (Watts et al.) are available for users that are less familiar with ArcGIS.

Marxan version 2.4.3 was used for this analysis. There is currently no official user's manual for this version and some differences exist between it and the previous versions. The accompanying README text file explains the major changes. The biggest difference is in the format of the species vs. planning unit file and is described below. Formatting of the input files seems consistent with the formats described in the Marxan with zones handbook (Watts et al. 2008), which was used to cross-reference formatting questions.

Marxan requires four data files and an input file in order to run. They are all text files (either tab or comma delimited) that have been renamed with the extension .dat. The file names can be changed but they must have the correct extension for Marxan to work properly. There are a specific set of column names that are required for each file. They must be present and match the descriptions given in the handbook in order for Marxan to read the input files.

9.1 Species File (spec.dat)

This contains information on all conservation features in the analysis. It assigns each conservation feature (NRT) a unique numerical id, which is uses to relate to the other Marxan input files, and gives the target amounts (or proportion) for each conservation feature in the final solution, and assigns each conservation feature a species protection factor. In addition, it can contain a name for each conservation feature. For Region 4, this was made in Excel and exported to a csv.

Example species file:

id	target	name	spf
1	0	Emergent_wetland	100
2	2796820	Est_soft_bottom_deep	100
3	14916712	Est_soft_bottom_shallow	100
4	2838143	Est_soft_bottom_mid	100
5	0	Est_soft_bottom_ND	100
6	71188072	Forested_wet	100

9.2 Planning Units File (pu.dat)

This is a list giving the planning units in the study area, their cost, and their status. Alteration score was used as the cost. We assigned planning units defined as inlets to have a status of '2', which means they must be included in the final solution. Other options for status are to include a planning unit in the initial solution, or to exclude a planning unit from the final solution. This was created in ArcGIS by joining the alteration score to the planning unit shapefile and exported to a csv.

Example planning unit file:

id	cost	status
1	2.000000	0
2	5.490000	0
3	2.000000	0
4	2.000000	0
5	2.000000	0
6	1.000000	0
7	1.900000	0
9	1.000000	0
10	1.000000	0

9.3 Boundary Tile (bound.dat)

The boundary file gives the length of the boundary between adjacent files. It is in the format of id1, id2, and amount. For the Region 4 analysis it was created in ArcGIS, using the tool 'Make Boundary file' in the SHA tools toolbox. This tool requires a layer file of the planning units as an input. The input layer file must have a field called 'MarxID' and the workspace should be set to the default geodatabase. The tool outputs a DBF file, which can be converted to a csv using Excel.

Example boundary file:

id1	id2	boundary
1	14650	225.000073
1	14651	225.000000
1	14861	225.000000
2	9281	225.000000
2	9339	225.000000
2	9340	224.99998
3	7745	225.000000
3	8011	225.000000

9.4 Planning Units vs. Species File (puvspr.dat)

This file gives the amount of each conservation feature in each planning unit. Marxan version 2.4.3 differs from previous Marxan in that it will only read the long format, where each combination of planning unit and conservation feature is in a separate row. Previous versions of Marxan were configured to accept this table in the wide format, where each planning unit was a row and the conservation features were the columns. The Marxan software comes with a utility (convert_mtx.exe) to convert records from the long to wide format and vice versa. The file needs to be ordered by the planning unit, and then species ID. This file was made in ArcGIS by intersecting the planning unit with the polygon habitat shapefiles (R4_NRTs). These three tables were exported as DBFs, concatenated and then sorted by planning unit and then species in Excel.

Example planning unit vs species file.

Species	pu	amount
10	1	131527.61
3	2	13031.22
7	2	560.42
10	2	5995.63
11	2	16166.99
12	2	8248.68
13	2	7.25
25	2	13798

9.5 The Input File (input.dat)

Sets the Marxan specifications for the analysis. Marxan comes with an executable called InEdit.exe. that guides the user through all of the Marxan options and generates the input file.

9.6 Marxan Resources:

Watts, M. E., R.R. Stewart, D. Segan, L. Kircher: Using the Zonae Cogito Decision Support System, a Manual.

Ball, I. R., H. P. Possingham, and M. Watts. 2009. Marxan and relatives: software for spatial conservation prioritisation. Pages 185-195 *in* A. Moilanen, K. A. Wilson, and H. P. Possingham, editors. Spatial conservation prioritisation: quantitative methods and computational tools. Oxford University Press, Oxford, United Kingdom.

Ball, I.R., and H.P. Possingham, 2000. MARXAN (V1.8.2): Marine Reserve Design Using Spatially Explicit Annealing, a Manual.

Game, E.T. and H.S. Grantham, 2008. Marxan User Manual: For Marxan version 1.8.10. University of Queensland, St. Lucia, Queensland, Australia, and Pacific Marine Analysis and Research Association, Vancouver, British Columbia, Canada.

Watts, M.E., C.K. Klein, R. R. Stewart, I. R. Ball, and H. P. Possingham. 2008. Marxan with Zones (V1.0.1): Conservation Zoning using Spatially Explicit Annealing, a Manual.

10 APPENDIX C: DATA/INFORMATION DIRECTORY

Region 4 SHA Natural Resource Target and Alteration Factor GIS models and files:

See Appendix A: Natural Resource Targets and Calculating Total Alteration Section 8.1 Processing Details for further details.

S:\HABITAT\CHPP\SHA\Region 4\GIS\

Models\
1. SHA R4.tbx
2. Final Alteration Tools.tbx

Inputs\AlterationFactors\Finals
1. R4_Bridges.shp
2. R4_Bulkheads_RipRap_Final.shp
3. R4_CAFOsbyHUC.shp
4. R4_CAFOsbyHUC_Poultry.shp
5. R4_Canals_Boat_Basins.shp
6. R4_CCAP_2010_AgHUC_Final.shp
7. R4_CCAP_2010_DevHUC_Final.shp
8. R4_Culverts.shp
9. R4_Dams.shp
10. R4_Ditched_Final.shp
11. R4_DocksandPiers.shp
12. R4_DredgedChannels.shp
13. R4_Major_NPDES_HUC.shp
14. R4_Marinas_SGA_Closures.shp
15. R4_Mechanical_clam_harvesting_areas.shp
16. R4_Minor_NPDES_HUC.shp
17. R4_ProhibitedShellfishHarvest.shp
18. R4_Trawling_allowed

Inputs\Boundaries
1. Region4.shp
2. R4_USGS_HUCs
3. R4_trip_ticket_water_bodies.shp
4. R4_Hex20170615.shp
5. R4_A24k_jurisditional_waters.shp
6. R4_500m_FocusArea.shp
7. R4_Hexagons225SL_FocusArea.shp

Inputs\NRTs\Finals
1. ALT_HABITA_Poly20170508.shp
2. NRT_by_Hex20170619.shp
3. R4_ContiguousWetlands_W_FA.shp

4. R4_HardBottom_Final.shp
5. R4_NRTs_20170619.shp
6. R4_SAV_Final.shp
7. R4_SAV_ShellBottom_Final.shp
8. R4_ShellBottom_Final.shp
9. R4_Streams_Final.shp
10. R4_WetlandEdge_Final.shp
11. R4_WetlandEdge_w_FA.shp
12. StreamsUplandRiparian.shp

Region 4 SHA R script input/output files:

See Appendix A: Natural Resource Targets and Calculating Total Alteration Section 8.3 Extent Calculations for further details.

S:\HABITAT\CHPP\SHA\Region 4\GIS\Data

1. alt_lines_by_hex20170612.csv
2. alt_scores_20170612.csv
3. alteration_factor_weighting_land20170515.csv
4. alteration_factor_weighting_water20170515.csv
5. hab_alt_by_hex20170612.csv
6. hab_by_hex20170612.csv
7. hab_scores20170612.csv
8. hu_alt_factors_table20170508.csv
9. hu_by_hex20170612.csv
10. ind_scores_20170612.csv
11. LBSE_20170612.csv
12. lines_by_ditch_by_hex20170612.csv
13. lines_by_hex20170612.csv
14. NRT_by_hex20170613.csv
15. riprap_by_hex20170612.csv
16. seawalls_by_hex20170612.csv
17. shellfish_by_hex20170612.csv
18. shoreline_by_hex20170612.csv
19. streams_by_culvert_by_hex20170612.csv
20. WBSE_20170612.csv

Region 4 SHA R script files:

S:\HABITAT\CHPP\SHA\Region 4\GIS\R Scripts

1. alteration scores final_20170405.r
2. water based severity extent calculations_final.r
3. land based severity extent calculations_20170421.r
4. output_processing.r

Region 4 SHA Marxan files:

See Section 9 Appendix B: Preparing the Marxan files for further details.

S:\HABITAT\CHPP\SHA\Region 4\GIS\Marxan2.4.3

1. Marxan.exe
2. Inedit.exe
3. Input.dat

\input

1. Bound.dat
2. Pu.dat
3. Puvspr.dat
4. Spec.dat

11 APPENDIX D: PUBLIC COMMENT

To be completed after public comment

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
STEPHEN W. MURPHEY
Director

May 17, 2018

MEMORANDUM

TO: Marine Fisheries Commission

FROM: Catherine Blum, Fishery Management Plan and Rulemaking Coordinator
Fisheries Management Section

SUBJECT: Rulemaking Update

This memo describes the materials about the rulemaking update for the May 2018 commission meeting. In accordance with requirements of G.S. 150B-21.3A, Periodic Review and Expiration of Existing Rules, the commission is scheduled to vote on approval to begin the rule readoption process for a portion of rules in 15A NCAC 03. This includes approval of the proposed text of the rules and the fiscal analysis of the rules, as approved by the Office of State Budget and Management. Background information is provided here, including recent actions that have occurred, followed by a summary of items scheduled for the commission to take action on at this meeting.

Additional handouts are provided in your briefing book, including figures showing the steps in the commission's 2018-2019 annual rulemaking cycle and the associated rules prepared for the readoption process. The approved fiscal analyses are also provided and each of these documents contains an appendix with the text of the corresponding proposed rules.

Background on the Periodic Review and Expiration of Existing Rules

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 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, followed by the readoption of rules. An evaluation of the rules under the authority of the Marine Fisheries Commission is being undertaken in two lots (see Figure 1.) A report on the rules in Title 15A, Environmental Quality, Chapter 03, Marine Fisheries was due to the Rules Review Commission December 2017. A report on the rules in Chapter 18, Environmental Health, for portions of Subchapter A that govern shellfish sanitation and recreational water quality is due January 2019. The Marine Fisheries Commission has 211 rules in Chapter 03 and 164 rules in Chapter 18A. The Marine Fisheries Commission is the body with the authority for the approval steps prescribed in the process for these rules.

Figure 1. Marine Fisheries Commission schedule to comply with G.S. 150B-21.3A, Periodic Review and Expiration of Existing Rules.

Rules	2017	2018	2019	2020	2021	2022
Chapter 03 (211 rules)	Report	Rule Readoption				
Chapter 18A (164 rules)		Report	Rule Readoption			

The process began for the Marine Fisheries Commission at its February 2017 business meeting with approval of the draft report on the rules in Title 15A, Environmental Quality, Chapter 03, Marine Fisheries. This report contained 211 rules and was reviewed by the Rules Review Commission December 2017.

Nine of these 211 rules are jointly adopted by the Marine Fisheries Commission and the Wildlife Resources Commission. The rules are subtitled "Jurisdiction of Agencies: Classification of Waters" and are found in 15A NCAC 03Q .0100. Similarly, the Wildlife Resources Commission has 11 rules that are jointly adopted and have the same subtitle; they are found in 15A NCAC 10C .0100. For the required steps in the periodic review process, both agencies must approve both sets of rules, since the rules were all jointly adopted. The approvals for the draft report on these rules occurred at the Marine Fisheries Commission's February and May 2017 business meetings and the Wildlife Resources Commission's April 2017 meeting.

For the reports, the first step is for each agency to make a determination as to whether each rule is necessary with substantive public interest, necessary without substantive public interest, or unnecessary. After the draft reports are approved, they are posted on the Division of Marine Fisheries website for public comment for a minimum of 60 days. It is important to note, for the purposes of these requirements, "public comment" means written comments from the public objecting to the rule. The agency must review the public comments and prepare a brief response addressing the merits of each comment. This information becomes the final report.

The final report for rules in 15A NCAC 03Q .0100 and the final report for all other rules in 15A NCAC 03 were reviewed and approved by the Rules Review Commission at its December 2017 meeting. The reports were forwarded to the Joint Legislative Administrative Procedure Oversight Committee for final determination. The committee met Jan. 9, 2018 and the review process was completed for these rules.

The second part of the periodic review process is the readoption of rules; this is scheduled to begin for the Marine Fisheries Commission May 2018. The final report determines the process for readoption. Rules determined to be necessary and without substantive public interest and for which no public comment was received remain in effect without further action. Rules determined

Nothing Compares
State of North Carolina | Division of Marine Fisheries
3441 Arendell Street | P.O. Box 769 | Morehead City, North Carolina 28557
252-726-7021

to be unnecessary and for which no public comment was received expire on the first day of the month following the date the report becomes effective. Rules determined to be necessary with substantive public interest must be readopted as though the rules were new rules. The Rules Review Commission works with each agency to consider the agency's rulemaking priorities in establishing a deadline for the readoption of rules.

The final determinations for the rules in 15A NCAC 03Q .0100 and all other rules in 15A NCAC 03 were unchanged from how they were submitted. As a result, three rules were determined to be unnecessary and expired, 36 rules were determined to be necessary without substantive public interest and remained in effect without further action, and 172 rules were determined to be necessary with substantive public interest and must be readopted as though they were new rules. The next step in the process is to set a readoption schedule.

Recent Actions for the Periodic Review and Expiration of Existing Rules

Readoption Schedule for 15A NCAC 03 Rules

The process of rule readoption is scheduled to begin at the Marine Fisheries Commission's May 2018 business meeting. Given the large number of rules subject to readoption, this will be the first of several years proposed to readopt rules. In preparation for the May meeting, staff prepared a readoption schedule for the 15A NCAC 03 rules. At its February 2018 meeting, the commission approved the schedule for readoption of these rules to be completed by June 30, 2022. To achieve this, staff will prepare approximately 40 to 45 rules in 15A NCAC 03 for readoption in each of four years. For the 2018-2019 rule package, the proposed rules have been recently amended and/or need only technical changes. The rules have no anticipated costs associated with them and will benefit stakeholders with increased clarity and consistency across rules. The rules are intended to become effective April 1, 2019.

The proposed readoption schedule, as approved by the Marine Fisheries Commission, was submitted to the Rules Review Commission for approval. Due to the nature of the jointly-adopted rules of the Marine Fisheries Commission and the Wildlife Resources Commission, the Wildlife Resources Commission is also part of the process of approving the readoption schedule, as shown by its April 2018 meeting agenda. The readoption schedule is slated for approval by the Rules Review Commission at its May 2018 meeting. The schedule must be approved by the Rules Review Commission prior to publication of proposed rules in the *N.C. Register*. The Marine Fisheries Commission can take action to begin the rulemaking process at its May 2018 business meeting.

Draft Report on 15A NCAC 18A Rules

At its February 2018 meeting, the Marine Fisheries Commission gave approval to begin the report process for the 164 rules in 15A NCAC 18A .0100, .0300-.0900, and .3400, regarding shellfish sanitation and recreational water quality requirements. All rules were classified as necessary with substantive public interest and are subject to readoption. The process will follow the same timing that occurred in 2017 for the previous rule reports. A public comment period is being held for the rules in 15A NCAC 18A .0100, .0300-.0900, and .3400 from Feb. 26-May

7, 2018; no public comments have been received to date. If public comments are received, staff will review the public comments and prepare a brief response addressing the merits of each comment. This information becomes the final report. The final report will be presented to the Marine Fisheries Commission at its August 2018 meeting and is due to the Rules Review Commission by January 2019.

2018/2019 Notice of Text for Rulemaking to Readopt Rules per G.S. 150B-21.3A
In accordance with requirements of G.S. 150B-21.3A, Periodic Review and Expiration of Existing Rules, the commission is scheduled to vote on approval to begin the rule readoption process for a portion of rules in 15A NCAC 03. This includes approval of the proposed text of the rules and the fiscal analysis of the rules, as approved by the Office of State Budget and Management. The rules have an intended effective date of April 1, 2019.

Associated handouts are provided in your briefing book, including two figures. The first figure shows the steps in the commission's 2018-2019 annual rulemaking cycle and the second provides a list of the associated rules prepared for the readoption process in this first of four years. The two approved fiscal analyses are also provided and each of these documents contains an appendix with the text of the corresponding proposed rules. Although G.S. 150B-21.3A(d) exempts an agency from the requirement to prepare a fiscal note for a rule that is readopted without substantive change, the Marine Fisheries Commission's rules remain subject to the requirements of Section 2 of Executive Order 70 under Governor Perdue. These requirements include that an agency "shall quantify the costs and benefits to all parties of a rule to the greatest extent possible. The level of analysis shall be proportional to the significance of the rule."

The first fiscal analysis is entitled "Conforming Changes to For-Hire Licenses" and addresses proposed changes to 15A NCAC 03O .0112. These changes amend the rule to conform to changes that previously occurred in an authorizing statute. Session Law 2013-360 made statutory changes to the way for-hire licenses are structured, creating three new licenses. This law also required certain for-hire operations to obtain a Commercial Fishing Vessel Registration with a for-hire endorsement for their vessel. Updating the rule will provide consistency with rules and statutes pertaining to for-hire licenses as well as provide clarity for affected stakeholders.

The second analysis is entitled "Readoption of a Portion of Rules in 15A NCAC 03I, 03J, 03K, 03L, 03M, 03O, and 03R" and addresses amendments that are of an administrative nature to update rules. The rules have no anticipated costs associated with them and will benefit stakeholders with increased clarity and consistency across rules. Amendments include deleting two obsolete permits (Albemarle Sound Management Area for River Herring Dealer Permit; Permit to Waive the Requirement to use Turtle Excluder Devices in the Atlantic Ocean), alphabetizing permits, and making other conforming and minor technical changes.

Staff recommends the commission approve the following proposed rules and associated fiscal analyses for Notice of Text for Rulemaking to readopt rules per G.S. 150B-21.3A, Periodic Review and Expiration of Existing Rules:

- Conforming Changes to For-Hire Licenses, 15A NCAC 03O .0112; and
- Readoption of a Portion of Rules in 15A NCAC 03I, 03J, 03K, 03L, 03M, 03O, and 03R.

N.C. Marine Fisheries Commission
2018-2019 Annual Rulemaking Cycle

May 2018

Time of Year	Action
January 2018	Last opportunity for a new issue to be presented to DMF Rules Advisory Team
February 2018	Second review by DMF Rules Advisory Team
February-April 2018	Fiscal analysis of rules prepared by DMF staff and approved by Office of State Budget and Management
May 2018	MFC considers approval of Notice of Text for Rulemaking
August 2018	Publication of proposed rules in the North Carolina Register
September 2018	Public hearing(s) held
November 2018	MFC considers approval of permanent rules
January 2019	Rules reviewed by Office of Administrative Hearings Rules Review Commission
(January)	(Last opportunity for a new issue to be presented to DMF Rules Advisory Team)
(February)	(Second review by DMF Rules Advisory Team)
February 1, 2019	Earliest possible effective date of rules
February/March 2019	Rulebook prepared
April 1, 2019	Actual effective date of new rules
April 1, 2019	Rulebook available online
April 15, 2019	Commercial license sales begin

Proposed Readoption Schedule for 15A NCAC 03
Year 1 of 4: 2018-2019 (41 rules)
May 1, 2018

Rule Citation	Rule Name
15A NCAC 03I .0120	POSSESSION OR TRANSPORTATION LIMITS
15A NCAC 03J .0101	FIXED OR STATIONARY NETS
15A NCAC 03J .0102	NETS OR NET STAKES
15A NCAC 03J .0108	NETS PULLED BY MORE THAN ONE BOAT
15A NCAC 03J .0203	CHOWAN RIVER AND ITS TRIBUTARIES
15A NCAC 03J .0204	CURRITUCK SOUND AND ITS TRIBUTARIES
15A NCAC 03J .0206	SOUTHPORT BOAT HARBOR
15A NCAC 03J .0207	DUKE ENERGY PROGRESS BRUNSWICK NUCLEAR PLANT INTAKE CANAL
15A NCAC 03J .0209	ALBEMARLE SOUND/CHOWAN RIVER RIVER HERRING MANAGEMENT AREAS
15A NCAC 03J .0303	DREDGES AND MECHANICAL METHODS PROHIBITED
15A NCAC 03J .0304	ELECTRICAL FISHING DEVICE
15A NCAC 03K .0402	SEASON, SIZE AND HARVEST LIMITS
15A NCAC 03K .0403	DISPOSITION OF MEATS
15A NCAC 03K .0404	DREDGES/MECHANICAL METHODS PROHIBITED AND OPEN SEASON
15A NCAC 03K .0405	OYSTERS, MUSSELS, HARD CLAMS PROHIBITED
15A NCAC 03K .0501	BAY SCALLOP HARVEST MANAGEMENT
15A NCAC 03K .0502	TAKING BAY SCALLOPS AT NIGHT AND ON WEEKENDS
15A NCAC 03K .0503	PROHIBITED BAY SCALLOP DREDGE
15A NCAC 03K .0504	CALICO SCALLOP SEASON
15A NCAC 03K .0507	MARKETING SCALLOPS TAKEN FROM SHELLFISH LEASES OR FRANCHISES
15A NCAC 03K .0508	SCALLOP SEASON AND HARVEST LIMIT EXEMPTIONS
15A NCAC 03L .0208	STONE CRABS (MENIPPE MERCENARIA)
15A NCAC 03M .0101	MUTILATED FINFISH
15A NCAC 03M .0102	UNMARKETABLE FINFISH
15A NCAC 03M .0103	MINIMUM SIZE LIMITS
15A NCAC 03M .0501	RED DRUM
15A NCAC 03M .0502	MULLET
15A NCAC 03M .0506	SNAPPER-GROUPER COMPLEX
15A NCAC 03M .0507	BILLFISH
15A NCAC 03M .0510	AMERICAN EEL
15A NCAC 03M .0513	RIVER HERRING
15A NCAC 03M .0515	DOLPHIN
15A NCAC 03M .0517	WAHOO
15A NCAC 03M .0518	KINGFISH (SEA MULLET)
15A NCAC 03M .0520	TUNA
15A NCAC 03M .0521	SHEEPSHEAD
15A NCAC 03O .0106	DISPLAY OF LICENSES AND REGISTRATIONS
15A NCAC 03O .0112	FOR HIRE COASTAL RECREATIONAL FISHING *
15A NCAC 03O .0501	PROCEDURES AND REQUIREMENTS TO OBTAIN PERMITS
15A NCAC 03O .0503	PERMIT CONDITIONS; SPECIFIC
15A NCAC 03R .0112	ATTENDED GILL NET AREAS

* See “Regulatory Impact Analysis of Proposed Rule 15A NCAC 03O .0112 Conforming Changes to For-Hire Licenses”. All other rules are addressed by “Regulatory Impact Analysis for Readoption of a Portion of Rules in 15A NCAC 03I, 03J, 03K, 03L, 03M, 03O, and 03R”.

Regulatory Impact Analysis of Proposed Rule 15A NCAC 03O. 0112

Conforming Changes to For-Hire Licenses

Rule Amendments: 15A NCAC 03O .0112

Name of Commission: N.C. Marine Fisheries Commission

Agency Contact: Adam Stemle, Fisheries Economics Program Manager
N.C. Division of Marine Fisheries
3441 Arendell Street
Morehead City, NC 28557
(252) 808-8107
adam.stemle@ncdenr.gov

Impact Summary:
State government: No
Local government: No
Federal government: No
Substantial impact: No

Authority:

North Carolina Marine Fisheries Commission Rules May 1, 2015
(see Appendix I)
15A NCAC 03O. 0112 For-Hire Coastal Recreational Fishing

North Carolina Session Laws (see Appendix II)
North Carolina Session Law 2006-255, Section 7
North Carolina Session Law 2006-259, Section 20.5
North Carolina Session Law 2013-360, Section 14.8(e); Section 14.8(n); Section 14.8(o) [See Appendix 2]

North Carolina General Statutes (see Appendix III)
G.S. 113-168.6 Commercial fishing vessel registration
G.S. 113-174.3 For-Hire Licenses

Necessity: Session Law 2013-360 made statutory changes to the way for-hire licenses are structured, creating three new licenses. This law also required certain for-hire operations to obtain a Commercial Fishing Vessel Registration (CFVR) with a for-hire endorsement for their vessel. Current Marine Fisheries Commission (MFC) rules need to be amended to conform to the existing statute.

The anticipated effective date of the proposed rule changes is April 1, 2019

I. Summary

To address deficiencies and inequities in the for-hire licensing structure, the North Carolina Division of Marine Fisheries (DMF) proposed changes to the license structure to include a blanket

captain's license, a blanket vessel license, and a non-blanket vessel license. These three licenses were incorporated into G.S. 113-174.3 in 2013. The original For-Hire Blanket CRFL was eliminated from the statute and the For-Hire Fishing Permit was discontinued June 30, 2014. The Marine Fisheries Commission (MFC) removed the For-Hire Fishing Permit requirement from Rule 15A NCAC 03O .0503 effective May 1, 2015, but Rule 15A NCAC 03O .0112 still references this permit and has yet to be updated to reflect the for-hire licenses currently found in G.S. 113-174.3. Paragraph (d) of Rule 15A NCAC 03O .0112 is still relevant and the content was added to 15A NCAC 03O .0106 (Display of Licenses and Registrations), also effective May 1, 2015; therefore, Paragraph (d) needs to be removed from 15A NCAC 03O .0112, as it is redundant. Updating the accompanying rule will provide consistency with rules and statutes pertaining to for-hire licenses as well as provide clarity for affected stakeholders.

II. Introduction and Purpose of Rule Changes

In July 1994, the North Carolina General Assembly established the Moratorium Steering Committee (MSC) to study North Carolina's entire coastal fisheries management process and to recommend changes to improve the licensing system. Within the MSC, a License Sub-committee was established and charged with, among other things, examining in detail the licensing of the for-hire fishing sector.

The findings and recommendations of the MSC served as the framework for development and passage of the Fisheries Reform Act of 1997. Within the MSC final report were provisions for for-hire vessel licenses and recreational fishing licenses. However, these provisions were not included in the final legislation. Ten years later, these recommendations were implemented by additional legislation.

To establish a system to provide management tools for monitoring the for-hire industry in the interim, the Marine Fisheries Commission utilized rule-making authority to establish a provisional no-cost For-Hire Fishery Permit in 2003. Several years after the permit requirement was established, new laws were passed in North Carolina creating a Coastal Recreational Fishing License (CRFL). In part, this was done to provide management tools for monitoring recreational anglers. During the 2003 Session, the General Assembly of North Carolina passed a CRFL requirement (G.S. 113-174 *et. seq.*) which became effective January 1, 2007. One of the new laws, G.S. 113-174.3 pertained directly to the optional Blanket For-Hire CRFL, which established fees and removed responsibility for licensure of angling customers from the individual and placed it on the owner or operator of the vessel. Having a database of for-hire participants allowed the DMF to survey the industry for effort information as part of the For-Hire Survey that DMF conducts as a contractor to the National Marine Fisheries Service. It also satisfied requirements of the National Angler Registry as put forth in the federal Magnusson-Stevens Reauthorization Act of 2006[1] (NOAA, 2007).

This component of the CRFL for an optional for-hire blanket license covered anglers' licensing requirements if they were aboard a properly licensed for-hire boat. The for-hire blanket license was available to USCG-licensed captains who carried six or fewer passengers (guides and charter boats) as well as a separate license for USCG-certified vessels carrying more than six passengers (headboats) and operated by a USCG-licensed captain. The price was $250 for six or

[1] Magunson-Stevens Fishery Conservation and Management Act. As Amended Through January 12, 2007. May 2007. National Oceanic and Atmospheric Administration. National Marine Fisheries Service. http://www.nmfs.noaa.gov/msa2005/docs/MSA_amended_msa%20_20070112_FINAL.pdf

fewer passengers and $350 for more than six passengers, with nonresidents paying the same fee as residents.

In March of 2011, the DMF held three meetings throughout coastal North Carolina with members of the for-hire industry to get industry feedback on changes to the license structure, logbooks, and other issues the industry may have. Inequities and inefficiencies in the license design were brought to DMF's attention during the for-hire stakeholders meetings. Recommendations from the series of meetings were drafted in the *Summary of the 2011 For-Hire Stakeholders Meetings Report to the Marine Fisheries Commission*[2]. The MFC agreed with the recommendations which were then incorporated into DMF's request for statutory amendments to the N.C. General Assembly. These recommendations were adopted by the 2013 session of the General Assembly in Session Law 2013-360.

Session Law 2013-360 made statutory changes in G.S. 113-168.6 and G.S. 113-174.3 that alter the way for-hire licenses are structured, require certain for-hire operations to obtain Commercial Fishing Vessel Registrations (CFVR) with for-hire endorsements for their vessels, and obligate for-hire operators to affirm liability coverage and knowledge of USCG safety requirements.

Current for-hire licenses are as follows:

1. The Blanket For-Hire Captain's CRFL allows the holder to use any properly licensed vessel in his/her operation while covering the licensing requirements of the anglers. All vessels operated by the holder of a Blanket For-Hire Captain's CRFL must have a CFVR with a for-hire endorsement. This license satisfies recreational fishing license requirements, but without the CFVR with a for-hire endorsement, does not satisfy for-hire licensing requirements. The Blanket For-Hire Captain's CRFL was developed primarily for inshore fishing guides who operate multiple vessels. The fee is the same as the Blanket For-Hire Vessel CRFL but should result in a cost savings to resident fishing guides who operate multiple vessels since the accompanying CFVR with for-hire endorsement is considerably less expensive than the Blanket For-Hire Vessel CRFL and is based on vessel length. The holder of this license must also be a United States Coast Guard (USCG) licensed captain.

2. The Blanket For-Hire Vessel CRFL is a license issued to the vessel and must be operated by a USCG licensed captain. This license was developed primarily for the headboat industry where oftentimes multiple captains operate one headboat vessel at different times, resulting in potential cost savings for a vessel owner. A vessel owner can simply license the vessel instead of obtaining a license for each captain who might operate that vessel.

3. The Non-Blanket For-Hire Vessel License (note: not a CRFL) is also a license issued to the vessel. This license satisfies for-hire licensing requirements, but does not intersect with recreational fishing license requirements. It was developed primarily for the dive boat industry that infrequently has divers who wish to spear fish. Spear fishermen on a dive boat licensed with a Non-Blanket For-Hire Vessel License must obtain an individual CRFL to legally take fish. It is possible that many inshore fishing guides may seek to purchase this

[2] Available at http://portal.ncdenr.org/c/document_library/get_file?uuid=a1055e24-5169-4ddb-aa9d-c8cd422ecf9d&groupId=38337

license if they do not wish to cover their anglers' licensing requirements. The vessel must be operated by a USCG licensed captain.

The original For-Hire Blanket CRFL was eliminated from the statute and the For-Hire Fishing Permit was discontinued June 30, 2014. The MFC removed the For-Hire Fishing Permit requirement from Rule 15A NCAC 03O .0503 effective May 1, 2015, but Rule 15A NCAC 03O .0112 still references this permit and has yet to be updated to reflect the for-hire licenses currently found in G.S. 113-174. Paragraph (d) of Rule 15A NCAC 03O .0112 is still relevant and the content was added to 15A NCAC 03O .0106 (Display of Licenses and Registrations), also effective May 1, 2015; therefore, Paragraph (d) needs to be removed from 15A NCAC 03O .0112, as it is redundant.

Additionally, G.S. 150B-19.1, part of the Administrative Procedure Act, sets forth the principles of rulemaking. These principles include that rules shall be written in a clear and unambiguous manner and that rules shall be based on sound, reasonably available scientific, technical, and other relevant information. Amending the rule to conform to the statute will comply with the statutory requirements for rulemaking.

III. Benefits

While there are no quantifiable economic benefits to the proposed rule change, the public and law enforcement will benefit from changing rule 15A NCAC 03O .0112 to align with current management practices and to use terms as found in the current statute.

IV. Costs

There are no anticipated costs associated with the proposed rule changes, as rule changes reflect current management practices.

Appendix I Proposed Rule Changes:

15A NCAC 03O .0112 ~~FOR HIRE COASTAL RECREATIONAL FISHING~~ FOR-HIRE LICENSE REQUIREMENTS

~~(a) It is unlawful to operate a For Hire Vessel unless the vessel operator possesses either the For Hire Blanket Coastal Recreational Fishing License (CRFL) for the vessel or a Division of Marine Fisheries For Hire Fishing Permit for the vessel as provided in 15A NCAC 03O .0503(k).~~

(a) The license requirements for the operator of a vessel engaged in a for-hire operation are set forth in G.S. 113-174.3. Either the vessel owner or the for-hire vessel operator may seek to obtain the applicable for-hire vessel license. Only the vessel owner may seek to obtain the applicable registration and endorsement as set forth in G.S. 113-168.6. For the purpose of this Rule, "for-hire vessel operator" includes the holder of a Blanket For-Hire Captain's Coastal Recreational Fishing License, Blanket For-Hire Vessel Coastal Recreational Fishing License, or Non-Blanket For-Hire Vessel License, as set forth in G.S. 113-174.3.

(b) To be eligible for a for-hire license, an applicant shall meet the requirements as set forth in Rule .0101(a) of this Section.

(c) The for-hire vessel operator shall follow the requirements for display of licenses and registrations for a vessel engaged in for-hire recreational fishing as set forth in Rule .0106 of this Section.

~~(b) It is unlawful for a For Hire Vessel operator to operate under the For Hire Blanket CRFL without:~~

~~(1) Holding the USCG certification required in 15A NCAC 03O .0101(a)(13);~~

~~(2) Having the For Hire Blanket CRFL for the vessel or copy thereof in possession and ready at hand for inspection; and~~

~~(3) Having current picture identification in possession and ready at hand for inspection.~~

~~(c)~~(d) It is unlawful for ~~the holder of the For Hire Blanket CRFL~~ a for-hire vessel operator to fail to participate in survey programs administered by the Division of Marine Fisheries and ~~provide accurate information as requested by the Division for~~ comply with biological sampling as requested by the Division.~~and survey programs.~~

~~(d) It is unlawful to fail to display a current For Hire Blanket CRFL decal mounted on an exterior surface of the vessel so as to be visible when viewed from the port side while engaged in for-hire recreational fishing.~~

Authority G.S. 113-134; 113-168.6; 113-174.1; 113-174.3; 143B-289.52

Appendix II Excerpts of North Carolina Session Laws:

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2005

SESSION LAW 2006-255
SENATE BILL 1587

. . .

The General Assembly of North Carolina enacts:

. . .

SECTION 7. G.S. 113-174.3(a) reads as rewritten:
"(a) License. – A person who operates a for hire boat may purchase a For Hire Blanket CRFL issued by the ~~Division~~.Division for the for hire boat. A For Hire Blanket CRFL authorizes all individuals on the for hire boat who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. A For Hire Blanket CRFL does not authorize individuals to engage in recreational fishing in joint fishing waters or inland fishing waters. This ~~license~~A For Hire Blanket CRFL is valid for a period of one year from the date of issuance. The fee for a For Hire Blanket CRFL is:
(1) Two hundred fifty dollars ($250.00) for a vessel captained by an individual who holds a certification from the United States Coast Guard to carry six or fewer passengers.
(2) Three hundred fifty dollars ($350.00) for a vessel captained by an individual who holds a certification from the United States Coast Guard to carry greater than six passengers."

. . .

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2005

SESSION LAW 2006-259
SENATE BILL 1523

. . .

The General Assembly of North Carolina enacts:

. . .

SECTION 20.5. If Senate Bill 1587, 2005 Regular Session, becomes law, then G.S. 113-174.3(a), as enacted by that act, reads as rewritten:
"(a) License. – A person who operates a for hire boat may purchase a For Hire Blanket CRFL issued by the Division. A For Hire Blanket CRFL authorizes all individuals on the for hire boat who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. A For Hire Blanket CRFL does not authorize individuals to engage in recreational fishing in joint fishing waters or inland fishing waters. This license is valid for a period of one year from the date of issuance. The fee for a For Hire Blanket CRFL is:

(1) Two hundred fifty dollars ($250.00) for a vessel ~~captained by an individual who holds a certification from the United States Coast Guard to~~ that will carry six or fewer passengers.
(2) Three hundred fifty dollars ($350.00) ~~for a vessel captained by an individual who holds a certification from the United States Coast Guard to~~ that will carry greater than six passengers."

. . .

GENERAL ASSEMBLY OF NORTH CAROLINA
SESSION 2013

SESSION LAW 2013-360
SENATE BILL 402

. . .

The General Assembly of North Carolina enacts:

. . .

SECTION 14.8.(e) G.S. 113-168.6 reads as rewritten:
"**§ 113-168.6. Commercial fishing vessel registration.**
(a) As used in this subsection, a North Carolina vessel is a vessel that has its primary situs in the State. A vessel has its primary situs in the State if:

(1) A certificate of number has been issued for the vessel under Article 1 of Chapter 75A of the General Statutes;
(2) A certificate of title has been issued for the vessel under Article 4 of Chapter 75A of the General Statutes; or
(3) A certification of documentation has been issued for the vessel that lists a home port in the State under 46 U.S.C. § 12101, et seq., as amended.

(b) The owner of a vessel used in a commercial fishing operation in the coastal fishing waters of the State or a North Carolina vessel used to land or sell fish in the State shall register the vessel with the Division. It is unlawful to use a vessel that is not registered with the Division in a commercial fishing operation or a for-hire operation in the coastal fishing waters of the

State. It is unlawful to use a North Carolina vessel that is not registered with the Division to land or sell fish in the State. No registration is required for a vessel of any length that does not have a motor if the vessel is used only in connection with another vessel that is properly registered.

(b1) The vessel owner at the time of application for registration under subsection (b) of this section shall obtain either a commercial vessel endorsement if the vessel is intended to be used primarily for the harvest of fish for sale, a for-hire endorsement if the vessel is intended to be used primarily for for-hire activities, or both endorsements if the vessel is intended to be engaged in both activities. The owner of a vessel applying for a commercial fishing vessel registration with a for-hire endorsement must affirm liability coverage and knowledge of applicable United States Coast Guard safety requirements.

(c) The annual fee for a commercial fishing vessel registration shall be determined by the length of the vessel and shall be in addition to the fee for other licenses issued under this Article. The length of a vessel shall be determined by measuring the distance between the ends of the vessel along the deck and through the cabin, excluding the sheer. The annual fee for a commercial fishing vessel registration is:

(1) ~~One dollar ($1.00)~~One dollar and twenty-five cents ($1.25) per foot for a vessel not over 18 feet in length.

(2) ~~One dollar and fifty cents ($1.50)~~One dollar and ninety cents ($1.90) per foot for a vessel over 18 feet but not over 38 feet in length.

(3) ~~Three dollars ($3.00)~~Three dollars and seventy-five cents ($3.75) per foot for a vessel over 38 feet but not over 50 feet in length.

(4) ~~Six dollars ($6.00)~~Seven dollars and fifty cents ($7.50) per foot for a vessel over 50 feet in length.

(d) A vessel may be registered at any office of the Division. A commercial fishing vessel registration expires on the last day of the license year.

(e) Within 30 days of the date on which the owner of a registered vessel transfers ownership of the vessel, the new owner of the vessel shall notify the Division of the change in ownership and apply for a replacement commercial fishing vessel registration. An application for a replacement commercial fishing vessel registration shall be accompanied by proof of the transfer of the vessel. The provisions of G.S. 113-168.1(h) apply to a replacement commercial fishing vessel registration."

. . .

SECTION 14.8.(n) G.S. 113-174(2a) reads as rewritten:

"(2a) "For Hire ~~Boat~~'Vessel" means a charter boat, head boat, dive boat, or other ~~boat~~ vessel hired to allow individuals to engage in recreational fishing."

SECTION 14.8.(o) G.S. 113-174.3 reads as rewritten:

"**§ 113-174.3. For Hire Blanket CRFL.For-Hire Licenses.**

~~(a) License. – A person who operates a for hire boat may purchase a For Hire Blanket CRFL issued by the Division for the for hire boat. A For Hire Blanket CRFL authorizes all individuals on the for hire boat who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. A For Hire Blanket CRFL does not authorize individuals to engage in recreational fishing in joint fishing waters or inland fishing waters. A For Hire Blanket CRFL is valid for a period of one year from the date of issuance. The fee for a For Hire Blanket CRFL is:~~

~~(1) Two hundred fifty dollars ($250.00) for a vessel that will carry six or fewer passengers.~~

~~(2) Three hundred fifty dollars ($350.00) for a vessel that will carry greater than six passengers.~~

~~(b) Implementation. Except as provided in this section and G.S. 113-174.2(d), each individual on board a for hire boat engaged in recreational fishing, other than crew members who do not engage in recreational fishing, must hold a license issued under this Article or Article 25A of this Chapter. An owner, operator, or crew member of a for hire boat is not responsible for the licensure of a customer fishing from the boat.~~

(c) License. – It is unlawful for a person to engage in a for-hire operation without having obtained one of the following licenses issued by the Division:

(1) Blanket For-Hire Captain's CRFL. – This license allows individuals properly licensed by the United States Coast Guard to carry passengers on any vessel with a commercial vessel registration with a for-hire endorsement. A Blanket For-Hire Captain's CRFL authorizes all individuals on the for-hire vessel who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. The resident fees for a Blanket For-Hire Captain's CRFL are two hundred fifty dollars ($250.00) for a vessel carrying six or fewer passengers and three hundred fifty dollars ($350.00) for a vessel carrying more than six passengers. The nonresident fees for a Blanket For-Hire Captain's CRFL are three hundred twelve dollars and fifty cents ($312.50) for a vessel carrying six or fewer passengers and four hundred thirty-seven dollars and fifty cents ($437.50) for a vessel carrying more than six passengers. Any vessel whose operator is licensed under this subdivision and that is engaged in for-hire fishing must obtain a Commercial Fishing Vessel Registration with a for-hire endorsement.

(2) Blanket For-Hire Vessel CRFL. – This license allows any United States Coast Guard licensed operator to carry passengers aboard the licensed vessel. A Blanket For-Hire Vessel CRFL authorizes all individuals on the for-hire vessel who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. The resident fees for a Blanket For-Hire Vessel CRFL are two hundred fifty dollars ($250.00) for a vessel carrying six or fewer passengers and three hundred fifty dollars ($350.00) for a vessel carrying more than six passengers. The nonresident fees for a Blanket For-Hire Vessel CRFL are three hundred twelve dollars and fifty cents ($312.50) for a vessel carrying six or fewer passengers and four hundred thirty-seven dollars and fifty cents ($437.50) for a vessel carrying more than six passengers. Any vessel whose operator is licensed under this subdivision and that is engaged in for-hire fishing is not required to obtain a Commercial Fishing Vessel Registration with a for-hire endorsement.

(3) Non-Blanket For-Hire Vessel License. – This license allows any United States Coast Guard licensed operator to carry passengers aboard the licensed vessel. This license does not authorize individuals aboard the vessel to engage in recreational fishing unless they hold an individual CRFL issued under this Article or Article 25A of this Chapter. The fee for the Non-Blanket For-Hire Vessel License is twenty-five dollars ($25.00) for a vessel operated by a resident operator and thirty-seven dollars and fifty cents ($37.50) for a vessel operated by a nonresident operator. Any vessel whose operator is licensed under this subdivision and that is engaged in for-hire fishing is not required to obtain a Commercial Fishing Vessel Registration with a for-hire endorsement.

(d) A license issued under this section does not authorize individuals to engage in recreational fishing in joint fishing waters or inland fishing waters. All for-hire licenses expire on the last day of the license year.
(e) Each individual who obtains a for-hire license shall submit to the Division logbooks summarizing catch and effort statistical data to the Division. The Commission may adopt rules that determine the means and methods to satisfy the requirements of this subsection."

. . .

Appendix III Current Statutes Text:

§ 113-168.6. Commercial fishing vessel registration.

(a) As used in this subsection, a North Carolina vessel is a vessel that has its primary situs in the State. A vessel has its primary situs in the State if:

(1) A certificate of number has been issued for the vessel under Article 1 of Chapter 75A of the General Statutes;

(2) A certificate of title has been issued for the vessel under Article 4 of Chapter 75A of the General Statutes; or

(3) A certification of documentation has been issued for the vessel that lists a home port in the State under 46 U.S.C. § 12101, et seq., as amended.

(b) The owner of a vessel used in a commercial fishing operation in the coastal fishing waters of the State or a North Carolina vessel used to land or sell fish in the State shall register the vessel with the Division. It is unlawful to use a vessel that is not registered with the Division in a commercial fishing operation in the coastal fishing waters of the State. It is unlawful to use a North Carolina vessel that is not registered with the Division to land or sell fish in the State. No registration is required for a vessel of any length that does not have a motor if the vessel is used only in connection with another vessel that is properly registered.

(b1) The vessel owner at the time of application for registration under subsection (b) of this section shall obtain either a commercial vessel endorsement if the vessel is intended to be used primarily for the harvest of fish for sale, a for-hire endorsement if the vessel is intended to be used primarily for for-hire activities, or both endorsements if the vessel is intended to be engaged in both activities. The owner of a vessel applying for a commercial fishing vessel registration with a for-hire endorsement must affirm liability coverage and knowledge of applicable United States Coast Guard safety requirements.

(c) The annual fee for a commercial fishing vessel registration shall be determined by the length of the vessel and shall be in addition to the fee for other licenses issued under this Article. The length of a vessel shall be determined by measuring the distance between the ends of the vessel along the deck and through the cabin, excluding the sheer. The annual fee for a commercial fishing vessel registration is:

(1) One dollar and twenty-five cents ($1.25) per foot for a vessel not over 18 feet in length.

(2) One dollar and ninety cents ($1.90) per foot for a vessel over 18 feet but not over 38 feet in length.

(3) Three dollars and seventy-five cents ($3.75) per foot for a vessel over 38 feet but not over 50 feet in length.

(4) Seven dollars and fifty cents ($7.50) per foot for a vessel over 50 feet in length.

(d) A vessel may be registered at any office of the Division. A commercial fishing vessel registration expires on the last day of the license year.

(e) Within 30 days of the date on which the owner of a registered vessel transfers ownership of the vessel, the new owner of the vessel shall notify the Division of the change in ownership and apply for a replacement commercial fishing vessel registration. An application for a replacement commercial fishing vessel registration shall be accompanied by proof of the transfer of the vessel. The provisions of G.S. 113-168.1(h) apply to a replacement commercial fishing vessel registration. (1998-225, s. 4.15; 2001-213, s. 3; 2013-360, s. 14.8(e).)

§ 113-174.3. For-Hire Licenses.

(a), (b) Repealed by Session Laws 2013-360, s. 14.8(o), effective August 1, 2013.

(c) License. – It is unlawful for a person to engage in a for-hire operation without having obtained one of the following licenses issued by the Division:

(1) Blanket For-Hire Captain's CRFL. – This license allows individuals properly licensed by the United States Coast Guard to carry passengers on any vessel with a commercial vessel registration with a for-hire endorsement. A Blanket For-Hire Captain's CRFL authorizes all individuals on the for-hire vessel who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. The resident fees for a Blanket For-Hire Captain's CRFL are two hundred fifty dollars ($250.00) for a vessel carrying six or fewer passengers and three hundred fifty dollars ($350.00) for a vessel carrying more than six passengers. The nonresident fees for a Blanket For-Hire Captain's CRFL are three hundred twelve dollars and fifty cents ($312.50) for a vessel carrying six or fewer passengers and four hundred thirty-seven dollars and fifty cents ($437.50) for a vessel carrying more than six passengers. Any vessel whose operator is licensed under this subdivision and that is engaged in for-hire fishing must obtain a Commercial Fishing Vessel Registration with a for-hire endorsement.

(2) Blanket For-Hire Vessel CRFL. – This license allows any United States Coast Guard licensed operator to carry passengers aboard the licensed vessel. A Blanket For-Hire Vessel CRFL authorizes all individuals on the for-hire vessel who do not hold a license issued under this Article or Article 25A of this Chapter to engage in recreational fishing in coastal fishing waters that are not joint fishing waters. The resident fees for a Blanket For-Hire Vessel CRFL are two hundred fifty dollars ($250.00) for a vessel carrying six or fewer passengers and three hundred fifty dollars ($350.00) for a vessel carrying more than six passengers. The nonresident fees for a Blanket For-Hire Vessel CRFL are three hundred twelve dollars and fifty cents ($312.50) for a vessel carrying six or fewer passengers and four hundred thirty-seven dollars and fifty cents ($437.50) for a vessel carrying more than six passengers. Any vessel whose operator is licensed under this subdivision and that is engaged in for-hire fishing is not required to obtain a Commercial Fishing Vessel Registration with a for-hire endorsement.

(3) Non-Blanket For-Hire Vessel License. – This license allows any United States Coast Guard licensed operator to carry passengers aboard the licensed vessel. This license does not authorize individuals aboard the vessel to engage in recreational fishing unless they hold an individual CRFL issued under this Article or Article 25A of this Chapter. The fee for the Non-Blanket For-Hire Vessel License is twenty-five dollars ($25.00) for a vessel operated by a resident operator and thirty-seven dollars and fifty cents ($37.50) for a vessel operated by a nonresident operator. Any vessel whose operator is licensed under this subdivision and that is engaged in for-hire fishing is not required to obtain a Commercial Fishing Vessel Registration with a for-hire endorsement.

(d) A license issued under this section does not authorize individuals to engage in recreational fishing in joint fishing waters or inland fishing waters. All for-hire licenses expire on the last day of the license year.

(e) Repealed by Session Laws 2015-201, s. 1, effective August 5, 2015. (2005-455, s. 1.5; 2006-255, s. 7; 2006-259, s. 20.5; 2013-360, s. 14.8(o); 2015-201, s. 1.)

N.C. MARINE FISHERIES COMMISSION REGULATORY IMPACT ANALYSIS FOR READOPTION OF A PORTION OF RULES IN 15A NCAC 03I, 03J, 03K, 03L, 03M, 03O, AND 03R

Rule Readoptions:	15A NCAC 03I .0120, 03J .0101, .0102, .0108, .0203, .0204, .0206, .0207, .0209, .0303, .0304, 03K .0402-.0405, .0501-.0504, .0507, .0508, 03L .0208, 03M .0101-.0103, .0501, .0502, .0506, .0507, .0510, .0513, .0515, .0517, .0518, .0520, .0521, 03O .0106, .0501, .0503, 03R .0112
Name of Commission:	N.C. Marine Fisheries Commission
Agency Contact:	Catherine Blum, Rule Making Coordinator N.C. Division of Marine Fisheries 3441 Arendell Street Morehead City, NC 28557 (252) 808-8014 catherine.blum@ncdenr.gov
Analyst Contact:	Adam Stemle, Fisheries Economics Program Manager N.C. Division of Marine Fisheries 3441 Arendell Street Morehead City, NC 28557 (252) 808-8107 adam.stemle@ncdenr.gov
Impact Summary:	State government: No Local government: No Federal government: No Substantial impact: No
Authority:	G.S. 113-134; 113-168.6; 113-169.1; 113-169.2; 113-169.3; 113-169.4; 113-170; 113-170.4; 113-170.5; 113-173; 113-174.1; 113-182; 113-182.1; 113-185; 113-201; 113-202; 113-210; 113-221.1; 113-252; 143B-289.52
Necessity:	The proposed amendments readopt a portion of rules in 15A NCAC 03I .0100; 03J .0100, .0200, .0300; 03K .0400, .0500; 03L .0200; 03M .0100, .0500; 03O .0100, .0500; and 03R .0100 pursuant to requirements of G.S. 150B-21.3A.

I. Summary

The purpose of this document is to provide a regulatory impact analysis addressing any fiscal impacts associated with the readoption of a portion of rules in 15A NCAC 03I .0100; 03J .0100, .0200, .0300; 03K .0400, .0500; 03L .0200; 03M .0100, .0500; 03O .0100, .0500; and 03R .0100. These rules have been reviewed to conform to the requirements of G.S. 150B-21.3A, Periodic Review and Expiration of Existing Rules. The proposed readoptions consist of amendments that are of an administrative nature to update the 40 rules. Overall, the proposed readoptions do not result in a significant economic impact to the regulated community, state government, or other parties.

II. Introduction and Purpose of Rule Change(s)

The purpose of the Marine Fisheries Commission is to manage, restore, develop, cultivate, conserve, protect, and regulate the marine and estuarine resources within its jurisdiction, as described in G.S. 113-132, including commercial and recreational fisheries resources (Chapter 143B, Article 7, Part 5D). N.C. General Statute §150B-21.3A, adopted in 2013, requires state agencies to review existing rules every 10 years. Following an initial review, rules will be reviewed on a 10-year review cycle. The initial review comment period on all rules in 15A NCAC 03[1] was held from Feb. 23 - May 3, 2017; no public comments were received. The Marine Fisheries Commission subsequently approved the report on the review of the rules Aug. 16, 2017. The final report for rules in 15A NCAC 03 was reviewed and approved by the Rules Review Commission at its Dec. 14, 2017 meeting. The reports were forwarded to the Joint Legislative Administrative Procedure Oversight Committee for final determination. The committee met Jan. 9, 2018, completing the review process for these rules.

The final determinations were unchanged from how they were originally submitted. As a result, three rules were determined to be unnecessary and were expired from the N.C. Administrative Code, 36 rules were determined to be necessary without substantive public interest and remain in effect without further action, and 163 rules were determined to be necessary with substantive public interest and must be readopted as though they were new rules. This document addresses the first group of rules being considered for readoption.

III. Discussion

While proposed readoptions consist of amendments that are of an administrative nature, a few of the changes warrant additional explanation. A review of rule 15A NCAC 03O .0501 showed a need to consistently address the eligibility to apply for specific permits by the holder of an assigned Standard Commercial Fishing License. The current rule overtly states the eligibility for certain permits, but is silent about others. After conducting a review of procedures and eligibility for all permits, staff identified only one permit for which the holder of an assigned Standard Commercial Fishing License is not eligible: a Pound Net Set Permit (Appendix I, pg. 15). Proposed changes to the rule clearly state this eligibility status.

Rule 15A NCAC 03O .0503 currently includes the requirements for the Albemarle Sound Management Area River Herring Dealer Permit. To purchase river herring, a dealer must obtain an Albemarle Sound Management Area River Herring Dealer Permit (Appendix I, pg. 17). The permit conditions require the dealer to report landings daily to the Division and allow biological sampling of catches by Division personnel. But, Rule 15A NCAC 03M .0513 states it is unlawful to take or possess river herring from North Carolina Coastal Fishing Waters. This rule reflects the moratorium on the harvest of river herring put in place by the 2007 North Carolina River Herring Fishery Management Plan Amendment 1 that became effective in 2008. This was a result of the Division's 2005 stock assessment of river herring that determined river herring were overfished and overfishing was occurring, there was minimal recruitment with continued declines in abundance, and high fishing mortality rates. The only exception to the moratorium was a limited discretionary harvest for collection of biological data that occurred in conjunction with the Easter holiday

[1] A public comment period on the report for rules in 15A NCAC 03Q .0100 was held separately, from April 25-July 5, 2017, in conjunction with a similar public comment period held from May 22-July 31, 2017 on the report for rules in 15A NCAC 10C .0100 that are under the authority of the Wildlife Resources Commission. Both sets of rules are substantively identical and were jointly adopted by both agencies. These rules will be jointly readopted by both agencies at a future date.

weekend to provide product to local herring festivals. Even this harvest was discontinued after the 2014 discretionary season due to lack of compliance with the season's stated intent, in accordance with the 2015 North Carolina River Herring Fishery Management Plan Amendment 2.

Since 2014, there has been no harvest of river herring allowed. The rebuilding timeframe for the river herring population was projected to exceed 10 years from the date of the 2008 moratorium. As of 2018, the moratorium continues and the river herring stock is depleted, based on the results of the 2012 Atlantic States Marine Fisheries Commission Atlantic coastwide stock assessment of river herring. The stock assessment found that, although the North Carolina stock in the Albemarle Sound was not experiencing overfishing due to the harvest moratorium, it remained overfished. Since the Albemarle Sound Management Area River Herring Dealer Permit still exists in rule and all Division permits are issued free of charge, there is a small number of these permits that has continued to be issued (six to eight per year); however, the permits have not "permitted" the harvest, possession, purchase, or sale of river herring. The permit is obsolete and is proposed to be deleted from Rule 15A NCAC 03O .0503.

Rule 15A NCAC 03O .0503 also currently includes the requirements for the Permit to Waive the Requirement to Use Turtle Excluder Devices in the Atlantic Ocean (Appendix I, pg. 20). The rule provides that it is unlawful to trawl for shrimp in the Atlantic Ocean without a Turtle Excluder Device (TED) installed in trawls within one nautical mile of the shore from Browns Inlet to Rich's Inlet (an area approximately 30 nautical miles in length) without this permit when allowed by proclamation from April 1 through November 30. The purpose of the permit is to allow fishing activity to continue when concentrations of algae are found that would prevent fishing from occurring with a TED installed; the gear becomes so clogged with algae that fishing is nearly impossible. In lieu of using a TED, fishermen were required to limit their tow times to minimize impacts to sea turtles. In order for a proclamation to be issued so that the permit can be issued, a Section 10 Incidental Take Permit (ITP) under the Endangered Species Act must be in place from the National Oceanic and Atmospheric Administration Fisheries. An ITP allows a limited number of "takes" of a protected or endangered species, in this case sea turtles, with requirements to comply with specific permit conditions. Currently, there is not an ITP in place, thus there is insufficient authority in place to issue the proclamation that would enable a Permit to Waive the Requirement to Use Turtle Excluder Devices in the Atlantic Ocean to be issued.

From 2001-2005, there was an annual average number of 16 permits issued. This was the last five-year period for which the Division submitted an ITP application to the National Oceanic and Atmospheric Administration Fisheries in support of this permit. The algae has not returned to this area, but if it appeared in the future, a separate effort would have to be undertaken to seek an ITP and then address any rulemaking or permitting needs. There is no way to foresee when, where, or if algae would return and become an issue to address in this or any other fishery. The permit is obsolete and is proposed to be deleted from Rule 15A NCAC 03O .0503.

Finally, there are additional proposed amendments to the rules to make other minor technical and conforming changes. These include alphabetizing permits, using consistent language to refer to the Division of Marine Fisheries, and making other minor technical changes for proper punctuation and capitalization.

IV. Benefits

While there are no quantifiable economic benefits from the proposed rule amendments and readoptions, the public and law enforcement will benefit from clarity and consistency across rules.

V. Costs

There are no new anticipated costs to either the state government or regulated community associated with the proposed rule amendments and readoptions, as rule changes reflect current management practices.

Appendix I: Proposed Rule Readoptions

15A NCAC 03I .0120 POSSESSION OR TRANSPORTATION LIMITS

(a) It is unlawful to possess any species of fish ~~which~~ that is subject to ~~size~~ season, size, or harvest restrictions, while ~~actively~~ engaged in a fishing operation, unless all fish taken are in compliance with the restrictions for the waterbody and area being fished. If State season, size, or harvest restrictions that implement or comply with a fishery management plan adopted by the Atlantic States Marine Fisheries Commission, in accordance with G.S. 113-252, or adopted by the United States Secretary of Commerce pursuant to the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801, et seq. as amended, differ from regulations adopted by these entities, or if there are no federal regulations, the State restrictions shall apply. Nothing provided here is intended to supersede or interrupt the process to address State restrictions that do not implement or comply with a fishery management plan as described in this Paragraph. This process is found in the N.C. Fishery Management Plan for Interjurisdictional Fisheries available at http://portal.ncdenr.org/web/mf/nc-fisheries-management.

(b) It is unlawful to import into the ~~state~~ State species of fish native to North Carolina for sale in North Carolina that do not meet ~~established~~ size ~~limits,~~ limits established by rule or proclamation, except as provided in ~~15A NCAC~~ Rules 03K ~~.0202(c),~~ .0202, ~~03K~~ .0207, ~~03K~~ and .0305, and 03M ~~.0503.~~.0503 of this Chapter.

Authority G.S. 113-134; 113-170; 113-170.4; 113-170.5; 113-182; 113-182.1; 113-252; 143B-289.52

15A NCAC 03J .0102 NETS OR NET STAKES

It is unlawful to use nets or net stakes:

(1) ~~Within~~ within 150 yards of any railroad or highway bridge crossing the Northeast Cape Fear River, New River, White Oak River, Trent River, Neuse River, Pamlico River, Roanoke River, and Alligator ~~River;~~River.

(2) ~~Within~~ within 300 yards of any highway bridge crossing Albemarle Sound, Chowan River, Croatan Sound, Currituck ~~Sound~~ Sound, and Roanoke ~~Sound;~~Sound.

(3) ~~If~~ if such net stakes are of metallic material.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0108 NETS PULLED BY MORE THAN ONE ~~BOAT~~ VESSEL

It is unlawful to pull or tow a net with more than one ~~boat~~ vessel, except in ~~long haul fishing~~ long haul operations.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0203 CHOWAN RIVER AND ITS TRIBUTARIES

(a) In the Chowan River and its ~~tributaries:~~tributaries, it is unlawful to:

(1) ~~It is unlawful to~~ anchor the lead line of any net closer than 50 feet from ~~shore~~ shore, except in the Meherrin River.

~~(2) It is unlawful to use pound nets in any tributary creek or within 150 yards of the mouth of any such tributary creek of the Chowan River.~~

~~(3)~~(2) ~~It is unlawful to~~ set a pound net within 200 yards parallel to any other pound net in the Chowan River.

~~(4) It is unlawful to use a seine within 1,000 yards of the mouth of any creek tributary to the Chowan River.~~

~~(5)~~(3) ~~It is unlawful to~~ set a trotline within 100 yards of a pound net from February 1 through May 31.

(b) It is unlawful to set a pound net in any tributary of the Chowan River or within 150 yards of the mouth of any tributary of the Chowan River.

(c) It is unlawful to use a seine within 1,000 yards of the mouth of any tributary of the Chowan River.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0204 CURRITUCK SOUND AND ITS TRIBUTARIES

In Currituck Sound and its ~~tributaries:~~tributaries, it is unlawful to use a seine:

(1) ~~It is unlawful to use any net or seine with more than one power boat.~~in long haul operations.

(2) ~~It is unlawful to use any seine or haul net which~~ that is more than 900 yards in length or ~~which~~ that has a mesh length of less than three inches.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0206 SOUTHPORT BOAT HARBOR

It is unlawful to use any commercial fishing gear in the Southport Boat Harbor, Brunswick County, north of a line beginning at a point on the west side of the mouth of the harbor ~~33°54.9656'N – 78°01.4477' W~~ 33° 54.9656' N – 78° 01.4477' W running easterly to a point on the east side of the mouth of the harbor ~~33°54.9656'N – 78°01.3797' W.~~33° 54.9656' N – 78° 01.3797' W.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0207 ~~DUKE ENERGY PROGRESS BRUNSWICK~~ NUCLEAR PLANT INTAKE CANAL

It is unlawful to use any commercial fishing equipment in ~~the Duke Energy Progress Brunswick Nuclear Plant Intake Canal~~ a nuclear plant intake canal between the fish diversion screen and the ~~Duke Energy Progress Brunswick Nuclear Plant.~~nuclear plant.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0209 ALBEMARLE ~~SOUND/CHOWAN~~ SOUND AND CHOWAN RIVER RIVER HERRING MANAGEMENT AREAS

It is unlawful to use drift gill nets with a mesh length less than three inches from January 1 through May 15 in the Albemarle Sound and Chowan River river herring management areas defined in ~~15A NCAC 03R .0202.~~Rule 03R .0202 of this Chapter.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0303 DREDGES AND MECHANICAL METHODS PROHIBITED

(a) It is unlawful to use any dredge weighing more than 100 ~~pounds~~ pounds, except in the Atlantic Ocean.

(b) It is unlawful to use more than one dredge per vessel to take oysters or crabs or to use any dredges or mechanical methods between sunset and sunrise.

(c) It is unlawful to possess oysters aboard a vessel with a dredge weighing more than 100 pounds on board.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0304 ELECTRICAL FISHING DEVICE IN CAPE FEAR RIVER

It is unlawful to take catfish by the use of a hand-operated device generating pulsating electrical current in the Cape Fear River ~~except~~ except:

(1) from 800 feet downstream of Lock and Dam No. 1 in Bladen County to where the Black River joins the Cape Fear ~~River~~ River; and

(2) from July 1 through ~~the last day of February.~~March 1.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03J .0306 ~~HOOK-AND-LINE~~ HOOK AND LINE

It is unlawful to use any hook larger than 4/0 from July 1 through September 30 in the ~~internal coastal fishing waters~~ Internal Coastal Waters of Pamlico Sound and its tributaries south of the Albemarle Sound Management Area as defined in ~~15A NCAC~~ Rule 03R .0201 of this Chapter and north of a line beginning at a point 34° 59.7942' N - 76° 14.6514' W on Camp Point; running easterly to a point 34° 58.7853' N - 76° 09.8922' W on Core Banks while using natural bait from 7:00 p.m. to 7:00 a.m. unless the terminal tackle consists of:

(1) ~~A circle hook~~ a "circle hook", defined for the purpose of this Rule as a hook with the point of the hook directed perpendicularly back toward the ~~shank,~~ shank and with the barb either compressed or removed; and
(2) ~~A~~ a fixed sinker not less than two ounces in weight, secured not more than six inches from the fixed weight to the circle hook.

Authority G.S. 113-134; 113-182; ~~113-182.1;~~ 143B-289.52

15A NCAC 03K .0402 ~~SEASON,~~ SIZE AND HARVEST LIMITS
Size and harvest limits applicable to hard clams in ~~15A NCAC 03K~~ Rule .0301 of this Subchapter do not apply to Rangia clams.

Authority G.S. 113-134; 113-182; 113-201; 113-202; 143B-289.52

15A NCAC 03K .0403 DISPOSITION OF MEATS
It is unlawful to dispose of meats from Rangia clams taken ~~in~~ from prohibited (polluted) waters ~~for~~ by a method that will result in human consumption or ~~by a method that will~~ create risk of human consumption.

Authority G.S. 113-134; 113-182; 113-201; 113-202; 143B-298.52

15A NCAC 03K .0404 ~~DREDGES/MECHANICAL~~ DREDGES AND MECHANICAL METHODS PROHIBITED AND OPEN SEASON
It is unlawful to use mechanical methods for oystering or clamming to take Rangia clams or their shells:
(1) within 100 feet of any pier;
(2) within any established bed of submerged aquatic vegetation as defined in ~~15A NCAC~~ Rule 03I .0101 of this Chapter or salt water cordgrass (Spartina alterniflora) that may exist together or separately;
(3) in areas designated in ~~15A NCAC 03R .0108,~~ Rule 03R .0108 of this Chapter, except on shellfish leases and franchises with a Permit to Use Mechanical Methods for ~~Oysters and Clams~~ Shellfish on Shellfish Leases and Franchises.
(4) in areas designated in ~~15A NCAC 03K .0204(3) and 03R .0103;~~ Rule .0204 of this Subchapter and 03R .0103 of this Chapter; and
(5) except in areas and at times specified by proclamation as authorized by ~~15A NCAC 03K .0201 and 03K .0302.~~ Rules .0201 and .0302 of this Subchapter.

Authority G.S. 113-134; 113-182; 113-201; 143B-289.52

15A NCAC 03K .0405 OYSTERS, ~~MUSSELS,~~ HARD ~~CLAMS~~ CLAMS, OR MUSSELS PROHIBITED
~~While taking Rangia clams or their shells from a prohibited (polluted) area it~~ It is unlawful to possess ~~any other shellfish.~~ oysters, hard clams, or mussels while taking Rangia clams or their shells from a prohibited (polluted) area.

Authority G.S. 113-134; 113-182; 113-201; 143B-289.52

15A NCAC 03K .0501 BAY SCALLOP HARVEST MANAGEMENT
The Fisheries Director may, by proclamation, impose any or all of the following restrictions ~~for commercial or recreational~~ on the taking of bay ~~scallop harvest~~ scallops from public bottom:
(1) specify time;
(2) specify area;
(3) specify means and methods;
(4) specify open seasons for the taking of bay scallops during the period beginning the last Monday in January and ending the last Friday in May;
(5) specify size; and

(6) specify quantity, but shall not exceed possession of more than 15 standard U.S. bushels per person per day or a total of 30 standard U.S. bushels in any combined commercial fishing operation per day.

Authority G.S. 113-134; 113-182; 113-201; 113-221.1; 143B-289.52

15A NCAC 03K .0502 TAKING BAY SCALLOPS AT NIGHT AND ON WEEKENDS

(a) It is unlawful to take bay scallops between sunset and sunrise, or on Saturdays or Sundays, except as provided in ~~15A NCAC 03K .0105.~~Rule .0105 of this Subchapter.

(b) Bay scallops taken on Saturdays or Sundays from shellfish leases or franchises in accordance with G.S. 113-208 are exempt from this Rule.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03K .0503 ~~PROHIBITED~~ BAY SCALLOP DREDGE PROHIBITED

It is unlawful to take bay scallops with dredges weighing more than 50 pounds or equipped with teeth. Any other instrument or device designed to drag the bottom to aid in the taking of bay scallops is also prohibited.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03K .0504 CALICO SCALLOP ~~SEASON~~ HARVEST MANAGEMENT

(a) It is unlawful to land or possess aboard a vessel calico scallops ~~except~~ except, at such times as designated by the Fisheries Director by proclamation.

(b) The Fisheries Director may, be proclamation, impose any or all of the following restrictions on the taking of calico scallops:

(1) specify time;
(2) specify area;
(3) specify means and methods;
(4) specify season;
(5) specify size; and
(6) specify quantity.

Authority G.S. 113-134; 113-182; ~~113-221;~~ 113-221.1; 143B-289.52

15A NCAC 03K .0507 MARKETING SCALLOPS TAKEN FROM SHELLFISH LEASES OR FRANCHISES

(a) It is unlawful to sell, purchase, or possess scallops during the closed season without the lease or franchise holder delivering to the purchaser or other recipient a certification, on a form provided by the ~~Division,~~ Division of Marine Fisheries, that the scallops were taken from a valid shellfish lease or franchise. Certification forms shall be furnished by the Division to lease and franchise holders upon request.

(b) It is unlawful for lease or franchise holders or their designees to take or possess scallops from public bottom while possessing aboard a vessel scallops taken from shellfish leases or franchises.

Authority G.S. 113-134; 113-182; 113-201; 143B-289.52

15A NCAC 03K .0508 SCALLOP ~~SEASON AND~~ AQUACULTURE HARVEST ~~LIMIT~~ EXEMPTIONS

The following exemptions and restrictions shall apply to the possession, sale, purchase, or transport of scallops produced in an aquaculture operation:

(1) Possession and sale of scallops by a scallop aquaculture operation shall be exempt from restrictions set forth in ~~15A NCAC 03K~~ Rules .0501, .0504, and ~~.0505.~~.0505 of this Section.

(2) Purchase and possession of scallops from a scallop aquaculture operation shall be exempt from restrictions set forth in ~~15A NCAC 03K~~ Rules .0501, .0504, and ~~.0505.~~.0505 of this Section.

(3) It is unlawful for a person to possess, sell, purchase, or transport scallops described in Sub-Items (1) and (2) of this Rule unless in compliance with all conditions of the Aquaculture Operation ~~Permit, as set forth in 15A NCAC 03O .0501 and .0503.~~Permit set forth in 15A NCAC 03O Section .0500.

Authority G.S. 113-134; 113-182; 113-201; 143B-289.52

15A NCAC 03L .0208 STONE CRABS ~~(MENIPPE MERCENARIA)~~

~~It is unlawful to:~~

~~(1) Possess stone crab bodies, or fail to immediately return stone crab bodies to the waters from which taken;~~

~~(2) Remove, take or possess any claw(s) from June 15 through August 15;~~

~~(3) Remove, take or possess any claw(s) from egg-bearing stone crabs;~~

~~(4) Use any device to take stone crabs that can puncture, crush, or injure the crab body, such as gigs, spears, grabs, hooks, or similar devices; and~~

~~(5) Remove, take or possess stone crab claw(s) which have a propodus (forearm) less than two and three quarter inches in length, measured by a straight line from the elbow to the tip of the lower immovable finger. The propodus (forearm) is defined as the largest section of the claw assembly that has both a movable and immovable finger and is located farthest from the body of the crab.~~

(a) It is unlawful to possess stone crab bodies or fail to immediately return stone crab bodies to the waters from which taken.

(b) It is unlawful to remove, take, or possess any claw(s) from June 15 through August 15.

(c) It is unlawful to remove, take, or possess any claw(s) from egg-bearing stone crabs.

(d) It is unlawful to use any device to take stone crabs that can puncture, crush, or injure the crab body, such as gigs, spears, grabs, hooks, or similar devices.

(e) It is unlawful to remove, take, or possess stone crab claw(s) that have a propodus (forearm) less than 2 and ¾ inches in length, measured by a straight line from the elbow to the tip of the lower immovable finger. For the purpose of this Rule, "propodus" is defined as the largest section of the claw assembly that has both a movable and immovable finger and is located farthest from the body of the crab.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0101 is proposed for readoption with substantive changes as follows:

SUBCHAPTER 03M - FINFISH

SECTION .0100 – FINFISH, GENERAL

15A NCAC 03M .0101 MUTILATED FINFISH

It is unlawful to possess aboard a vessel or while engaged in fishing any species of finfish that is subject to a size or harvest restriction without having head and tail attached, except:

(1) mullet when used for bait;

(2) hickory shad when used for ~~bait~~ 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 ~~15A NCAC 03M .0520~~ Rule .0520 of this Subchapter.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0102 is proposed for readoption with substantive changes as follows:

15A NCAC 03M .0102 UNMARKETABLE FINFISH

~~(a) It is unlawful to land finfish if in violation of minimum size or possession limits established by rule or proclamation.~~

~~(b)~~(a) It is unlawful to land ~~finfish~~ finfish, taken in connection with a commercial fishing ~~operations which~~ operation, that are unmarketable as individual finfish by reason of size, except a quantity not exceeding 5,000 pounds per vessel per day may be sold to a dealer that is licensed under G.S. 113-169.3(f)(6), ~~(7) and~~ (7), or (8).
~~(c)~~(b) ~~Menhaden,~~ Atlantic menhaden, Atlantic thread herring, gizzard shad, and pinfish are exempt from this Rule.

Authority G.S. 113-134; 113-182; 113-185; 143B-289.52
15A NCAC 03M .0103 is proposed for readoption with substantive changes as follows:

15A NCAC 03M .0103 MINIMUM SIZE LIMITS
It is unlawful to possess, sell, or purchase finfish under four inches in length except:

(1) bait in the crab pot fishery in North Carolina with the following provision: such crab pot bait shall not be transported west of U.S. Interstate 95 and when transported, shall be accompanied by documentation showing the name and address of the shipper, the name and address of the consignee, and the total weight of the shipment;
(2) bait in the finfish fishery with the following provisions:
  (a) ~~It~~ it is unlawful to possess more than 200 pounds of live finfish or 100 pounds of dead finfish; and
  (b) ~~Such~~ such finfish bait may not be transported outside ~~the State~~ of North Carolina;
(3) live finfish in aquaria, provided the finfish are not subject to other minimum size limits under the authority of Marine Fisheries Commission ~~Rule;~~ rules; and
(4) ~~menhaden, herring,~~ Atlantic menhaden, Atlantic thread herring, gizzard shad, and pinfish.

Bait dealers who possess a valid finfish dealer license from the Division of Marine Fisheries are exempt from Sub-Items (2)(a) and (b) of this Rule. Tolerance of not more than five percent by number of species shall be allowed.

Authority G.S. 113-134; 113-182; 113-185; 143B-289.52

15A NCAC 03M .0501 RED DRUM
(a) It is unlawful to remove red drum from any type of net with the aid of any boat hook, gaff, spear, gig, or similar device.
(b) It is unlawful to take or possess red drum taken by any boat hook, gaff, spear, gig, or similar device.
(c) It is unlawful to possess red drum less than 18 inches total length or greater than 27 inches total length.
(d) It is unlawful to possess more than one red drum per person per day taken by ~~hook-and-line~~ hook and line or for recreational purposes.
(e) ~~The annual~~ Annual commercial harvest limit ~~(September 1 through August 31)~~ for red ~~drum~~ drum: ~~is 250,000 pounds. The annual commercial harvest limit is allotted in two periods: September 1 through April 30 at 150,000 pounds, and May 1 through August 31 at 100,000 pounds plus any remainder from the first period allotment. Any annual commercial harvest limit that is exceeded one year will result in the poundage overage being deducted from the subsequent year's commercial harvest limit and the Fisheries Director shall adjust the period allotments accordingly. If the harvest limit is projected to be taken in any period, the Fisheries Director shall, by proclamation, prohibit possession of red drum taken in a commercial fishing operation for the remainder of that period.~~

(1) The annual commercial harvest limit for red drum is 250,000 pounds.
(2) The annual commercial harvest limit for red drum is calculated from September 1 through August 31 and is allotted in two periods:
  (A) September 1 through April 30 at 150,000 pounds; and
  (B) May 1 through August 31 at 100,000 pounds plus any remainder from the first period allotment.
(3) If the harvest limit is projected to be taken in any period, the Fisheries Director shall, by proclamation, prohibit possession of red drum taken in a commercial fishing operation for the remainder of that period.

(4) Any commercial harvest limit that is exceeded one year shall result in the poundage overage being deducted from the subsequent year's commercial harvest limit and the Fisheries Director shall, by proclamation, adjust the period allotments as described in this Paragraph.

Authority G.S. 113-134; 113-182; ~~113-221;~~ 113-221.1; 143B-289.52

15A NCAC 03M .0502 MULLET

~~(a) The Fisheries Director may, by proclamation, impose any or all of the following restrictions on the taking of mullet:~~

~~(1) Specify season,~~
~~(2) Specify areas,~~
~~(3) Specify quantity,~~
~~(4) Specify means/methods,~~
~~(5) Specify size.~~

~~(b)~~(a) It is unlawful to possess more than 200 mullet per person per day for recreational purposes.

(b) The Fisheries Director may, by proclamation, impose any or all of the following restrictions on the taking of mullet:

(1) specify time;
(2) specify area;
(3) specify means and methods;
(4) specify season;
(5) specify size; and
(6) specify quantity, except as provided in Paragraph (a) of this Rule.

Authority G.S. 113-134; 113-182; ~~113-221;~~ 113-221.1; 143B-289.52

15A NCAC 03M .0506 ~~SNAPPER-GROUPER~~ SNAPPER GROUPER COMPLEX

(a) In the Atlantic Ocean, it is unlawful for an individual fishing under a Recreational Commercial Gear License with seines, shrimp trawls, pots, ~~trotlines~~ trotlines, or gill nets to take any species of the ~~Snapper-Grouper~~ snapper grouper complex.

(b) The species of the ~~snapper-grouper~~ snapper grouper complex listed in the South Atlantic Fishery Management Council Fishery Management Plan for the ~~Snapper Grouper~~ Snapper Grouper Fishery of the South Atlantic Region are hereby incorporated by ~~reference and copies~~ reference. Copies of the plan are available ~~via the Federal Register posted on the Internet~~ at www.safmc.net and at the Division of Marine Fisheries, 3441 Arendell Street, P.O. Box 769, Morehead City, North Carolina ~~28557~~ 28557, at no cost.

Authority G.S. 113-134; 113-182; ~~113-221;~~ 143B-289.52

15A NCAC 03M .0507 BILLFISH

(a) It is unlawful to take blue marlin, white marlin, roundscale spearfish, or sailfish, except by hook and line or for recreational purposes.

~~(a)~~(b) ~~Marlin: Taken for recreational purposes or by hook and line:~~For blue marlin, white marlin, and roundscale spearfish, it is unlawful to:

(1) ~~It is unlawful to~~ possess blue marlin less than 99 inches in length from the lower jaw to the fork in the tail.
(2) ~~It is unlawful to~~ possess white marlin or roundscale spearfish less than 66 inches in length from the lower jaw to the fork in the tail.
(3) ~~It is unlawful to~~ possess more than one blue marlin, ~~or~~ white ~~marlin~~ marlin, or roundscale spearfish in the aggregate per vessel per trip.
(4) ~~It is unlawful to~~ sell or offer for sale blue marlin, ~~or~~ white ~~marlin.~~marlin, or roundscale spearfish.

~~(b)~~(c) ~~Sailfish: Taken for recreational purposes or by hook and line:~~For sailfish, it is unlawful to:

(1) ~~It is unlawful to~~ possess sailfish less than 63 inches in length from the lower jaw to the fork in the tail.
(2) ~~It is unlawful to~~ possess more than one sailfish per person per day.

(3) ~~It is unlawful to~~ sell or offer for sale sailfish.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0510 AMERICAN EEL

~~It is unlawful to:~~

~~(1) Possess, sell or take American eels less than nine inches in length;~~

~~(2) Possess more than 25 American eels per person per day for recreational purposes, except the master and each mate of for-hire vessels that hold a valid for-hire license may possess 50 eels each per day; and~~

~~(3) Possess American eels from September 1 through December 31 except when taken by baited pots.~~

(a) It is unlawful to possess, sell, or take American eels less than nine inches in length.

(b) It is unlawful to possess more than 25 American eels per person per day for recreational purposes, except the master and each mate of for-hire vessels that hold a valid for-hire license may possess 50 eels each per day.

(c) It is unlawful to possess American eels from September 1 through December 31, except when taken by baited pots.

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0513 RIVER HERRING

It is unlawful to take or possess river herring from North Carolina Coastal Fishing Waters. Possession of river herring from sources other than North Carolina Coastal Fishing Waters shall be limited to fish less than or equal to six inches total length when aboard a vessel or while engaged in fishing.

Authority G.S. 113-134; 113-182; ~~113-221;~~ 143B-289.52

15A NCAC 03M .0515 DOLPHIN

(a) It is unlawful to possess for recreational purposes:

(1) more than 10 dolphin per person per day taken by hook and ~~line for recreational purposes.~~line.

(2) more than 60 dolphin per vessel per day regardless of the number of individuals on board, except headboat vessels with a valid U.S. Coast Guard Certificate of Inspection may possess 10 dolphin per paying customer.

~~(b) It is unlawful to possess more than 60 dolphin per day per vessel regardless of the number of people on board, except headboat vessels with a valid U.S. Coast Guard Certificate of Inspection may possess 10 dolphin per paying customer.~~

~~(c)~~(b) It is unlawful ~~to take or possess~~ in a commercial fishing operation without a valid federal Atlantic Dolphin/Wahoo Commercial vessel permit:

(1) to take or possess more than 10 dolphin per person per ~~day, or~~ day.

(2) to sell dolphin.~~dolphin without a valid Federal Commercial Dolphin/Wahoo vessel permit and either a Standard Commercial Fishing License, a Retired Standard Commercial Fishing License, or a Land or Sell License.~~

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0517 WAHOO

(a) It is unlawful to possess for recreational purposes more than two wahoo per person per day taken by hook and ~~line for recreational purposes.~~line.

(b) It is unlawful in a commercial fishing operation:

(1) without a valid federal Atlantic Dolphin/Wahoo Commercial vessel permit:

(A) to take or possess more than two wahoo per person per ~~day, or~~ day.

(B) to sell wahoo.~~wahoo without a Federal Commercial Dolphin/Wahoo permit and either a Standard Commercial Fishing License, Retired Standard Commercial Fishing License, or a Land or Sell License.~~

(2) to possess aboard a vessel or land more than 500 pounds of wahoo per trip.

~~(c) It is unlawful to possess aboard or land more than 500 pounds of wahoo per trip in a commercial fishing operation.~~

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0518 ~~KINGFISH~~ KINGFISHES (SEA MULLET)

The Fisheries Director may, by proclamation, impose any or all of the following restrictions on the taking of kingfishes:

~~(1) Specify season,~~
~~(2) Specify areas,~~
~~(3) Specify quantity,~~
~~(4) Specify means and methods,~~
~~(5) Specify size.~~
(1) specify time;
(2) specify area;
(3) specify means and methods;
(4) specify season;
(5) specify size; and
(6) specify quantity.

Authority G.S. 113-134; 113-182; ~~113-221; 143B-289.4~~113-221.1; 143B-289.52

15A NCAC 03M .0520 TUNA

(a) It is unlawful to possess for recreational purposes:

(1) yellowfin tuna less than 27 inches curved fork length.
(2) bigeye tuna less than 27 inches curved fork length.
(3) more than three yellowfin tuna per person per day.

~~(a)~~(b) It is unlawful to possess in a commercial fishing operation:

(1) ~~Yellowfin~~ yellowfin tuna less than 27 inches curved fork length or 27 inches from the fork of the tail to the forward edge of the cut of beheaded tuna.
(2) ~~Bigeye~~ bigeye tuna less than 27 inches curved fork length or 27 inches from the fork of the tail to the forward edge of the cut of beheaded tuna.
(3) ~~Bluefin~~ Atlantic bluefin tuna less than 73 inches curved fork length or 54 inches pectoral fin curved fork length.
~~(b)~~(4) ~~It is unlawful to possess in a commercial fishing operation tunas~~ tuna subject to a size or harvest restriction without having ~~tails~~ the tail attached.

~~(c) It is unlawful to possess for recreational purposes:~~

~~(1) Yellowfin tuna less than 27 inches curved fork length.~~
~~(2) Bigeye tuna less than 27 inches curved fork length.~~
~~(3) More than three yellowfin tuna per person per day.~~

Authority G.S. 113-134; 113-182; 143B-289.52

15A NCAC 03M .0521 SHEEPSHEAD

The Fisheries Director may, by proclamation, impose any or all of the following restrictions on the taking of sheepshead:

(1) specify time;
(2) specify area;
(3) specify means and methods;
(4) specify season;
(5) specify size; and
(6) specify quantity.

Authority G.S. 113-134; 113-182; 113-221.1; 143B-289.52

15A NCAC 03O .0106 DISPLAY OF LICENSES AND REGISTRATIONS

(a) It is unlawful:

(1) ~~For~~ for any person to use a vessel required to be registered under the provisions of G.S. 113-168.6 in a commercial fishing operation without a current ~~commercial fishing vessel registration~~ Commercial Fishing Vessel Registration decal mounted on an exterior surface so as to be plainly visible when viewed from the port side; and

(2) ~~To~~ to display any ~~commercial fishing vessel registration~~ Commercial Fishing Vessel Registration decal not issued for the vessel displaying it.

(b) It is unlawful to fail to display ~~any fish dealer's licenses~~ a Fish Dealer License required by G.S. ~~113-169.3,~~ 113-169.3 or ~~ocean fishing pier license~~ Ocean Fishing Pier License required by G.S. 113-169.4 in prominent public view in each location subject to licensing.

(c) It is unlawful for any person licensed under G.S. 113-174.3 to fail to display a current ~~For Hire License~~ for-hire vessel decal on the exterior surface of the vessel so as to be visible when viewed from the port side while engaged in for-hire recreational fishing.

Authority G.S. 113-134; 113-168.6; 113-169.3; 113-169.4; 113-174.1; 113-182; 143B-289.52

15A NCAC 03O .0501 PROCEDURES AND REQUIREMENTS TO OBTAIN PERMITS

(a) To obtain any Division of Marine Fisheries permit, an applicant, responsible party, or person holding a power of attorney shall provide the following information:

(1) the full name, physical address, mailing address, date of birth, and signature of the applicant on the application and, if the applicant is not appearing before a license agent or the designated Division of Marine Fisheries contact, the applicant's signature on the application shall be notarized;

(2) a current picture identification of applicant, responsible party, or person holding a power of ~~attorney. Acceptable~~ attorney, acceptable forms of which include ~~picture identification are~~ driver's license, North Carolina Identification card issued by the North Carolina Division of Motor Vehicles, military identification card, resident alien card (green card), or passport, or if applying by mail, a copy thereof;

(3) for permits that require a list of designees, the full names and dates of birth of designees of the applicant who will be acting under the requested permit;

(4) certification that the applicant and his designees do not have four or more marine or estuarine resource convictions during the previous three years;

(5) for permit applications from business entities:

(A) the business name;

(B) the type of business entity: corporation, "educational institution" as defined in ~~15A NCAC 03I .0101,~~ Rule 03I .0101 of this Chapter, limited liability company (LLC), partnership, or sole proprietorship;

(C) the name, address, and phone number of responsible party and other identifying information required by this Subchapter or rules related to a specific permit;

(D) for a corporation applying for a permit in a corporate name, the current articles of incorporation and a current list of corporate officers;

(E) for a partnership that is established by a written partnership agreement, a current copy of such agreement shall be provided when applying for a permit; and

(F) for business entities other than corporations, copies of current assumed name statements if filed with the Register of Deeds office for the corresponding county and copies of current business privilege tax certificates, if applicable; and

(6) additional information as required for specific permits.

~~(b) A permittee shall hold a valid Standard or Retired Standard Commercial Fishing License in order to hold a:~~

~~(1) Pound Net Permit;~~

~~(2) Permit to Waive the Requirement to Use Turtle Excluder Devices in the Atlantic Ocean;~~

~~(3) Atlantic Ocean Striped Bass Commercial Gear Permit; or~~

~~(4) Permit for Weekend Trawling for Live Shrimp.~~

~~(A) An individual who is assigned a Standard Commercial Fishing License is the individual required to hold a Permit for Weekend Trawling for Live Shrimp.~~

~~(B) The master designated on the single vessel corporation Standard Commercial Fishing License is the individual required to hold the Permit for Weekend Trawling for Live Shrimp.~~

(b) A permittee shall hold a valid:

(1) Standard or Retired Standard Commercial Fishing License in order to hold:

(A) an Atlantic Ocean Striped Bass Commercial Gear Permit;

(B) a Permit for Weekend Trawling for Live Shrimp; or

(C) a Pound Net Set Permit.

The master designated on the single vessel corporation Standard Commercial Fishing License is the individual required to hold the Permit for Weekend Trawling for Live Shrimp.

(2) Fish Dealer License in the proper category in order to hold dealer permits for monitoring fisheries under a quota or allocation for that category.

(c) An individual who is assigned a valid Standard Commercial Fishing License with applicable endorsements is eligible to hold any permit that requires a Standard Commercial Fishing License except a Pound Net Set Permit.

~~(c)~~(d) If mechanical methods to take shellfish are used, a permittee and his designees shall hold a valid Standard or Retired Standard Commercial Fishing License with a Shellfish Endorsement in order for a permittee to hold a:

~~(1) Permit to Transplant Prohibited (Polluted) Shellfish;~~

~~(2) Permit to Transplant Oysters from Seed Oyster Management Areas;~~

~~(3) Permit to Use Mechanical Methods for Shellfish on Shellfish Leases or Franchises, except as provided in G.S. 113-169.2;~~

~~(4) Permit to Harvest Rangia Clams from Prohibited (Polluted) Areas; or~~

~~(5) Depuration Permit.~~

(1) Depuration Permit;

(2) Permit to Harvest Rangia Clams from Prohibited (Polluted) Areas;

(3) Permit to Transplant Oysters from Seed Oyster Management Areas;

(4) Permit to Transplant Prohibited (Polluted) Shellfish; or

(5) Permit to Use Mechanical Methods for Shellfish on Shellfish Leases or Franchises, except as provided in G.S. 113-169.2.

~~(d)~~(e) If mechanical methods to take shellfish are not used, a permittee and his designees shall hold a valid Standard or Retired Standard Commercial Fishing License with a Shellfish Endorsement or a Shellfish License in order for a permittee to hold a:

~~(1) Permit to Transplant Prohibited (Polluted) Shellfish;~~

~~(2) Permit to Transplant Oysters from Seed Oyster Management Areas;~~

~~(3) Permit to Harvest Rangia Clams from Prohibited (Polluted) Areas; or~~

~~(4) Depuration Permit.~~

(1) Depuration Permit;

(2) Permit to Harvest Rangia Clams from Prohibited (Polluted) Areas;

(3) Permit to Transplant Oysters from Seed Oyster Management Areas; or

(4) Permit to Transplant Prohibited (Polluted) Shellfish.

~~(e) A permittee shall hold a valid:~~

~~(1) Fish Dealer License in the proper category in order to hold Dealer Permits for Monitoring Fisheries Under a Quota/Allocation for that category; and~~

~~(2) Standard Commercial Fishing License with a Shellfish Endorsement, Retired Standard Commercial Fishing License with a Shellfish Endorsement, or a Shellfish License in order to harvest clams or oysters for depuration.~~

(f) ~~Aquaculture Operations/Collection Permits:~~Aquaculture Operation Permit and Aquaculture Collection Permit:

(1) A permittee shall hold a valid Aquaculture Operation Permit issued by the Fisheries Director to hold an Aquaculture Collection Permit.

(2) The permittee or designees shall hold appropriate licenses from the Division of Marine Fisheries for the species harvested and the gear used under the Aquaculture Collection Permit.

(g) Atlantic Ocean Striped Bass Commercial Gear Permit:

(1) An applicant for an Atlantic Ocean Striped Bass Commercial Gear Permit shall declare one of the following types of gear for an initial permit and at intervals of three consecutive license years thereafter:
(A) a gill net;
(B) a trawl net; or
(C) a beach seine.
For the purpose of this Rule, a "beach seine" is defined as a swipe net constructed of multi-filament or multi-fiber webbing fished from the ocean beach that is deployed from a vessel launched from the ocean beach where the fishing operation takes place. Gear declarations shall be binding on the permittee for three consecutive license years without regard to subsequent annual permit issuance.

(2) A person is not eligible for more than one Atlantic Ocean Striped Bass Commercial Gear Permit regardless of the number of Standard Commercial Fishing Licenses, Retired Standard Commercial Fishing Licenses, or assignments held by the person.

(h) Applications submitted without complete and required information shall not be processed until all required information has been submitted. Incomplete applications shall be returned to the applicant with the deficiency in the application noted.

(i) A permit shall be issued only after the application has been deemed complete by the Division of Marine Fisheries and the applicant certifies to abide by the permit general and specific conditions established under ~~15A NCAC~~ Rules 03J .0501, .0505, 03K .0103, .0104, .0107, .0111, .0401, 03O .0502, and ~~.0503,~~ .0503 of this Chapter, as applicable to the requested permit.

(j) In determining whether to issue, modify, or renew a permit, the Fisheries Director or his agent shall evaluate factors such as the following:

(1) potential threats to public health or marine and estuarine resources regulated by the Marine Fisheries Commission;

(2) the applicant's demonstration of a valid justification for the permit and a showing of responsibility; and

(3) the applicant's history of fisheries violations evidenced by eight or more violations in 10 years.

(k) The Division of Marine Fisheries shall notify the applicant in writing of the denial or modification of any permit request and the reasons therefor. The applicant may submit further information or reasons why the permit should not be denied or modified.

(l) Permits are valid from the date of issuance through the expiration date printed on the permit. Unless otherwise established by rule, the Fisheries Director may establish the issuance timeframe for specific types and categories of permits based on season, calendar year, or other period based upon the nature of the activity permitted, the duration of the activity, compliance with federal or state fishery management plans or implementing rules, conflicts with other fisheries or gear usage, or seasons for the species involved. The expiration date shall be specified on the permit.

(m) For permit renewals, the permittee's signature on the application shall certify all information as true and accurate. Notarized signatures on renewal applications shall not be required.

(n) It is unlawful for a permit holder to fail to notify the Division of Marine Fisheries within 30 days of a change of name or address, in accordance with G.S. 113-169.2.

(o) It is unlawful for a permit holder to fail to notify the Division of Marine Fisheries of a change of designee prior to use of the permit by that designee.

(p) Permit applications are available at all Division of Marine Fisheries offices.~~Offices.~~

Authority G.S. 113-134; 113-169.1; 113-169.2; 113-169.3; 113-182; 113-210; 143B-289.52

15A NCAC 03O .0503 PERMIT CONDITIONS; SPECIFIC

~~(a) Horseshoe Crab Biomedical Use Permit:~~

~~(1) It is unlawful to use horseshoe crabs for biomedical purposes without first obtaining a permit.~~

~~(2) It is unlawful for persons who have been issued a Horseshoe Crab Biomedical Use Permit to fail to submit an annual report on the use of horseshoe crabs to the Division of Marine Fisheries due on February 1 of each year. Such reports shall be filed on forms provided by the Division and shall include a monthly account of the number of crabs harvested,~~

statement of percent mortality up to the point of release, harvest method, number or percent of males and females, and disposition of bled crabs prior to release.

(3) It is unlawful for persons who have been issued a Horseshoe Crab Biomedical Use Permit to fail to comply with the Atlantic States Marine Fisheries Commission Interstate Fishery Management Plan for Horseshoe Crab. The Atlantic States Marine Fisheries Commission Interstate Fishery Management Plan for Horseshoe Crab is incorporated by reference including subsequent amendments and editions. Copies of this plan are available via the Internet from the Atlantic States Marine Fisheries Commission at http://www.asmfc.org/fisheries-management/program-overview and at the Division of Marine Fisheries, 3441 Arendell Street, P.O. Box 769, Morehead City, NC 28557 at no cost.

(b) Dealers Permits for Monitoring Fisheries under a Quota/Allocation:

(1) During the commercial season opened by proclamation or rule for the fishery for which a Dealers Permit for Monitoring Fisheries under a Quota/Allocation permit is issued, it is unlawful for the fish dealers issued such permit to fail to:

(A) fax or send via electronic mail by noon daily, on forms provided by the Division, the previous day's landings for the permitted fishery to the dealer contact designated on the permit. Landings for Fridays or Saturdays shall be submitted on the following Monday. If the dealer is unable to fax or electronic mail the required information, the permittee shall call in the previous day's landings to the dealer contact designated on the permit.

(B) submit the required form set forth in Subitem (b)(1)(A) of this Rule to the Division upon request or no later than five days after the close of the season for the fishery permitted;

(C) maintain faxes and other related documentation in accordance with 15A NCAC 03I .0114;

(D) contact the dealer contact designated on the permit daily regardless of whether or not a transaction for the fishery for which a dealer is permitted occurred; and

(E) record the permanent dealer identification number on the bill of lading or receipt for each transaction or shipment from the permitted fishery.

(2) Striped Bass Dealer Permit:

(A) It is unlawful for a fish dealer to possess, buy, sell, or offer for sale striped bass taken from the following areas without first obtaining a Striped Bass Dealer Permit validated for the applicable harvest area:

(i) Atlantic Ocean;

(ii) Albemarle Sound Management Area as designated in 15A NCAC 03R .0201; and

(iii) the Joint and Coastal Fishing Waters of the Central/Southern Management Area as designated in 15A NCAC 03R .0201.

(B) No permittee shall possess, buy, sell, or offer for sale striped bass taken from the harvest areas opened by proclamation without having a North Carolina Division of Marine Fisheries issued valid tag for the applicable area affixed through the mouth and gill cover, or, in the case of striped bass imported from other states, a similar tag that is issued for striped bass in the state of origin. North Carolina Division of Marine Fisheries striped bass tags shall not be bought, sold, offered for sale, or transferred. Tags shall be obtained at the North Carolina Division of Marine Fisheries Offices. The Division of Marine Fisheries shall specify the quantity of tags to be issued based on historical striped bass landings. It is unlawful for the permittee to fail to surrender unused tags to the Division upon request.

(3) Albemarle Sound Management Area for River Herring Dealer Permit: It is unlawful to possess, buy, sell, or offer for sale river herring taken from the Albemarle Sound Management Area for River Herring as defined in 15A NCAC 03R .0202 without first obtaining an Albemarle Sound Management Area for River Herring Dealer Permit.

(4) Atlantic Ocean Flounder Dealer Permit:

~~(A) It is unlawful for a fish dealer to allow vessels holding a valid License to Land Flounder from the Atlantic Ocean to land more than 100 pounds of flounder from a single transaction at their licensed location during the open season without first obtaining an Atlantic Ocean Flounder Dealer Permit. The licensed location shall be specified on the Atlantic Ocean Flounder Dealer Permit and only one location per permit shall be allowed.~~

~~(B) It is unlawful for a fish dealer to possess, buy, sell, or offer for sale more than 100 pounds of flounder from a single transaction from the Atlantic Ocean without first obtaining an Atlantic Ocean Flounder Dealer Permit.~~

~~(5) Black Sea Bass North of Cape Hatteras Dealer Permit: It is unlawful for a fish dealer to purchase or possess more than 100 pounds of black sea bass taken from the Atlantic Ocean north of Cape Hatteras (35° 15.0321' N) per day per commercial fishing operation during the open season unless the dealer has a Black Sea Bass North of Cape Hatteras Dealer Permit.~~

~~(6) Spiny Dogfish Dealer Permit: It is unlawful for a fish dealer to purchase or possess more than 100 pounds of spiny dogfish per day per commercial fishing operation unless the dealer has a Spiny Dogfish Dealer Permit.~~

(a) Aquaculture Operation Permit and Aquaculture Collection Permit:

(1) It is unlawful to conduct aquaculture operations utilizing marine and estuarine resources without first securing an Aquaculture Operation Permit from the Fisheries Director.

(2) It is unlawful:

(A) to take marine and estuarine resources from Coastal Fishing Waters for aquaculture purposes without first obtaining an Aquaculture Collection Permit from the Fisheries Director;

(B) to sell, or use for any purpose not related to North Carolina aquaculture, marine and estuarine resources taken under an Aquaculture Collection Permit; or

(C) to fail to submit to the Fisheries Director an annual report due on December 1 of each year on the form provided by the Division of Marine Fisheries the amount and disposition of marine and estuarine resources collected under authority of an Aquaculture Collection Permit.

(3) Lawfully permitted shellfish relaying activities authorized by Rules 03K .0103 and .0104 of this Chapter are exempt from requirements to have an Aquaculture Operation Permit or Aquaculture Collection Permit issued by the Fisheries Director.

(4) Aquaculture Operation Permits and Aquaculture Collection Permits shall be issued or renewed on a calendar year basis.

(5) It is unlawful to fail to provide the Division with a listing of all designees acting under an Aquaculture Collection Permit at the time of application.

(b) Atlantic Ocean Striped Bass Commercial Gear Permit:

(1) It is unlawful to take striped bass from the Atlantic Ocean in a commercial fishing operation without first obtaining an Atlantic Ocean Striped Bass Commercial Gear Permit.

(2) It is unlawful to obtain more than one Atlantic Ocean Striped Bass Commercial Gear Permit during a license year, regardless of the number of Standard Commercial Fishing licenses, Retired Standard Commercial Fishing licenses, or assignments.

(c) Blue Crab Shedding Permit: It is unlawful to possess more than 50 blue crabs in a shedding operation without first obtaining a Blue Crab Shedding Permit from the Division of Marine Fisheries.

(d) Coastal Recreational Fishing License Exemption Permit:

(1) It is unlawful for the responsible party seeking exemption from recreational fishing license requirements for eligible individuals to conduct an organized fishing event held in Joint or Coastal Fishing Waters without first obtaining a Coastal Recreational Fishing License Exemption Permit.

(2) The Coastal Recreational Fishing License Exemption Permit shall only be issued for recreational fishing activity conducted solely for the participation and benefit of one of the following groups of eligible individuals:

(A) individuals with physical or mental limitations;

(B) members of the United States Armed Forces and their dependents, upon presentation of a valid military identification card;

(C) individuals receiving instruction on recreational fishing techniques and conservation practices from employees of state or federal marine or estuarine resource management agencies, or instructors affiliated with educational institutions; and

(D) disadvantaged youths as set forth in U.S. Code 42 § 12511.

For purposes of this Paragraph, educational institutions include high schools and other secondary educational institutions.

(3) The Coastal Recreational Fishing License Exemption Permit is valid for the date, time, and physical location of the organized fishing event for which the exemption is granted and the duration of the permit shall not exceed one year from the date of issuance.

(4) The Coastal Recreational Fishing License Exemption Permit shall only be issued when all of the following, in addition to the information required in Rule .0501 of this Section, is submitted to the Fisheries Director, in writing, at least 30 days prior to the event:

(A) the name, date, time, and physical location of the event;

(B) documentation that substantiates local, state, or federal involvement in the organized fishing event, if applicable;

(C) the cost or requirements, if any, for an individual to participate in the event; and

(D) an estimate of the number of participants.

(e) Dealer permits for monitoring fisheries under a quota or allocation:

(1) During the commercial season opened by proclamation or rule for the fishery for which a dealer permit for monitoring fisheries under a quota or allocation is issued, it is unlawful for a fish dealer issued such permit to fail to:

(A) fax or send via electronic mail by noon daily, on forms provided by the Division of Marine Fisheries, the previous day's landings for the permitted fishery to the Division; contact information for the Division is provided on the forms; landings for Fridays or Saturdays shall be submitted on the following Monday; if the dealer is unable to fax or electronically mail the required information, the permittee shall call in the previous day's landings to the Division;

(B) submit the required form set forth in Part (e)(1)(A) of this Rule to the Division upon request or no later than five days after the close of the season for the fishery permitted;

(C) maintain faxes and other related documentation in accordance with Rule 03I .0114 of this Chapter;

(D) contact the Division daily regardless of whether or not a transaction for the fishery for which a dealer is permitted occurred; and

(E) record the permanent dealer identification number on the bill of lading or receipt for each transaction or shipment from the permitted fishery.

(2) Atlantic Ocean Flounder Dealer Permit:

(A) It is unlawful for a fish dealer to allow vessels holding a valid License to Land Flounder from the Atlantic Ocean to land more than 100 pounds of flounder from a single transaction at their licensed location during the open season without first obtaining an Atlantic Ocean Flounder Dealer Permit. The licensed location shall be specified on the Atlantic Ocean Flounder Dealer Permit and only one location per permit shall be allowed.

(B) It is unlawful for a fish dealer to possess, buy, sell, or offer for sale more than 100 pounds of flounder from a single transaction from the Atlantic Ocean without first obtaining an Atlantic Ocean Flounder Dealer Permit.

(3) Black Sea Bass North of Cape Hatteras Dealer Permit: It is unlawful for a fish dealer to purchase or possess more than 100 pounds of black sea bass taken from the Atlantic Ocean north of Cape Hatteras (35° 15.0321' N) per day per commercial fishing operation during the open season unless the dealer has a Black Sea Bass North of Cape Hatteras Dealer Permit.

(4) Spiny Dogfish Dealer Permit: It is unlawful for a fish dealer to purchase or possess more than 100 pounds of spiny dogfish per day per commercial fishing operation unless the dealer has a Spiny Dogfish Dealer Permit.

(5) Striped Bass Dealer Permit:

(A) It is unlawful for a fish dealer to possess, buy, sell, or offer for sale striped bass taken from the following areas without first obtaining a Striped Bass Dealer Permit validated for the applicable harvest area:
(i) Atlantic Ocean;
(ii) Albemarle Sound Management Area as designated in Rule 03R .0201 of this Chapter; or
(iii) the Joint and Coastal Fishing Waters of the Central/Southern Management Area as designated in Rule 03R .0201 of this Chapter.

(B) No permittee shall possess, buy, sell, or offer for sale striped bass taken from the harvest areas opened by proclamation without having a valid Division of Marine Fisheries-issued tag for the applicable area affixed through the mouth and gill cover or, in the case of striped bass imported from other states, a similar tag that is issued for striped bass in the state of origin. Division striped bass tags shall not be bought, sold, offered for sale, or transferred. Tags shall be obtained at the Division offices. The Division shall specify the quantity of tags to be issued based on historical striped bass landings. It is unlawful for the permittee to fail to surrender unused tags to the Division upon request.

(f) Horseshoe Crab Biomedical Use Permit:

(1) It is unlawful to use horseshoe crabs for biomedical purposes without first obtaining a permit.

(2) It is unlawful for persons who have been issued a Horseshoe Crab Biomedical Use Permit to fail to submit an annual report on the use of horseshoe crabs to the Division of Marine Fisheries due on February 1 of each year. Such reports shall be filed on forms provided by the Division and shall include a monthly account of the number of crabs harvested, statement of percent mortality up to the point of release, harvest method, number or percent of males and females, and disposition of bled crabs prior to release.

(3) It is unlawful for persons who have been issued a Horseshoe Crab Biomedical Use Permit to fail to comply with the Atlantic States Marine Fisheries Commission Interstate Fishery Management Plan for Horseshoe Crab. The Atlantic States Marine Fisheries Commission Interstate Fishery Management Plan for Horseshoe Crab is incorporated by reference including subsequent amendments and editions. Copies of this plan are available via the Internet from the Atlantic States Marine Fisheries Commission at http://www.asmfc.org/fisheries-management/program-overview and at the Division of Marine Fisheries, 3441 Arendell Street, P.O. Box 769, Morehead City, NC 28557, at no cost.

(g) Permit for Weekend Trawling for Live Shrimp:

(1) It is unlawful to take shrimp with trawls from 9:00 p.m. on Friday through 12:00 p.m. (noon) on Saturday without first obtaining a Permit for Weekend Trawling for Live Shrimp.

(2) It is unlawful for a holder of a Permit for Weekend Trawling for Live Shrimp to use trawls from 12:01 p.m. on Saturday through 4:59 p.m. on Sunday.

(3) It is unlawful for a permit holder during the timeframe specified in Subparagraph (k)(1) of this Rule to:

(A) use trawl nets to take live shrimp except from areas open to the harvest of shrimp with trawls;

(B) take shrimp with trawls that have a combined headrope length of greater than 40 feet in Internal Coastal Waters;

(C) possess more than one gallon of dead shrimp (heads on) per trip;

(D) fail to have a functioning live bait tank or a combination of multiple functioning live bait tanks with aerator(s) and/or circulating water, with a minimum combined tank capacity of 50 gallons; or

(E) fail to call the Division of Marine Fisheries Communications Center at 800-682-2632 or 252-726-7021 prior to each weekend use of the permit, specifying activities and location.

~~(d) Permit to Waive the Requirement to Use Turtle Excluder Devices in the Atlantic Ocean:~~

~~(1) It is unlawful to trawl for shrimp in the Atlantic Ocean without Turtle Excluder Devices installed in trawls within one nautical mile of the shore from Browns Inlet (34° 35.7000' N latitude) to Rich's Inlet (34° 17.6000' N latitude) without a valid Permit to Waive the Requirement to Use Turtle Excluder Devices in the Atlantic Ocean when allowed by proclamation as set forth in 15A NCAC 03I .0107 from April 1 through November 30.~~

~~(2) It is unlawful to tow a shrimp trawl net for more than 55 minutes from April 1 through October 31 and 75 minutes from November 1 through November 30 in the area described in Subparagraph (d)(1) of this Rule when working under this permit. Tow time begins when the doors enter the water and ends when the doors exit the water.~~

~~(3) It is unlawful to fail to empty the contents of each net at the end of each tow.~~

~~(4) It is unlawful to refuse to take observers upon request by the Division of Marine Fisheries or the National Oceanic and Atmospheric Administration Fisheries.~~

~~(5) It is unlawful to fail to report any sea turtle captured. Reports shall be made within 24 hours of the capture to the Marine Patrol Communications Center by phone. All turtles taken incidental to trawling shall be handled and resuscitated in accordance with requirements specified in 50 Code of Federal Regulations (CFR) 223.206. 50 CFR 223.206 is hereby incorporated by reference, including subsequent amendments and editions. A copy of the reference materials can be found at http://www.ecfr.gov/cgi-bin/text-idx?SID=9088932317e242b91d6a87a47b6bda54&mc=true&tpl=/ecfrbrowse/Title50/50tab_02.tpl, free of charge.~~

~~(e)~~(h) Pound Net Set Permit: The holder of a Pound Net Set Permit shall follow the Pound Net Set Permit conditions as set forth in Rule ~~15A NCAC~~ 03J .0505 ~~sets forth the specific conditions for pound net set permits.~~ of this Chapter.

~~(f) Aquaculture Operation Permit and Aquaculture Collection Permit:~~

~~(1) It is unlawful to conduct aquaculture operations utilizing marine and estuarine resources without first securing an Aquaculture Operation Permit from the Fisheries Director.~~

~~(2) It is unlawful:~~

~~(A) to take marine and estuarine resources from Coastal Fishing Waters for aquaculture purposes without first obtaining an Aquaculture Collection Permit from the Fisheries Director;~~

~~(B) to sell, or use for any purpose not related to North Carolina aquaculture, marine and estuarine resources taken under an Aquaculture Collection Permit; and~~

~~(C) to fail to submit to the Fisheries Director an annual report due on December 1 of each year on the form provided by the Division the amount and disposition of marine and estuarine resources collected under authority of an Aquaculture Collection Permit.~~

~~(3) Lawfully permitted shellfish relaying activities authorized by 15A NCAC 03K .0103 and .0104 are exempt from requirements to have an Aquaculture Operation Permit or Aquaculture Collection Permit issued by the Fisheries Director.~~

~~(4) Aquaculture Operation Permits and Aquaculture Collection Permits shall be issued or renewed on a calendar year basis.~~

~~(5) It is unlawful to fail to provide the Division of Marine Fisheries with a listing of all designees acting under an Aquaculture Collection Permit at the time of application.~~

~~(g)~~(i) Scientific or Educational Activity Permit:

(1) It is unlawful for institutions or agencies seeking exemptions from license, rule, proclamation, or statutory requirements to collect, hold, culture, or exhibit for scientific or educational purposes any marine or estuarine species without first obtaining a Scientific or Educational Activity Permit.

(2) The Scientific or Educational Activity Permit shall only be issued for collection methods and possession allowances approved by the Division of Marine Fisheries.

(3) The Scientific or Educational Activity Permit shall only be issued for approved activities conducted by or under the direction of Scientific or Educational institutions as defined in Rule ~~15A NCAC 03I .0101.~~03I .0101 of this Chapter.

(4) It is unlawful for the responsible party issued a Scientific or Educational Activity Permit to fail to submit an annual report on collections and, if authorized, sales to the Division ~~of Marine Fisheries~~ due on December 1 of each year unless otherwise specified on the permit.

The reports shall be filed on forms provided by the Division. Scientific or Educational Activity permits shall be issued on a calendar year basis.

(5) It is unlawful to sell marine or estuarine species taken under a Scientific or Educational Activity Permit without:
   (A) the required license for such sale;
   (B) an authorization stated on the permit for such sale; and
   (C) providing the information required in Rule ~~15A NCAC~~ 03I .0114 of this Chapter if the sale is to a licensed fish dealer.

(6) It is unlawful to fail to provide the Division ~~of Marine Fisheries~~ a listing of all designees acting under a Scientific or Educational Activity Permit at the time of application.

(7) The permittee or designees utilizing the permit shall call the Division of Marine Fisheries Communications Center at 800-682-2632 or 252-726-7021 not later than 24 hours prior to use of the permit, specifying activities and location.

~~(h)~~(j) Under Dock Oyster Culture Permit:

(1) It is unlawful to cultivate oysters in containers under docks for personal consumption without first obtaining an Under Dock Oyster Culture Permit.

(2) An Under Dock Oyster Culture Permit shall be issued only in accordance with provisions set forth in G.S. 113-210(c).

(3) The applicant shall complete and submit an examination, with a minimum of 70 percent correct answers, based on an educational package provided by the Division of Marine Fisheries pursuant to G.S. 113-210(j). The examination demonstrates the applicant's knowledge of:
   (A) the application process;
   (B) permit criteria;
   (C) basic oyster biology and culture techniques;
   (D) shellfish harvest area closures due to pollution;
   (E) safe handling practices;
   (F) permit conditions; and
   (G) permit revocation criteria.

(4) Action by an Under Dock Oyster Culture Permit holder to encroach on or usurp the legal rights of the public to access public trust resources in Coastal Fishing Waters shall result in permit revocation.

~~(i) Atlantic Ocean Striped Bass Commercial Gear Permit:~~

~~(1) It is unlawful to take striped bass from the Atlantic Ocean in a commercial fishing operation without first obtaining an Atlantic Ocean Striped Bass Commercial Gear Permit.~~

~~(2) It is unlawful to use a single Standard Commercial Fishing License, including assignments, to obtain more than one Atlantic Ocean Striped Bass Commercial Gear Permit during a license year.~~

~~(j) Coastal Recreational Fishing License Exemption Permit:~~

~~(1) It is unlawful for the responsible party seeking exemption from recreational fishing license requirements for eligible individuals to conduct an organized fishing event held in Joint or Coastal Fishing Waters without first obtaining a Coastal Recreational Fishing License Exemption Permit.~~

~~(2) The Coastal Recreational Fishing License Exemption Permit shall only be issued for recreational fishing activity conducted solely for the participation and benefit of one of the following groups of eligible individuals:~~
   ~~(A) individuals with physical or mental limitations;~~
   ~~(B) members of the United States Armed Forces and their dependents, upon presentation of a valid military identification card;~~
   ~~(C) individuals receiving instruction on recreational fishing techniques and conservation practices from employees of state or federal marine or estuarine resource management agencies, or instructors affiliated with educational institutions; and~~
   ~~(D) disadvantaged youths as set forth in U.S. Code 42 § 12511.~~

~~For purposes of this Paragraph, educational institutions include high schools and other secondary educational institutions.~~

~~(3) The Coastal Recreational Fishing License Exemption Permit is valid for the date, time, and physical location of the organized fishing event for which the exemption is granted and the duration of the permit shall not exceed one year from the date of issuance.~~

~~(4) The Coastal Recreational Fishing License Exemption Permit shall only be issued when all of the following, in addition to the information required in 15A NCAC 03O .0501, is submitted to the Fisheries Director, in writing, at least 30 days prior to the event:~~

~~(A) the name, date, time, and physical location of the event;~~

~~(B) documentation that substantiates local, state, or federal involvement in the organized fishing event, if applicable;~~

~~(C) the cost or requirements, if any, for an individual to participate in the event; and~~

~~(D) an estimate of the number of participants.~~

~~(k) Permit for Weekend Trawling for Live Shrimp:~~

~~(1) It is unlawful to take shrimp with trawls from 9:00 p.m. on Friday through 12:00 p.m. (noon) on Saturday without first obtaining a Permit for Weekend Trawling for Live Shrimp.~~

~~(2) It is unlawful for a holder of a Permit for Weekend Trawling for Live Shrimp to use trawls from 12:01 p.m. on Saturday through 4:59 p.m. on Sunday.~~

~~(3) It is unlawful for a permit holder during the timeframe specified in Subparagraph (k)(1) of this Rule to:~~

~~(A) use trawl nets to take live shrimp except from areas open to the harvest of shrimp with trawls;~~

~~(B) take shrimp with trawls that have a combined headrope length of greater than 40 feet in Internal Coastal Waters;~~

~~(C) possess more than one gallon of dead shrimp (heads on) per trip;~~

~~(D) fail to have a functioning live bait tank or a combination of multiple functioning live bait tanks with aerator(s) and/or circulating water, with a minimum combined tank capacity of 50 gallons; and~~

~~(E) fail to call the Division of Marine Fisheries Communications Center at 800-682-2632 or 252-726-7021 prior to each weekend use of the permit, specifying activities and location.~~

Authority G.S. 113-134; 113-169.1; 113-169.2; 113-169.3; 113-182; 113-210; 143B-289.52

15A NCAC 03R .0112 ATTENDED GILL NET AREAS

(a) The attended gill net areas referenced in 15A NCAC 03J .0103(g) are delineated in the following areas:

(1) Pamlico River, west of a line beginning at a point 35° 27.5768' N - 76° 54.3612' W on Ragged Point; running southwesterly to a point 35° 26.9176' N - 76° 55.5253' W on Mauls Point;

(2) ~~Within~~ within 200 yards of any shoreline in Pamlico River and its tributaries east of a line beginning at a point 35° 27.5768' N - 76° 54.3612' W on Ragged Point; running southwesterly to a point 35° 26.9176' N - 76° 55.5253' W on Mauls Point; and west of a line beginning at a point 35° 22.3622' N - 76° 28.2032' W on Roos Point; running southerly to a point at 35° 18.5906' N - 76° 28.9530' W on Pamlico Point;

(3) Pungo River, east of the northern portion of the Pantego Creek breakwater and a line beginning at a point 35° 31.7198' N - 76° 36.9195' W on the northern side of the breakwater near Tooleys Point; running southeasterly to a point 35° 30.5312' N - 76° 35.1594' W on Durants Point;

(4) ~~Within~~ within 200 yards of any shoreline in Pungo River and its tributaries west of the northern portion of the Pantego Creek breakwater and a line beginning at a point 35° 31.7198' N - 76° 36.9195' W on the northern side of the breakwater near Tooleys Point; running southeasterly to a point 35° 30.5312' N - 76° 35.1594' W on Durants Point; and west of a line beginning at a point 35° 22.3622' N - 76° 28.2032' W on Roos Point; running southerly to a point at 35° 18.5906' N - 76° 28.9530' W on Pamlico Point;

(5) Neuse River and its tributaries northwest of the Highway 17 highrise bridge;

(6) Trent River and its tributaries; and

(7) ~~Within~~ within 200 yards of any shoreline in Neuse River and its tributaries east of the Highway 17 highrise bridge and south and west of a line beginning on Maw Point at a point 35° 09.0407' N - 76° 32.2348' W; running southeasterly near the Maw Point Shoal Marker "2" to a point 35° 08.1250' N - 76° 30.8532' W; running southeasterly near the Neuse River Entrance Marker "NR" to a point 35° 06.6212' N - 76° 28.5383' W; running southerly to a point 35° 04.4833' N - 76° 28.0000' W near Point of Marsh in Neuse River. In Core and Clubfoot creeks, the Highway 101 Bridge constitutes the attendance boundary.

(b) The attended gill net areas referenced in 15A NCAC 03J .0103(h) are delineated in the following Internal Coastal Waters and Joint Fishing Waters of the state south of a line beginning on Roanoke Marshes Point at a point 35° 48.3693' N - 75° 43.7232' W; running southeasterly to a point 35° 44.1710' N - 75° 31.0520' W on Eagles Nest Bay to the South Carolina State line:

(1) ~~All~~ all primary nursery areas described in 15A NCAC 03R .0103, all permanent secondary nursery areas described in 15A NCAC 03R .0104, and no-trawl areas described in 15A NCAC 03R .0106(2), (4), (5), (8), (10), (11), and (12);

(2) ~~In~~ in the area along the Outer Banks, beginning at a point 35° 44.1710' N - 75° 31.0520' W on Eagles Nest Bay; running northwesterly to a point 35° 45.1833' N - 75° 34.1000' W west of Pea Island; running southerly to a point 35° 40.0000' N - 75° 32.8666' W west of Beach Slough; running southeasterly and passing near Beacon "2" in Chicamicomico Channel to a point 35° 35.0000' N - 75° 29.8833' W west of the Rodanthe Pier; running southwesterly to a point 35° 28.4500' N - 75° 31.3500' W on Gull Island; running southerly to a point 35° 22.3000' N - 75° 33.2000' W near Beacon "2" in Avon Channel ; running southwesterly to a point 35° 19.0333' N - 75° 36.3166' W near Beacon "2" in Cape Channel; running southwesterly to a point 35° 15.5000' N - 75° 43.4000' W near Beacon "36" in Rollinson Channel; running southeasterly to a point 35° 14.9386' N - 75° 42.9968' W near Beacon "35" in Rollinson Channel; running southwesterly to a point 35° 14.0377' N - 75° 45.9644' W near a "Danger" Beacon northwest of Austin Reef; running southwesterly to a point 35° 11.4833' N - 75° 51.0833' W on Legged Lump; running southeasterly to a point 35° 10.9666' N - 75° 49.7166' W south of Legged Lump; running southwesterly to a point 35° 09.3000' N - 75° 54.8166' W near the west end of Clarks Reef; running westerly to a point 35° 08.4333' N - 76° 02.5000' W near Nine Foot Shoal Channel; running southerly to a point 35° 06.4000' N - 76° 04.3333' W near North Rock; running southwesterly to a point 35° 01.5833' N - 76° 11.4500' W near Beacon "HL"; running southerly to a point 35° 00.2666' N - 76° 12.2000' W; running southerly to a point 34° 59.4664' N - 76° 12.4859' W on Wainwright Island; running easterly to a point 34° 58.7853' N - 76° 09.8922' W on Core Banks; running northerly along the shoreline and across the inlets following the COLREGS Demarcation Line to the point of beginning;

(3) ~~In~~ in Core and Back sounds, beginning at a point 34° 58.7853' N - 76° 09.8922' W on Core Banks; running northwesterly to a point 34° 59.4664' N - 76° 12.4859' W on Wainwright Island; running southerly to a point 34° 58.8000' N - 76° 12.5166' W; running southeasterly to a point 34° 58.1833' N - 76° 12.3000' W; running southwesterly to a point 34° 56.4833' N - 76° 13.2833' W; running westerly to a point 34° 56.5500' N - 76° 13.6166' W; running southwesterly to a point 34° 53.5500' N - 76° 16.4166' W; running northwesterly to a point 34° 53.9166' N - 76° 17.1166' W; running southerly to a point 34° 53.4166' N - 76° 17.3500' W; running southwesterly to a point 34° 51.0617' N - 76° 21.0449' W; running southwesterly to a point 34° 48.3137' N - 76° 24.3717' W; running southwesterly to a point 34° 46.3739' N - 76° 26.1526' W; running southwesterly to a point 34° 44.5795' N - 76° 27.5136' W; running southwesterly to a point 34° 43.4895' N - 76° 28.9411' W near Beacon "37A"; running southwesterly to a point 34° 40.4500' N - 76° 30.6833' W; running westerly to a point 34° 40.7061' N - 76° 31.5893' W near Beacon "35" in Back Sound; running westerly to a point 34° 41.3178' N -76° 33.8092' W near Buoy "3"; running southwesterly to a point 34° 39.6601' N - 76° 34.4078' W on Shackleford Banks; running easterly and northeasterly along the shoreline and across the inlets following the COLREGS Demarcation lines to the point of beginning;

(4) ~~Within~~ within 200 yards of any shoreline in the area upstream of the 76° 28.0000' W longitude line beginning at a point 35° 22.3752' N - 76° 28.0000' W near Roos Point in Pamlico River; running southeasterly to a point 35° 04.4833' N - 76° 28.0000' W near Point of Marsh in Neuse River; and

(5) ~~Within~~ within 50 yards of any shoreline east of the 76° 28.0000' W longitude line beginning at a point 35° 22.3752' N - 76° 28.0000' W near Roos Point in Pamlico River; running southeasterly to a point 35° 04.4833' N - 76° 28.0000' W near Point of Marsh in Neuse River, except from October 1 through November 30, south and east of Highway 12 in Carteret County and south of a line from a point 34° 59.7942' N - 76° 14.6514' W on Camp Point; running easterly to a point at 34° 58.7853' N - 76° 09.8922' W on Core Banks; to the South Carolina State Line.

Authority G.S. 113-134; 113-173; 113-182; ~~113-221;~~ 143B-289.52