Director's Report

INFORMATION WILL BE PROVIDED AT THE MEETING.

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Volume 24, Issue 3
June/July 2015

ASMFC
FISHERIES focus
Vision: Sustainably Managing Atlantic Coastal Fisheries

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ASMFC Summer Meeting

August 4-6, 2015

The Westin Alexandria
400 Courthouse Square
Alexandria, VA
703.253.8600

Preliminary Agenda

Please note: 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.

TUESDAY, AUGUST 4

8 - 10 AM

Executive Committee
- Executive Director's Annual Review **(Closed Session)**
- Review Performance and Recommended Changes to Appeal Process
- Review Recommended Changes to the Commission Guidance Documents
- Review Recommended Changes to Advisory Panel and Law Enforcement Participation at Board Meetings
- Review Conservation Equivalency Policy
- Future Annual Meetings Update

10:15 -11:45 AM

Atlantic Herring Section
- Provide Guidance to Plan Development Team on Revising Proposed Spawning Protection Measures of Draft Amendment 3
- Update on New England Fishery Management Council Actions

12:45 - 5 PM

American Lobster Management Board
- Review and Consider Acceptance of the 2015 Benchmark Stock Assessment and Peer Review Panel Reports
- Discuss Need for Management Response to the Benchmark Assessment
- Discuss Possible Addendum Initiation to Prohibit All Mobile Gear in Closed Area II from June 15 - October 31
- Update on Lobster Trap Transfer Database
- Review and Consider Final Approval of Jonah Crab Fishery Management Plan
- Discuss New England Fishery Observer Program (Tentative)

continued, see SUMMER MEETING AGENDA on page 6

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

Dr. Louis B. Daniel, III (NC)
Chair

Douglas E. Grout (NH)
Vice-Chair

Robert E. Beal
Executive Director

Patrick A. Campfield
Science Director

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Upcoming Meetings

July 15 (1 PM)
ASMFC Atlantic Menhaden Allocation Working Group Conference Call; go to http://www.asmfc.org/calendar for more details.

July 16 (2 PM)
ASMFC Weakfish Technical Committee Conference Call; go to http://www.asmfc.org/calendar for more details.

July 22 (3 - 6 PM)
ASMFC Jonah Crab Advisory Panel, Renaissance Providence Downtown, 5 Avenue of the Arts, Providence, RI.

July 27 - 30
ASMFC Weakfish Assessment Workshop, ASMFC, 1050 North Highland Street, Suite 200A-N, Arlington, VA.

July 30
ASMFC Atlantic Herring Section Days Out Conference Call; go to http://www.asmfc.org/calendar for more details.

August 4 - 6
ASMFC Summer Meeting, The Westin Alexandria, 400 Courthouse Square, Alexandria, VA.

August 10 - 13
Mid-Atlantic Fishery Management Council, Holiday Inn Midtown, 440 West 57th Street, New York City, NY.

August 14 (9 AM)
ASMFC Ecosystem Management Objectives Workshop Conference Call; go to http://www.asmfc.org/calendar for more details.

August 25 - 27
SEDAR Red Drum Assessment Review Workshop, Frances Marion Hotel, 387 King Street, Charleston, SC.

August 31 - September 1 (8:30 AM - 5 PM both days)
ASMFC Ecosystem Management Objectives Workshop, The Hotel at Arundel Preserve, 7795 Arundel Mills Boulevard, Hanover, MD.

September 14 - 18
South Atlantic Fishery Management Council, The Beach House Resort, 1 South Forest Beach Drive, Hilton Head Island, SC.

September 14 - 18
ASMFC Technical Committee Meeting Week, committees and location to be determined.

September 29 - October 1
New England Fishery Management Council, Radisson Hotel, Plymouth Harbor, Plymouth, MA.

October 6 - 8
Mid-Atlantic Fishery Management Council, Doubletree Philadelphia Center City 237 S Broad St Philadelphia, PA.

November 2 - 5
Joint Annual Meeting of the ASMFC & GSMFC, World Golf Village Renaissance St. Augustine Resort, 500 South Legacy Trail, St. Augustine, FL.

December 1 - 3
New England Fishery Management Council, Holiday Inn by the Bay, Portland, ME.

December 7 - 11
South Atlantic Fishery Management Council, Doubletree by Hilton Oceanfront Hotel, 2717 W. Fort Macon Road, Atlantic Beach, NC.

ASMFC Charts a New Course for Atlantic Menhaden Management

While Atlantic menhaden are not big fish, their historical, economic and ecological importance along the Atlantic coast is sizable. The commercial menhaden fishery can be traced as far back as colonial times when Native Americans, who called menhaden munnawhatteaug, taught colonists to use the fish as fertilizer for corn. The Commission became involved with menhaden in 1942 at its first Annual Meeting where Commissioners discussed how fisheries production could support the war effort. For menhaden, those discussions centered on the development of a menhaden cannery for wartime consumption. Over the next 40 years, Commissioners would continue to monitor the status of the resource and the fishery. However, it was not until 1981, with the adoption of the first Interstate Fishery Management Plan (FMP) for Atlantic Menhaden, that Commissioners began to truly manage this resource. (Interestingly, this plan and the Atlantic Striped Bass FMP were the first two FMPs adopted by the Commission). Thirty-one years later Amendment 2 was adopted and instituted the first total allowable catch limit for menhaden.

Now on the heels of the 2015 Benchmark Stock Assessment, we are once again heading into a new era of Atlantic menhaden management. Traditionally, the Commission has managed this fishery with a focus on mortality and reproductive capacity. However, this approach does not directly to take into account the ecological role of a forage species, like menhaden. At our 2015 Spring Meeting, Commissioners initiated Draft Amendment 3 to establish reference points to address menhaden's vital ecological role.

To initiate discussions on ecosystem objectives and allocation, the Commission's Atlantic Menhaden Management Board (Board) established two working groups to identify issues and options for Board discussion and consideration as part of the amendment process. The first working group, composed of Board members, stakeholder representatives, and technical experts, is tasked with identifying potential ecosystem goals and objectives to aid in the development of ecological reference points. This multi-disciplinary group will have a planning meeting via webinar in early August and an in-person workshop on August 31 and September 1. The webinar will review topics to be covered, expectations, and workshop goals, as well as provide participants an opportunity to ask questions and make suggestions on the process. It will also feature an ecosystem management case study from the Great Lakes region. The workshop will be facilitated by Dr. Michael Jones, who chaired the Peer Review Panel for the 2015 Atlantic Menhaden Benchmark Stock Assessment. Dr. Jones is knowledgeable of Atlantic menhaden science and management, and has expertize in ecosystem management in the Great Lakes region.

The second working group is comprised of a subset of Board members (see Board subgroup list below) and will focus on the issue of allocation. This working group is tasked with informing the Board as it develops options to be included in Draft Amendment 3. The first meeting of this working group, via webinar, is scheduled for July 15.

No management decisions will be formulated or acted upon by either working group. The meetings are a means to initiate discussions on ecosystem objectives and allocation, allowing for the identification of issues and options for Board discussion and consideration. All management actions must be approved by the Board at one of the Commission's four yearly meetings. In order to ensure transparency, the discussions of both working groups will be open to the public and interested stakeholders.

Ecosystem Management Objectives Workshop Participants

Board Subgroup
Russ Allen (NJ)
Bob Ballou (RI, Menhaden Board Vice Chair)
Robert Boyles (SC, Menhaden Board Chair)
Lynn Fegley (MD)
Jim Gilmore (NY)
Rob O'Reilly (VA)

Advisory Panel Subgroup
Ken Hinman (ecosystem)
Jeff Kaelin (bait, AP Chair)
Ron Lukens (reduction)
David Sikorski (recreational)

Technical Representatives
Matt Cieri (ME, BERP Chair)
Jason McNamee (RI, TC Chair)
Amy Schueller (NMFS, SAS Chair)

Facilitator
Michael Jones (SEDAR 40 Review Panel Chair)

These workshops reflect the Commission's continued commitment to addressing the importance of Atlantic menhaden to the ecosystem and industry. To be successful, the process will require the involvement of all interested parties – managers, stakeholders, and scientists – who are committed to the sustainable management of this valuable resource. The Commission's commitment to developing ecological reference points represents an important step forward not only for menhaden, but for coastal fisheries management as a whole. Until recently, managers have not had the tools necessary to undertake a holistic view of fishery management. As with any major new initiative, Commissioners are going to allow adequate time to ensure they listen to their constituents and use the best available science to do what is right for the resource and the fisheries it supports.

ASMFC Moves Forward on 2017 Benchmark Stock Assessment

Introduction

For the past 25 years, the 15 Atlantic coast states, through the Commission, have sought to effectively manage Atlantic sturgeon throughout its range. With the approval of Amendment I to the Atlantic Sturgeon FMP in 1998, which implemented a 40-year coastwide moratorium on harvest, states committed to protecting this ancient species. Additionally, states have invested considerable resources to increase understanding of sturgeon biology and life history. Despite these efforts, in February 2012 NOAA Fisheries announced Atlantic sturgeon was added to the Endangered Species List. In response, the Commission has initiated a coastwide stock assessment to evaluate stock status, stock delineation, and bycatch.

Life History

Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*) are ancient fish, dating back at least 150 million years. Historically, they have been found along the entire Atlantic coast from Labrador, Canada to St. Johns River, Florida. Atlantic sturgeon can reach lengths of over 14 feet, weigh over 800 pounds, and can live up to 60 years. They are also known to undergo extensive coastal migrations, which take them from the ocean into coastal estuaries and rivers to spawn once every two to five years.

Typically, sturgeon in the southern part of the species range mature faster and grow larger than those in the northern part of the range. Females reach sexual maturity between the ages of seven and 30, and males between the ages of five and 24. The number of eggs a female produces increases with age and size, which means older and larger females are more valuable to the population because they produce more eggs (up to eight millions eggs per spawning event) than younger, smaller females (estimated 400,000 eggs per spawning event). The oldest known sturgeon was estimated to be 60 years old.

Atlantic sturgeon are one of the largest and longest-lived anadromous fish in North America. Most juveniles remain in freshwater rivers from one to six years before migrating back out to the ocean. As mature adults, they return to their natal streams to spawn. Little is known about the movements of Atlantic sturgeon when they are at sea, and little is known about actual spawning locations. Sturgeon don't have teeth. Instead, they suck up prey using their downward projecting vacuum-like mouth. As juveniles, Atlantic sturgeon feed on flies, worms, shrimps, and small mollusks and crustaceans. As adults, they are opportunistic feeders and prey mainly on mollusks, snails, worms, shrimps and benthic fish. Very little is known about their natural predators.

Commercial Fishery

Atlantic sturgeon have been taken for food by humans in North America for at least 3,000-4,000 years, and have supported commercial fisheries of varying magnitude since colonial times. The fishery was once considered second in value only to lobster. There are reports from Maine and Massachusetts from as early as the 1600s that cite sturgeon as an important fishery in those states. While sturgeon were primarily harvested for their flesh and eggs

From Left: Matthew Breece and Dewayne Fox with a large female Atlantic sturgeon captured as part of Delaware State University's (DESU) Spring Sturgeon Sampling Program. The female measured 8.6 feet in total length and weighed 260 pounds. Photo (c) DESU.

Species Snapshot

Atlantic Sturgeon
Acipenser oxyrhynchus oxyrhynchus

Interesting Facts:

- Atlantic sturgeon fossils date back more than 150 million years. They were around throughout the Cretaceous period when dinosaurs roamed the earth.
- All 24 species of sturgeon can only be found in the Northern Hemisphere. Only Atlantic sturgeon and shortnose sturgeon are found on the US East Coast.
- Sturgeon do not have teeth and swallow their prey whole.
- Rather than having true scales, the Atlantic sturgeon has five rows of bony plates known as scutes.
- Sturgeon are known to leap out of water and sometimes land in boats. It is not known why they do this. Always remember to wear your life jacket!
- Sturgeon are the largest and longest-lived anadromous fish native to North America

Largest Recorded: 14 feet long and 811 pounds, Canada

Oldest Recorded: 60 years old, captured from the St. Lawrence River

Stock Status: Overfished and not experiencing overfishing; listed under the Endangered Species Act in 2012

(caviar from sturgeon eggs was considered a delicacy in Europe), other parts had commercial value as well. Sturgeon skin was made into leather for clothes and bookbinding. The swim bladder was used to make a gelatin that served as a clarifying agent in jellies, wine, beer, and glue. Swim bladders were also fashioned into windows for carriages.

In 1888, the U.S. Fish Commission reported that there was 7.3 million pounds of sturgeon caught on the East Coast. From 1950 through the mid-1990s, annual landings declined to between 100,000 and 250,000 pounds. In 1998 the Commission implemented a coastwide moratorium on the harvest of wild Atlantic sturgeon stocks, although many states had already closed their fisheries.

Status of the Stock

Very little is known about the stock status of Atlantic sturgeon. Reliable data is difficult to obtain because many river systems have so few fish, and rivers with more fish are often not easily sampled. In 1998, the Commission completed a peer-reviewed coastwide assessment of the population, examining each river system where Atlantic sturgeon were historically found.

The assessment concluded that all systems held significantly less sturgeon than they did in the late 1800s and early 1900s, and very few signs of recovery were detected. As a result of the assessment, the Commission established a 40+ year coastwide moratorium through Amendment 1 to the Atlantic Sturgeon Fishery Management Plan.

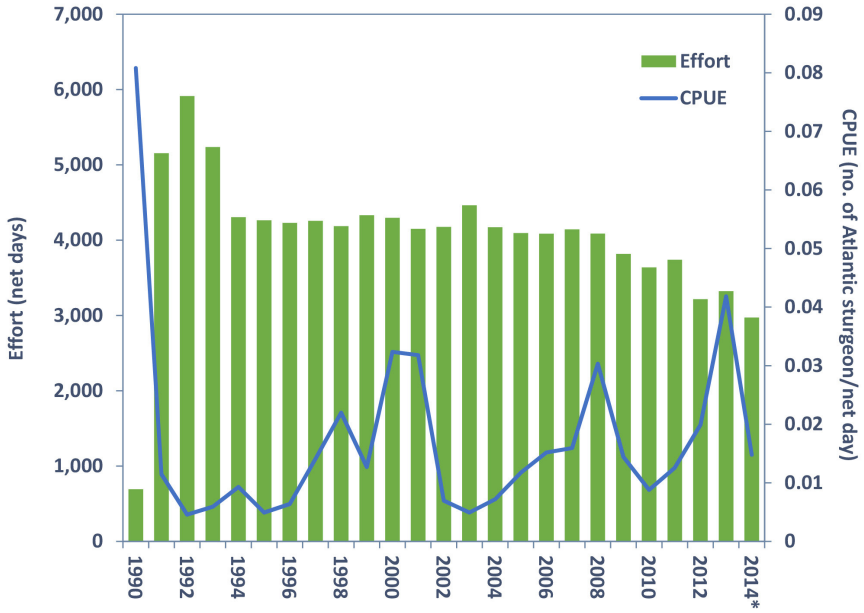
The accompanying graphs depict catch per unit effort (CPUE) for fishery-independent surveys conducted by North Carolina and New York. Both surveys have experienced significant fluctuations in recent years. However, in 2013, North Carolina's CPUE was the second highest value in the past twenty years. Further, the spike of juveniles seen in New York's survey are believed to be a direct result of New York's moratorium in 1997 and the concomitant increase of spawning fish in the Hudson River.

In 2014, the Sturgeon Board evaluated progress on the development of a coastwide benchmark stock assessment for Atlantic sturgeon to evaluate stock status, stock delineation, and bycatch. The assessment responds to the 2012 ESA listing of Atlantic sturgeon as threatened for the Gulf of Maine distinct population segment (DPS) and endangered for the remaining DPSs (New York Bight, Chesapeake Bay, Carolina, and South Atlantic). In order to allow for the most comprehensive assessment, and based on the Atlantic Sturgeon Stock Assessment Subcommittee's (SAS) recommendation, the Board decided to set the completion date for 2017 so that the most recent data from studies currently underway can be incorporated. For example, several assessment approaches at the DPS or stock-level would become possible from the analysis of genetic samples currently underway at the US Geological Survey's

continued, see ATLANTIC STURGEON on page 8

Fishery-independent Catch Rates of Juvenile Atlantic Sturgeon in Albemarle Sound

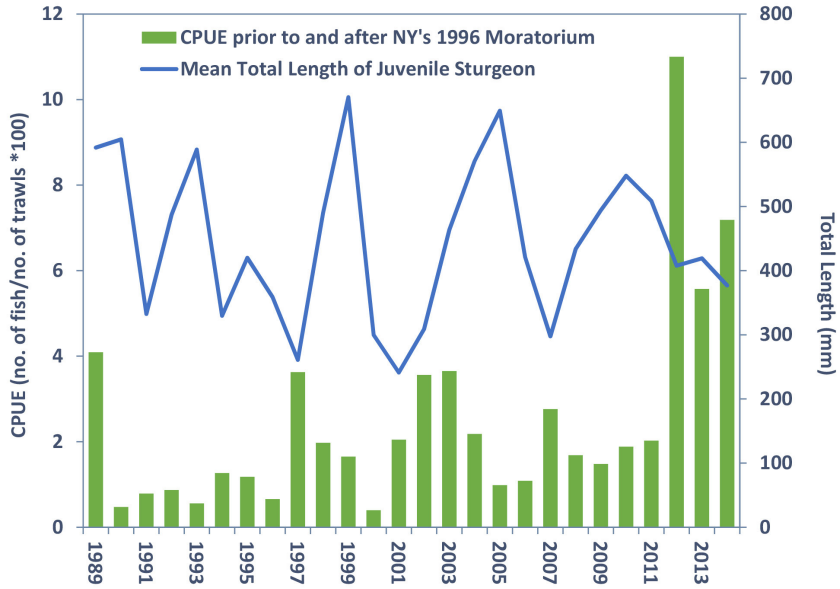
Source: NC Division of Marine Fisheries, 2014



*2014 data are preliminary

Catch Per Unit Effort (CPUE) of Hudson River Juvenile Atlantic Sturgeon

Source: Source: NY State Dept. of Environmental Conservation with data from Hudson River Power Generating Companies Hudson River Monitoring Program, 2014



Timeline of Management Actions: FMP ('90); Amendment 1 ('98); Addendum I ('01); Addendum II ('05); Addendum III ('06); Addendum IV ('12)

WEDNESDAY, AUGUST 5

8 - 8:45 AM **American Eel Management Board**
- Review and Consider Approval of Maine Eel Life Cycle Survey

9 - 10:30 AM **Tautog Management Board**
- Review and Consider Approval of the Draft PID for Amendment 1 to the Interstate Fishery Management Plan

9 - 10:30 AM **Atlantic Coastal Cooperative Statistics Program (ACCSP) Executive Committee**
- Status Report (Program and Committee Updates)
- Independent Program Review Progress
- APAIS Update
- Governance Update
- Executive Committee Membership SOPs

10:45 AM - 12:15 PM **ACCSP Coordinating Council**
- Status Report (Program and Committee Updates)
- Independent Program Review Progress
- Executive Committee Membership SOPs

1:15 - 2:45 PM **Atlantic Striped Bass Management Board**
- Review Technical Committee Report on Likelihood of Achieving Fishing Mortality (F) Target with Final Implemented Regulations
- Review Technical Committee Report on F Reference Points for the Coastal and Discard Fleets Consistent with Chesapeake Bay Specific F Reference Points
- Review Progress on Management-level Projections Using the Chesapeake Bay and Coastal Fleet Reference Points
- Review and Consider Approval of the 2015 FMP Review and State Compliance Reports

3 - 4:30 PM **Atlantic Menhaden Management Board**
- Update on Atlantic Menhaden Working Group Progress on Ecosystem-based Management Goals and Objectives
- Update on Atlantic Menhaden Working Group Progress on Allocation
- Discuss Quota Rollover Provisions of Amendment 2

THURSDAY, MAY 6

8 - 10 AM **Interstate Fisheries Management Program Policy Board**
- Executive Committee Report
- Review and Discuss Annual Performance of the Stocks
- Review Management and Science Committee Report on Results of Forage Fish Management Provisions Survey
- Review and Approve Revised LEC Report on Guidelines for Resource Managers on the Enforceability of Management Measures
- Atlantic Coastal Fish Habitat Partnership Report
- Review of Non-compliance Findings (if necessary)

10 - 10:30 AM **Business Session**
- Consider Approval of Jonah Crab Fishery Management Plan
- Review Non-compliance Findings (if necessary)

10:45 AM - 12:15 PM **South Atlantic State/Federal Fisheries Management Board**
- Review and Consider Approval of the Draft Terms of Reference for the 2016 Benchmark Stock Assessments for Atlantic Croaker and Spot
- Review the 2015 Traffic Light Analyses for Atlantic Croaker and Spot
- Review and Consider Approval of the 2015 FMP Review and State Compliance Reports for Atlantic Croaker, Black Drum, and Red Drum
- Discuss Extending the Provisions of Spanish Mackerel Addendum I for the 2015 Fishing Season and Possibly Beyond

Public Comment Guidelines

With the intent of developing policies in the Commission's procedures for public participation that result in a fair opportunity for public input, the ISFMP Policy Board has approved 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 with the main meeting materials.
2. Comments received by **5 PM Tuesday, July 28, 2015** 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 Tuesday, July 28, 2015 5 PM deadline, the commenter will be responsible for distributing the information to the management board prior to the board meeting or providing enough copies for the 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.

Science Highlight: The Ins and Outs of Fish Passage

Furnace Brook Fishway. Photo (c) CT DEEP

The Commission manages a number of diadromous species, including American eel, American shad, Atlantic sturgeon, Atlantic striped bass, and river herring (alewife and blueback herring). These species spend part of their lives in freshwater streams and rivers, and part in the ocean. They must migrate between these areas to complete their life cycles and maintain healthy populations. Migrating adults and the offspring they produce are forage for a variety of predators; many ecosystems depend on the seasonal influx of these fish. Aside from serving an integral role in various food webs, diadromous fish are culturally, recreationally, and commercially important.

The ability of migrating fish to pass man-made stream and river barriers is essential to the protection and restoration of these species and the habitats in which they live. Hundreds of thousands of artificial barriers have been constructed along the Atlantic coast to impound and redirect water for irrigation, flood control, electricity, recreation, drinking water, and transportation—all altering the natural features of rivers and streams. Fisheries managers, scientists, stakeholders, and the public at large have become increasingly concerned about the effects of barriers on fish and other aquatic species. Many barriers are obsolete and no longer serve their original purpose. These barriers often create impediments to fish migration, which is fundamental to the life history of diadromous species. As a result, some fish populations have significantly declined over their historical range.

Elements of Fish Passage: Factors to Consider

The first known fishway was built in 17th century France, when bundles of branches were used to create steps in otherwise impassible channels. A few other reports of constructed fishways are sprinkled throughout European history, though by no means was fish passage implementation a common practice. Though the dilemma of fish passage along the Atlantic coast dates back to the construction of the earliest barriers built in our river systems, and escalated considerably during the Industrial Revolution, the issue went largely unrecognized until the mid-1900s when it attracted the attention of environmental activists. Since then, considerable work has been done to evaluate rivers and determine which barriers cause the most significant impediment to migrating fish. Funding is focused either on removing these barriers entirely, or on constructing passage technology to allow fish to traverse the barrier.

Passage technology is difficult to design, owing to differences between species' natural swimming styles and abilities. Conditions and flow types that encourage and aid movement differ depending on the target species; not all species are able to use the same passage design. Target species must be studied and considered in order to construct an effective fishway.

This fact comprises the center of the argument for additional fish passage research and more informed management: not all fish passage is created equal. The fact that fish passage is built to accommodate a barrier does not mean that fish are actually traversing that barrier. And the fact that one species utilizes the passage technology does not necessarily mean that other species will be able to. Additionally, the implementation of fish passage over a barrier will not be useful if fish aren't encountering that barrier; there may be an obstruction further downstream or a degradation of water quality that is preventing species from even reaching that portion of the waterway.

The last point to consider is timeliness of passage. Fish must not only cross the barrier, they must reach their spawning habitat without undue delay. Mating success depends on a variety of factors, including prey, predators, competitors, and environmental conditions. If fish are delayed by the passage technology, conditions may no longer be suitable to support spawning adults or new offspring, negatively impacting recruitment and sustainability.

Current Technology

Passage technology takes many forms. Passage over a barrier is predominantly comprised of fish ladders and lifts. However, fish passing upstream often have difficulty finding the entrance of the passage structure. Conversely, fish passing downstream can get pulled into turbines by following the current before they find safe passage; for this reason fish screens are often implemented to redirect the path of migrating fish. Additional technologies must be developed to direct fish away from turbine intakes and toward passage structure entrances.

Additional information on upstream technology can be found in the Commission's Guidance Document on Upstream Fish Passage Technologies for Managed Species at http://www.asmfc.org/habitat/fish-passage.

continued, see SCIENCE HIGHLIGHTS on page 10

Leetown Science Center in West Virginia. This past May, the SAS identified each task of the assessment from data needs to modeling approaches, and the time it will take to complete each task to ensure the benchmark assessment is completed on schedule. Currently, the Bycatch and Tagging Working Groups are developing methodologies for their respective parts of the assessment, while each state actively updates its data through the terminal year of the assessment.

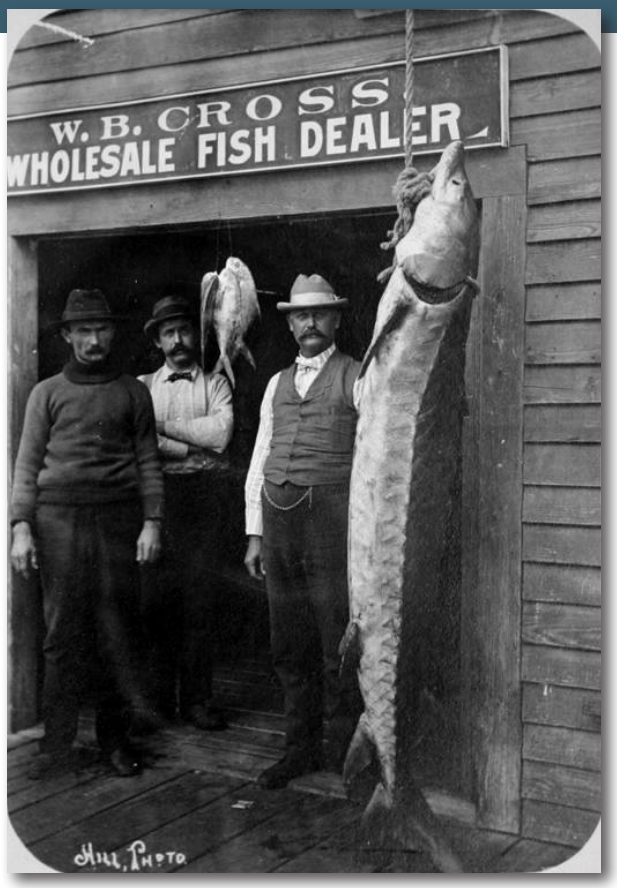


Image (c) NOAA Fisheries

Atlantic Coastal Management

Atlantic sturgeon is managed through Amendment 1 to the Interstate Fishery Management Plan for Atlantic Sturgeon (July 1998) and its subsequent addenda (Addendum I - IV). The primary measure of Amendment 1 was the implementation of a coastwide moratorium, as well as a prohibition on take, harvest, harassment and/or other actions that may cause the species harm.

Endangered Species Listing

NOAA Fisheries has investigated the status of Atlantic sturgeon with regard to its listing under the Endangered Species Act (ESA) three times since the Commission's implementation of Amendment 1 in 1998. The first two status reviews, conducted in 1998 and 2005, concluded that listing was not warranted. The last status review, initiated in 2009 and finalized in 2012, declared the Gulf of Maine DPS as threatened and the remaining four DPSs (New York Bight, Chesapeake Bay, Carolina and South Atlantic) as endangered (effective April 2012). The Status Review determined the most significant threats to the DPSs are bycatch mortality, poor water quality, lack of adequate state and/or federal regulatory mechanisms, and dredging activities. Additional stressors include habitat impediments and ship strikes. In December 2013, NOAA Fisheries published an Interim Final 4(d) Rule for the threatened Gulf of Maine DPS, which essentially provides the same protection as an endangered listing.

For more information, please contact Max Appelman, FMP Coordinator, at mappelman@asmfc.org.

ASMFC Comings & Goings

COMMISSIONERS

Thomas O'Connell

In late May, Maryland Governor Larry Hogan elected to make a number of changes to the leadership at the Maryland Department of Natural Resources (DNR). One of those changes was the appointment of David Goshorn as the Acting Director for the Fisheries Service. David replaced Thomas O'Connell who served in that capacity since 2008. Tom began with DNR in 1993 as a fisheries biologist working on striped bass monitoring and management. Over his 22-year tenure, he served as the Fisheries Service's Legislative and Policy Program Administrator, Coastal Bays Fisheries Management Plan Coordinator, Oyster Restoration Program Manager, and Assistant Director for the Estuarine and Marine Fisheries Division. Tom became active in the Commission process in the mid-1990s, when he became the first Fishery Management Plan Coordinator for horseshoe crab. Working with the Management Board, Technical Committee and Advisory Panel, he oversaw the development and implementation of the FMP and Addenda I and II, which established the first state quotas for horseshoe crab. For the past seven years, Tom served as the state's Administrative Commissioner to the ASMFC, bringing his passion for and commitment to sustainable management of marine resources to all his interactions.

We are grateful for Tom's longstanding support of the Commission and wish him the best in all his future endeavors.

David Goshorn

Since 2013, David Goshorn has served as Maryland's DNR's Assistant Secretary for Aquatic Resources. In this role, he is responsible for monitoring and assessment of water and geological resources; policy and management of the recreational and commercial fisheries; restoration of the Chesapeake and coastal bays; boating services; and the Department's Integrated Policy and Review Unit.

continued, see COMINGS & GOINGS on page 12

Research and Development

While there have been significant advancements in fish passage technologies over the past decade, more research is needed to increase efficiency and effectiveness of passage technologies. Several federal agencies, such as the Bureau of Reclamation, the National Biological Survey, the U.S. Army Corps of Engineers, and the Department of Energy are involved in research, development, and evaluation of new technologies. The U.S. Geological survey studies population dynamics, ecohydraulics, physiology, and toxicology factors of fish passage, and has even constructed an indoor simulated river to conduct research. The U.S Fish and Wildlife Service takes an application-focused approach, developing partnerships to implement individual passage projects.

To date, most efficiency studies rely on tagging methods, but only a small minority of fishways have been evaluated for efficiency. Diadromous fish are often collected by biologists below barriers during their annual migrations. The fish are fitted with tags and released to continue their upstream migration. Fish above the stream are detected or captured later and the number of tagged fish passing the barrier is compared to the number of fish initially tagged to estimate passage structure efficiency. Efficiency evaluations are of the utmost importance, not only to be sure that implemented passage technologies are meeting goals at a particular site, but also to gather more information on how to focus funding in ways that will make a maximum impact on fish population restoration.

Commission Involvement

The Commission is particularly concerned about the migrations of Atlantic sturgeon, American shad, alewife, blueback herring, and striped bass to their spawning habitat, as well as access to long-term riverine growth areas for American eel. Without access to these habitats, it will be very difficult to restore populations of these very important diadromous species.

The primary objective of the Commission's Policy on Passage Efficiency for Diadromous Species is "to pass as many upstream migrants as needed to support natural reproduction of anadromous species. The most effective method of improving fish passage is barrier removal, but when removal is not feasible, parties must work together to develop and implement fish passage technologies that will support restoration plans based on upstream habitat."

It is recognized that the percentage of migrants passed at each site will vary based on watershed-specific factors, including: location within the watershed, species, stream discharge, population size, and distribution of required habitat. It is also recognized that technical knowledge on effective passage design is more advanced for some species than others, and also that all parties should commit to continued improvement of passage efficiency as technology advances and as site-specific information improves the understanding of restoration in the watershed.

Working to restore both upstream and downstream fish passage is an evolving field that requires continued collaboration. In response to the growing concern about barrier impacts on diadromous species, the Commission created a Fish Passage Working Group, which continues to convene as needed to discuss developments and mitigate the negative effects of fish passage. Major accomplishments of this group include policy development on diadromous fish passage efficiency, a guidance document identifying effective approaches to upstream fish passage, and a guidance document to promote state involvement in Federal Energy Regulatory Commission licensing projects. The Atlantic Coastal Fish Habitat Partnership (ACFHP), endorses many projects, including dam removal, culvert replacement, and habitat restoration. Details can be found on the ACFHP Projects webpage at http://www.atlanticfishhabitat.org/projects/endorsedprojects/.

How You Can Help

Waterways along the Atlantic coast are littered with old dams, road culverts, and debris; keep your eye out for these obstructions. Observe local bridge culverts in particular, these should be positioned to allow fish to swim through a stream uninterrupted by an impassible "waterfall." If an impassible obstruction is encountered, report it to your state's wildlife service for remediation. Remember:

1. Removal of an unnecessary structure is the most effective option.
2. The construction of a fish passageway is a viable option for structures still in use. Often small, low-cost changes can be made to barriers to allow for fish passage, like adding spat rope to perched culverts.
3. Be sure that any new barriers scheduled for construction in waterways are designed to allow fish passage, and provide natural stream channel features where possible.

Finally, mark your calendars! The next Annual World Fish Migration Day is May 21, 2016; www.worldfishmigrationday.com. Check for events near you, or hold your own.

What's in a Name?

Finding it hard to tell the difference between anadromous, catadromous and diadromous? Here's a breakdown of their word origins with some examples of species that fall under the categories.

Anadromous, derived from Latinized form of Greek 'ana' meaning 'up or back' and 'dramein' meaning 'to run,' is running upward or ascending up-river. It describes species that spend most of their adult lives at sea and return to freshwater to spawn. American shad, Atlantic striped bass, Atlantic sturgeon, and river herring (alewife and blueback) are examples of Commission managed anadromous species.

Catadromous, derived from the Greek 'cata' meaning 'down, against, or back,' is running down river. It decsribes species that spend most of their adult lives in freshwater and return to the sea to spawn. American eel are the only catadromous species managed by the Commission.

Diadromous, derived from Greek 'dia' meaning 'through or passing through' is migrating between saltwater and freshwater. The category encompasses both anadromous and catadromous species.

ACCSP Announces 2015 Funding Awards

The Atlantic Coastal Cooperative Statistics Program (ACCSP) has allocated nearly two million dollars to its state and federal partners for new and ongoing projects to improve data collection for coastal fisheries in 2015. The following projects will be awarded funding.

- **Maine Department of Marine Resources** will receive (1) $176,373 to continue the state's management of dealer and harvester reporting and (2) $136,306 to continue portside commercial catch sampling and comparative bycatch sampling for Atlantic herring, Atlantic mackerel, and Atlantic menhaden.
- **New Hampshire Department of Fish and Game** will receive $74,423 to improve the American lobster biological and catch/effort data for Georges Bank and characterize seasonal egger aggregation in Closed Area II.
- **Rhode Island Division of Fish and Wildlife** will receive $79,719 to maintain and coordinate its fishery-dependent data feeds to ACCSP.
- **New York State Department of Environmental Conservation** will receive $62,928 to improve trip-level reporting and quota monitoring for state license participants in New York's marine fisheries.
- **New Jersey Division of Fish and Wildlife** will receive $155,126 to continue electronic reporting and biological characterization of its commercial fisheries and process and age summer flounder and black sea bass otoliths.
- **North Carolina Division of Marine Fisheries** will receive $75,620 to update and enhance the data transmission methods to ACCSP.
- **South Carolina Department of Natural Resources** will receive $165,824 to continue instituting a collection method for ACCSP commercial module in South Carolina.
- **Atlantic States Marine Fisheries Commission and the Mid-Atlantic Fishery Management Council** will receive $183,200 to continue carrying out an observer program for the Mid-Atlantic and Rhode Island small mesh otter trawl fishery.
- **NOAA Fisheries' Southeast Fisheries Science Center** will receive $250,831 to continue processing and ageing biological samples collected from U.S. South Atlantic commercial and recreational fisheries.
- **ACCSP Recreational Technical** will receive $168,738 to increase at-sea sampling levels for the recreational headboat fishery on the Atlantic coast (New Hampshire through Florida).

For more information, please contact Ann McElhatton, Program Manager with ACCSP, at info@accsp.org.

ACCSP Promotes Julie Defilippi and Welcomes Heather Konell

In recognition of her many accomplishments and longstanding commitment to the ACCSP as Data Coordinator, **Julie Defilippi** was promoted to Data Team Leader this June. As Team Leader, Julie provides guidance for all ACCSP data-related activities, including oversight of commercial and biological data, data collection and warehousing projects, user interface projects, and data dissemination activities. She staffs the Biological Review Panel and the Bycatch Prioritization Committee, and works closely with Ed Martino, Information Systems Manager, on database development and maintenance. Julie has a Bachelor's Degree in Marine Biology from Boston University. Congratulations, Julie!

This July, ACCSP welcomed **Heather Konell** as its new Fisheries Data Coordinator. Heather's primary responsibilities include providing programming capabilities and system support required to develop and fine tune the data management system. She also assists users as they access the system and supports customer-related data intensive activities (e.g., stock assessment data workshop).

From 2012 to 2015, Heather worked with the New Jersey Marine Fisheries Bureau managing its Saltwater Recreational Registry Program database, which contains over 500,000 participants, and providing angler support and outreach. She also worked on various field surveys including the Delaware River Recruitment Survey, Ocean Trawl Survey, Delaware Bay Tagging Survey, and American Eel Survey giving her experience with identifying, measuring, and sexing many species. Heather has also worked with the Adventure Aquarium, Stockton University, Rutgers University Marine Field Station, and the Marine Mammal Stranding Center through various internships and positions, gaining experience with a variety of marine fauna and flora. She earned a Bachelor of Science in Marine Science with a concentration in Marine Biology and minor in General Biology from Stockton University in December 2014. Welcome, Heather!

ACCSP
Good Data, Good Decisions

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.

On the Legislative Front: FY2016 Appropriations Update

On May 20th the House of Representatives passed 2016 appropriations legislation for the Department of Commerce, including NOAA Fisheries. The legislation includes $32 million for the "Councils & Commissions" line item, which provides funding for state fishery management programs and the Commission. The figure represents a decrease of $738,000 from 2015. The legislation also eliminates funding for "Interjurisdictional Fisheries Act Grants," which match state funding for fishery management programs. These grants received $2.5 million in funding in 2014.

NOAA Fisheries Operations, Research, and Facilities (in $ thousands)		
	House	Senate
Protected Resources Science and Management		
Marine Mammals, Sea Turtles and Other Species	113,200	110,246
ESA Salmon	67,000	-
Species Recovery Grants	-	6,000
Atlantic Salmon	-	6,163
Pacific Salmon	-	60,000
Protected Resources Science and Management Total	180,200	182,409
Fisheries Science and Management		
Fisheries and Ecosystem Science Programs and Services	132,189	134,489
Fisheries Data Collections, Surveys and Assessments	168,000	163,271
Observers and Training	43,000	43,655
Fisheries Management Programs and Services	119,000	114,545
Aquaculture	-	7,000
Salmon Management Activities	35,500	30,200
Regional Councils and Fisheries Commissions	32,000	33,470
Interjurisdictional Fisheries Act Grants	0	3,000
Fisheries Science and Management Total	529,689	529,630
Enforcement	65,000	67,049
Habitat Conservation and Restoration	53,854	51,484
Total, NMFS, Operations, Research, and Facilities	828,743	830,572

Meanwhile, on June 11th the Senate Appropriations Committee approved 2016 appropriations legislation for the Department of Commerce, including NOAA Fisheries. The "Councils & Commissions" line item would be increased by $732,000 and "Interjurisdictional Fisheries Act Grants" would receive a $500 increase under Senate funding levels. The Senate legislation is now awaiting approval of the full Senate.

Looking forward, Senate Democrats have vowed to filibuster all Republican spending bills until a budget deal is reached. Democrats are opposing any appropriations bill that adheres to the Republican budget framework, and are pushing for a multi-year agreement to increase sequester spending caps for defense and nondefense discretionary programs. The deadline to enact 2016 appropriations bills or a temporary extension is September 30, 2015.

Both the House and Senate appropriations bills contain policy riders that reference the Mid-Atlantic trawl survey for horseshoe crabs. While the specific language differs slightly, both lay the groundwork for resuming the survey. Since 2002, estimates of horseshoe crab abundance in the region were obtained from a trawl survey conducted through Virginia Tech aboard privately-owned commercial fishing vessels. From 2011 to 2013 the biomedical and fishing industries provided limited funding for increasingly smaller scale surveys. In 2014, the survey did not occur and barring further action no survey will be conducted in 2015. For more information, please contact Deke Tompkins at dtompkins@asmfc.org.

Preparations Begin for Atlantic Croaker and Spot Benchmark Stock Assessments

The Commission has begun work on the joint benchmark stock assessments for Atlantic croaker and spot. The spot assessment will be the first coastwide assessment for these species, while the Atlantic croaker assessment will build upon the last benchmark assessment conducted in 2010. The assessments will evaluate the health of Atlantic croaker and spot populations and inform future management of the species. The Commission's stock assessment process and meetings are open to the public (with the exception of discussion of confidential data).

The Commission welcomes the submission of data sets that will improve the accuracy of the assessments. These include, but are not limited to data on growth, maturation, migration, genetics, tagging, recruitment, natural mortality, abundance/biomass, and fishery removals. An essential need is data to inform the stock assessments of discards and bycatch in other directed fisheries (e.g., the South Atlantic shrimp trawl fishery). For data sets to be considered at the Data Workshop, the data must be sent in the required format, with accompanying methods description, to the Commission by August 1, 2015. All available data will be reviewed and vetted by the Atlantic Croaker and Spot Stock Assessment Subcommittee for possible use in the assessments. For those interested in submitting data, please contact Jeff Kipp, Stock Assessment Scientist, at jkipp@asmfc.org.

The Data Workshop will take place September 21-25, 2015 with the location to be determined. The assessment workshop and peer review will be conducted in 2016. For more information on the Atlantic croaker and spot stock assessment process, please contact Megan Ware, Fishery Management Plan Coordinator, at mware@asmfc.org.

Atlantic States Marine Fisheries Commission
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COMINGS & GOINGS continued from page 8

David has worked at DNR since 1992, serving initially as a member of the Fisheries Service Striped Bass Project, and later as Chief of the Living Resource Assessment Program, where he was responsible for submerged aquatic vegetation restoration, fish community assessments, coastal bays monitoring, and harmful algal bloom response.

From 2007 through 2013, David directed the agency's Office for a Sustainable Future, with responsibility for moving DNR in particular and Maryland in general toward a sustainable future. A Towson native, David received his Bachelor's Degree in Biology from Bucknell University and his Ph.D. in Marine Biology from the University of Delaware. Welcome aboard, David!

STAFF

Ashton Harp

In late June, Ashton Harp joined the Commission as its new Fishery Management Plan Coordinator, coordinating management programs for Atlantic herring, coastal sharks, tautog and winter flounder. Ashton comes to us having recently completed a Master of Public Policy/Environmental Policy *and* a Master of Science, Sustainable Development and Conservation Biology from the University of Maryland. Prior to pursuing her dual masters, Ashton worked at Conservation International as the Senior Seascapes Coordinator, where she focused on multiple projects including the evaluation of the supply chain of yellowfin, bigeye, and skipjack tuna in the Eastern Pacific Ocean. Ashton earned her Bachelor of Science, Business and Marketing Management from Virginia Tech. Welcome aboard, Ashton!

Lead and Back-up Coordinators for Commission Managed Species

Species back-ups are available to help answer questions when the lead coordinator is out of the office or provide additional support during times of high activity.

Species	Lead Coordinator	Species Back-ups
American Eel	Mike Waine, mwaine@asmfc.org	Megan Ware
American Lobster & Jonah Crab	Megan Ware, mware@asmfc.org	Kirby Rootes-Murdy
Atlantic Herring	Ashton Harp, aharp@asmfc.org	Kirby Rootes-Murdy
Atlantic Menhaden	Mike Waine, mwaine@asmfc.org	Ashton Harp
Atlantic Striped Bass	Max Appelman, mappelman@asmfc.org	Mike Waine
Bluefish	Kirby Rootes-Murdy, krootes-murdy@asmfc.org	Ashton Harp
Coastal Sharks	Ashton Harp, aharp@asmfc.org	Max Appelman
Horseshoe Crab	Kirby Rootes-Murdy, krootes-murdy@asmfc.org	Megan Ware
Northern Shrimp	Max Appelman, mappelman@asmfc.org	Mike Waine
Shad & River Herring	Kirby Rootes-Murdy, krootes-murdy@asmfc.org	Ashton Harp
South Atlantic Species	Megan Ware, mware@asmfc.org	Max Appelman
Spiny Dogfish	Ashton Harp, aharp@asmfc.org	Max Appelman
Sturgeon	Max Appelman, mappelman@asmfc.org	Mike Waine
Summer Flounder, Scup, Black Sea Bass	Kirby Rootes-Murdy, krootes-murdy@asmfc.org	Megan Ware
Tautog	Ashton Harp, aharp@asmfc.org	Kirby Rootes-Murdy
Weakfish	Megan Ware, mware@asmfc.org	Mike Waine
Winter Flounder	Ashton Harp, aharp@asmfc.org	Mike Waine

N.C. Marine Fisheries Commission Rule Suspension Update- As of July 27, 2015
(In accordance with N.C. Division of Marine Fisheries Resource Management Policy 2014-2)

New Suspensions-Action Required
The following new suspensions occurred since the commission's May 2015 meeting. These suspensions are action items on the August 2015 agenda and are subject to approval:

- **The following portion of N.C. Marine Fisheries Commission Rule 15A NCAC 03M .0301 SPANISH AND KING MACKEREL is suspended:**
  Section (a) (1), which reads:
  (a) Spanish Mackerel:
  (1) It is unlawful to possess Spanish mackerel less than 12 inches fork length.

Suspension of portions of this rule allows the division to implement an 11 ½ inch fork length minimum size limit for Spanish mackerel in the commercial pound net fishery. The intent of this size limit change is to reduce seasonal dead discards in this fishery. It is requested that portions of the rule listed above be suspended to a date certain. This suspension was implemented in proclamation FF-36-2015, effective 12:01 A.M., Friday, July 3, 2015 until midnight, September 30, 2015.

Continuing Suspensions
The following rule suspensions have been approved on a continuing basis by the commission and no further action is required:

- **The following portion of N.C. Marine Fisheries Commission Rule 15A NCAC 03J .0103 GILL NETS, SEINES, IDENTIFICATION, RESTRICTIONS is suspended:**
  Section (i) (1), which reads:
  (i) For gill nets with a mesh length five inches or greater, it is unlawful:
  (1) To use more than 3,000 yards of gill net per vessel in internal waters regardless of the number of individuals involved.

Suspension of portions of this rule allows the division to decrease the total yardage of gill nets with a mesh length five inches or greater in order to manage the gill net fishery in accordance with the Federal Incidental Take Permits (ITPs) for sea turtles and Atlantic sturgeon. This rule has been approved to be suspended indefinitely.

- **The following portion of N.C. Marine Fisheries Commission Rule 15A NCAC 03M .0519 SHAD is suspended:**
  Paragraphs (a) and (b) which read:
  (a) It is unlawful to take American shad and hickory shad by any method except hook-and-line from April 15 through December 31.
  (b) It is unlawful to possess more than 10 American shad or hickory shad, in the aggregate, per person per day taken by hook-and-line or for recreational purposes.

- **The following portion of N.C. Marine Fisheries Commission Rule 15A NCAC 03Q .0107 SPECIAL REGULATIONS: JOINT WATERS is suspended:**
  Paragraph (4) which reads**:**
  (4) Shad: It is unlawful to possess more than 10 American shad or hickory shad, in the aggregate per person per day taken by hook-and-line.

Suspension of portions of these rules allows the division to change the season and creel limit of American shad under the management framework of the N.C. American Shad Sustainable Fishery Plan. These rules have been approved to be suspended indefinitely.

North Carolina
Division of Marine Fisheries

Fishery Management Plan Review

August 2015

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FISHERY MANAGEMENT PLAN UPDATE
BAY SCALLOP
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 2007
Amendments:	Amendment 1 – November 2010 Amendment 2 – February 2015
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	July 2005 – Began the original FMP a year earlier than planned due to concern limited abundance
Next Benchmark Review:	July 2020

The N.C. Bay Scallop Fishery Management Plan (FMP) was adopted in November 2007 by the North Carolina Marine Fisheries Commission. The FMP implemented prohibited take from 2006 to 2008 until an independent sampling indicator was established for re-opening in 2009. Amendment 1 of the N.C. Bay Scallop FMP was finalized in November 2010 to provide more flexibility (Adaptive Management) to open the fisheries as the bay scallop population recovers. Target indices were established from fishery independent data collected before the red tide event in 1984 and 1985 in Core, Back, and Bogue sounds. A separate sampling indicator for re-opening was developed in 2009 for Pamlico Sound. Amendment 2, adopted in February 2015, continues to use the abundance thresholds for opening the harvest season and defining the harvest levels for all areas, except areas south of Bogue Sound. Areas south of Bogue Sound will not be managed with a specific abundance opening level, but will be opened or remain closed based on North Carolina Division of Marine Fisheries' (NCDMF) judgement from sampling in this region. Expanded sampling is to occur in all areas including areas south of Bogue Sound and improve the reliability of the data for the recreational scallop harvest. For private culture and enhancement the current management strategy is to modify rules for bottom culture and aquaculture operations to be consistent with rules for other shellfish species, and establish a pilot program with the Shellfish Research Hatchery to distribute cultured seed on private bottoms and contingent on results to distribute seed on private bottom, expand the pilot program to include public bottom.

Management Unit

Includes the bay scallop (*Argopecten irradians)* and its fisheries in all waters of coastal North Carolina.

Goal and Objectives

The goal of the North Carolina Bay Scallop Fishery Management Plan is to implement a management strategy that restores the stock, maintains sustainable harvest, maximizes the social and economic value, and considers the needs of all user groups. To achieve this goal, it is recommended that the following objectives be met:

1. Develop an objective management program that restores and maintains sustainable harvest.

2. Promote the protection, restoration, and enhancement of habitats and water quality necessary for enhancing the fishery resource.

3. Identify, enhance, and initiate studies to increase our understanding of bay scallop biology, predator/prey relationships, and population dynamics in North Carolina.

4. Investigate methods for protecting and enhancing the spawning stock.

5. Investigate methods and implications of bay scallop aquaculture.

6. Address social and economic concerns of all user groups.

7. Promote public awareness regarding the status and management of the North Carolina bay scallop stock.

STATUS OF THE STOCK

Stock Status

North Carolina's bay scallop stocks are listed as a species of concern in the annual Stock Status Report because of the population declines. Annual commercial landings of bay scallops show large fluctuations through time and are presumed to be driven by changing climate conditions (i.e., winter freezes, high freshwater runoff), predation, and red tide. Therefore, bay scallops are vulnerable to overharvest because of these different factors affecting their survival.

Stock Assessment

Independent data have been collected by the NCDMF since 1984 and consistently collected since 1998 to evaluate recruitment into the population and recruitment into the fishery for the current fishing season. Analyses of these data have demonstrated trends between NCDMF independent data and landings data from the following year. The long term landings data (1972-2005) most likely reflected population abundance because harvest was allowed to continue until scallop densities reached levels below those that make the fishing economically viable (Peterson and Summerson 1992). However, during 2006 and after the implementation of the 2007 N.C. Bay Scallop FMP, a harvest prohibited take went into effect in order to rebuild the stock and until a standardized catch per unit effort could be met (NCDMF 2007). Therefore using landings data as an indicator is no longer an effective tool to indicate population size. Data on scallop abundance from fishery independent sampling are evaluated annually and standardized scallop population level indicators were first established as progressive triggers for opening the harvest season in 2010 (NCDMF 2010). These triggers are based on NCDMF

sampling that occurred between the pre-red tide months of October and December in 1984 and 1985 for Back, Bogue, and Core sounds and in post-red tide January 2009 in Pamlico Sound (Table 1). This time period for estimating abundance makes the most sense since it is less likely for the two year-classes to be selecting to the sampling gear. Areas south of Bogue Sound will not be managed with a specific abundance opening level, but will be opened or remain closed based on NCDMF judgement from sampling in this region (NCMDF 2015). These progressive triggers allow for flexibility to open the fisheries as the bay scallop population recovers and determines harvest limits based on 50%, 75%, and 125% of the natural log of the Catch Per Unit Effort (lnCPUE) target (Tables 2 and 3).
Fishery independent sampling shows that most tows have small or zero catch, while only a few samples exhibit large catches producing a lognormal distribution, which is usual for most fishery independent data. The natural log (ln) of the catch per unit effort (lnCPUE), measured as the number of scallops per minute (dredges) and number of scallops per meter squared (quadrat), is taken to avoid bias towards occasional large catches. A constant of 0.1 was added to all catches so that tows/quadrats with zero catches can be included in the estimates of the mean since the natural log of zero is undefined. All tows/quadrats taken at a station are averaged to get a single value for each station and are referred to as a sample. This is done to avoid weighting some tows/quadrats to each station more than others because the number of tows/quadrats was not always consistent in duration. Each sample is averaged to get the estimated mean lnCPUE and standard deviation for the October-December time period for all areas to produce indices of abundance.

Trends in the past ten years show bay scallop abundance is very low in all regions which is also a reflection in landings when harvest is opened (Figures 1, 2, and 3). Since the inception of the harvest opening index of abundance the season has only opening three years in specific regions at the lowest allowed harvest levels. Two of the three open harvest seasons saw very little catch (Figure 4). Expanding the sampling coverage or number of stations in all areas is recommended in Amendment 2 of the FMP to improve estimates of bay scallop abundance. As bay scallops expand and retract from year to year, broader coverage of these areas will help identify more precisely what is happening to the population before entering the harvest season.

STATUS OF THE FISHERY

Current Regulations

The North Carolina Marine Fisheries Commission adopted an adaptive management strategy to open waters to bay scallop harvest with specific progressive triggers for Bogue, Core, Back, and Pamlico sounds (Table 1). Areas south of Bogue Sound will not be managed with a specific abundance opening level, but will be opened or remain closed based on NCDMF judgement from sampling in this region. Expanded sampling is to occur in all areas including areas south of Bogue Sound and improve the reliability of the data for the recreational scallop harvest. The triggers allow limited harvest when NCDMF sampling indicates bay scallop abundance in a given region is at 50 percent of the target. Trip limits and fishing days for commercial harvest will progressively increase if sampling showed bay scallop abundance was at 75 percent and 125 percent of the target levels established within each region (Table 2). Recreational daily harvest limits and open days remain the same at all abundance levels (Table 3).

The season can only occur from the last Monday in January through April 1st and there is no minimum size limit for both the commercial and recreational user groups. Specific trip limits, number of days to harvest, and specific gear allowances are implemented within the open

season. Both the opening of the season and the harvest restrictions within the open season are based on NCDMF fishery independent sampling abundance levels determining the levels of harvest (NCDMF 2015). There was no open harvest season for bay scallops in 2014 because abundance levels were too low to meet the threshold for opening the season.

Commercial Landings

Bay scallop abundance and harvest have widely fluctuated since landings have been recorded (MacKenzie 2008). Landings are closely linked to weather and other environmental factors. Landings ranged from a peak of approximately 1.4 million pounds of meats in 1928 when North Carolina led the nation in scallop production, to a low of zero landings in 2005 even though there was an open harvest season. Landings have been virtually non-existent since 2005.

The red tide (toxic dinoflagellate) event of late autumn 1987 and early 1988 caused mortality to approximately 21% of the adult scallops in Bogue and Back sounds and reduced recruitment of juvenile scallops the following spring to only 2% of normal (the mean of the previous three red tide-free years)(Summerson and Peterson 1990). This event has had lasting impacts to the bay scallop fishery and repopulation of the Bogue, Back, and Core sound regions has not fully occurred. Landings in recent years have been extremely low due to the failure of scallop stocks to recover after the red tide event, fishing pressure, and predation.

A moratorium on harvest occurred from 2006 to 2008 through the 2005 FMP (NCDMF 2007). Amendment 1 initiated abundance estimates to determine opening the fishery and at what levels harvest would occur based on the abundance estimates by region (NCDMF 2010). An open harvest commercial and recreational harvest season occurred in Core and Pamlico sounds in 2009, and in Pamlico Sound in 2010 (less than 500 pounds of meat (Figure 4). Bogue Sound and all areas south of Bogue Sound were opened to harvest to the NC/SC state line in internal waters in 2014 (less than 1,500 pounds of meat) (Figure 4).

Recreational Landings

Unknown

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Currently, the only data available for the stock in all areas are the commercial landings and associated effort from the Trip Ticket Program. There are no fishery dependent sampling programs that collect information on the commercial or recreational fisheries for bay scallops.

Fishery-Independent Monitoring

Independent sampling of bay scallops for fisheries management information has been conducted since 1975, and has varied from monthly examinations at twenty stations to seasonal monitoring at fewer locations.

Currently sampling occurs 4 times a year in Pamlico, Core, Back, Bogue and areas south of Bogue Sound during the second or third week of the month in January, April, July, and October. Standardized sampling at fixed stations occur quarterly (January, April, July, and October) in

Pamlico Sound using a m^2 quadrat and a bay scallop dredge in Core, Back, Bogue, and areas south of Bogue Sound. A core set of 8 stations are towed 3 times for two minutes with a scallop dredge in Core, Back, and Bogue sounds and additional stations are also sampled 3 times for two minutes where scallops have historically been found. The core set stations were selected based on historical information from Program 697 of traditionally abundant areas in Core, Bogue, and Back sounds. A set of 3 core stations, two in New River and 1 in Topsail Sound, are towed 3 times for two minutes with a scallop dredge beginning in 2009. Stations were selected in New River and Topsail Sound based on scouting the areas for scallops and input from fishermen and the public that use the waters regularly. Sampling also occurs at 5 core stations and 5 non-core stations off Hatteras Island. Scallops are collected with a rake or by hand for 10, meter-square (m^2) samples within the station in Pamlico Sound. The PVC m^2 quadrat is randomly placed 10 separate times within the area. Beginning in 2015, after adoption of Amendment 2 of the FMP, more stations will be sampled in most areas and especially in areas south of Bogue Sound. Catch per unit effort (lnCPUE) is defined as the natural logarithm, of the number of scallops (juvenile and adult combined) per 1 minute tow if a dredge is used or per quadrat. Additional stations (non-core) are sampled in most areas dependent on scallop abundance at the given time of year.

Most tows/quadrats have small or zero catch, while only a few samples exhibit large catches producing a lognormal distribution, which is usual for most fishery independent data. The natural log (ln) of the catch per unit effort (lnCPUE), measured as the number of scallops per minute (dredges) and number of scallops per meter squared (quadrat), is taken to avoid bias towards occasional large catches. A constant of 0.1 was added to all catches so that tows/quadrats with zero catches can be included in the estimates of the mean since the natural log of zero is undefined. All tows/quadrats taken at a station are averaged to get a single value for each station and are referred to as a sample. This is done to avoid weighting some tows/quadrats to each station more than others because the number of tows/quadrats was not always consistent in duration. Each sample is averaged to get the estimated mean lnCPUE and standard deviation for the October-December time period for all areas to produce indices of abundance (Figures 1 and 2).

Trends in the past ten years show bay scallop abundance is very low in all regions which is also a reflection in landings when harvest is opened (Table 4; Figure 1).

MANAGEMENT STRATEGY

The current management strategy for the bay scallop fisheries is to allow the NCDMF Director to open a region to limited bay scallop harvest when sampling indicates bay scallop abundance is at 50 percent of the natural logarithm of the Catch Per Unit Effort (lnCPUE) level it was in 1984-85 in the main harvest areas (Core, Bogue and Back sounds)(Table1). A separate sampling indicator for re-opening was developed in 2009 for Pamlico Sound (Table 1). Areas south of Bogue Sound will not be managed with a specific abundance opening level, but will be opened or remain closed based on NCDMF judgement from sampling in this region. Expanded sampling is to occur in all areas including areas south of Bogue Sound and improve the reliability of the data for the recreational scallop harvest. For private culture and enhancement the current management strategy is to modify rules for bottom culture and aquaculture operations to be consistent with rules for other shellfish species, and establish a pilot program with the Shellfish Research Hatchery to distribute cultured seed on private bottoms and contingent on results to distribute seed on private bottom, expand the pilot program to include public bottom.

Trip limits and fishing days will progressively increase if sampling shows bay scallop abundance is at 75 percent or 125 percent lnCPUE levels (Tables 2 and 3). The open season may only occur from the last Monday in January through April 1 to ensure spawning is complete and the economic yield is at an optimum for fishermen. Improving data collection on the biology, harvest, environment, enhancement, and socioeconomic aspects relative to bay scallops is recommended throughout Amendment 2 to provide more comprehensive information for assisting in future management decisions. See Table 5 for current management strategies and the status on the implementation of each.

Bay scallop abundance is still quite low (Figures 1, 2, and 3). Harvest openings have only occurred three times since the initiation of the original FMP which was scheduled one year earlier in development due to concern for the stock.

MANAGEMENT AND RESEARCH NEEDS

The status on the implementation of the research recommendations is unknown or incomplete at this time since Amendment 2 was just adopted in February 2015. See Table 5 for current management strategies and the status on the implementation of each.

The following research recommendations were compiled from the Status of the Stock Section 6.0, the Private Culture, Aquaculture, and Stock Enhancement Section 9.0, the Socioeconomic Aspects of the Bay Scallop Fishery Section 10.0, and the Environmental Factors Section 11.0 and issue papers listed in the Principal Issues and Management Options Section 12.0. The list below is presented in order as it would appear in draft Amendment 2 and the section or issue paper they come from is identified. The PDT reviewed and prioritized the research recommendations in accordance to the suggestion by the Biological Review Team research committee. The AC reviewed the draft research recommendations and provided input to prioritize these recommendations as well. The Management Review Team determined the final ranking. If there were differences between the PDT and AC priorities then the middle priority level was chosen between the two, if there was only one level difference the AC priority was chosen. If one group chose to delete the research recommendation but the other prioritized the item then the research recommendation remained with the ranking. The prioritization of each research recommendation is designated either a HIGH, MEDIUM, or LOW standing. A low ranking does not infer a lack of importance but is either already being addressed by others or provides limited information for aiding in management decisions. A high ranking indicates there is a substantial need, which may be time sensitive in nature, to provide information to help with management decisions.

Proper management of the bay scallop resource cannot occur until some of these research needs are met (status of need provided in parenthesis):

- Develop better methods to quantify the population including the means to have more precise measures of spatial and temporal variability at both within and between Sound scales - HIGH (Ongoing through NCDMF fishery independent sampling)
- Collect information on larval recruitment and spat settlement - LOW (needed)
- Genetically identify how many separate bay scallop stocks exist in North Carolina - MEDIUM (needed)
- Examine the effects of scallop culture and oyster cultch on seagrass density - MEDIUM (needed)

- Perform socioeconomic surveys on commercial participants to determine specific business characteristics, the economics of working in the fishery, which issues are important to the participants, attitudes towards management of the fishery and general demographic information - LOW (needed)
- Determine a method to collect socioeconomic information on processors – LOW (needed)
- Collect information on the economic impact and value of the recreational bay scallop fishery - MEDIUM (needed)
- Determine the spatial and biological characteristics of SAV beds that maximize their ecological value to the bay scallop for enhancement or conservation purposes – LOW (needed)
- Develop techniques to enhance SAV habitat to promote scallop survival – LOW (needed)
- Conduct research to evaluate the role of shell hash and shell bottom in bay scallop recruitment and survival, particularly where SAV is absent - LOW (needed)
- Determine the concentrations of EDCs in known bay scallop habitats and impacts on bay scallops – LOW (needed)
- Assess the impacts of nutrient loading and algae on SAV and the life history of bay scallops - MEDIUM (needed)
- Determine levels of TSS, turbidity, chlorophyll *a,* and other parameters necessary to achieve desired water clarity and investigate the feasibility of a water quality standard for light attenuation required for SAV growth – LOW (needed)
- Complete a more comprehensive study on treading and impacts of treading on juvenile and adult bay scallops – HIGH (needed)
- Survey fishermen that use a commercial license for personal consumption – LOW (Ongoing through NCDMF)
- Collect more information on the value of the spring spawn to the population – MEDIUM (needed)

FISHERY MANAGEMENT PLAN RECOMMENDATION

Recommend maintain the current timing of the Benchmark Review. Amendment 2 of the N.C. Bay Scallop FMP was just adopted in February 2015 with rule changes in effect May 1, 2015. Suggested statute change to G.S. 113-168.4 is also part of Amendment 2 with the intention to take this suggested change to legislators at their next short session, otherwise leaseholders who wish to grow out bay scallops reared in an aquaculture operation cannot acquire seed for further grow out without this change.

LITERATURE CITED

Cody, R. P. and J. K. Smith. 1997. Applied Statistics and the SAS Programming Language. Fourth edition. Prentice-Hall, Inc. Upper Saddle River, New Jersey. 445 pp.

MacKenzie Jr., C. L. 2008. History of the bay scallop, *Argopectin irradiens*, Massachusetts through North Carolina: its biology and the history of its habitat and fisheries. In: Bay Scallops in eastern North America: Part I. Marine Fisheries Review. 70(3-4): 6-79.

NCDMF. 2007. North Carolina Bay Scallop Fishery Management Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 198 pp.

NCDMF. 2010. North Carolina Bay Scallop Fishery Management Plan Amendment 1. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 20 pp.

NCDMF. 2015. North Carolina Bay Scallop Fishery Management Plan Amendment 2. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 179 pp.

Peterson, C. H. and H. C. Summerson. 1992. Basin-scale coherence of population dynamics of an exploited marine invertebrate, the bay scallop: implications of recruitment limitation. Marine Ecology Progress Series. 90: 257-272.

Summerson, H. C. and C. H. Peterson. 1990. Recruitment failure of the bay scallop, *Argopecten irradians concentricus*, during the first red tide, *Ptychodiscus breviw*, outbreak recorded in North Carolina. Estuaries. 13(3): 322-331.

TABLES

Table 1. Target and progressive triggers based on the lnCPUE (natural log of the number of scallops per 1 minute tow) for the October – December 1984-1985 time period for Back, Bogue, and Core sounds. Target and progressive triggers based on the lnCPUE (natural log of the number of scallops per meter squared) for Pamlico Sound based on sampling in January 2009.

	Pamlico Sound	Core Sound	Back Sound	Bogue Sound
Target lnCPUE	-0.18	1.72	2.02	2.33
Progressive trigger 50%	-0.27	0.86	1.01	1.17
Progressive trigger 75%	-0.23	1.29	1.52	1.75
Progressive trigger 125%	-0.14	2.15	2.53	2.91

Table 2. Adaptive management measures for opening the bay scallop commercial fishery as the selected management strategy of the Marine Fisheries Commission. The harvest levels are based on progressive triggers derived from the lnCPUE1984-1985 (Oct-Dec) target indicators for Core, Bogue and Back sounds and the lnCPUEJan 2009 target indicator for Pamlico Sound.

Progressive triggers and target	Trip limit	Days open in the week	Allowed gears	Season
Less than 50% of target	No allowed harvest			
50% or greater of target but less than 75% of target	5 bushels per person per day not to exceed 10 bushels per fishing operation	Mon and Wed	By hand, hand rakes, hand tongs, dip net, and scoops	Last Monday in January to April 1st
75% or greater of target but less than 125% of target	10 bushels per person per day not to exceed 20 bushels per fishing operation	Mon, Tues, Wed, and Thur	By hand, hand rakes, hand tongs, dip net, and scoops	Last Monday in January to April 1st
	10 bushels per person per day not to exceed 20 bushels per fishing operation	Mon and Wed	Bay scallop dredges as described by rule 15A NCAC 03K. 0503	Delay opening until first full week in March after hand harvest removes scallops from shallow waters to April 1st
125% or greater of target	15 bushels per person per day not to exceed 30 bushels per fishing operation	Mon, Tues, Wed, and Thur	By hand, hand rakes, hand tongs, dip net, and scoops	Last Monday in January to April 1st
	15 bushels per person per day not to exceed 30 bushels per fishing operation	Mon and Wed	Bay scallop dredges as described by rule 15A NCAC 03K. 0503	Delay opening until the third full week in February after hand harvest removes scallops from shallow waters to April 1st

Table 3. Adaptive management measures for opening the bay scallop recreational fishery as the selected management strategy by the Marine Fisheries Commission. The harvest levels are based on progressive triggers derived from the lnCPUE1984-1985 (Oct-Dec) target indicators for Core, Bogue and Back sounds and the lnCPUEJan 2009 target indicator for Pamlico Sound.

Progressive triggers and target	Trip limit	Days open in week	Allowed gears	Season
Less than 50% of target	No allowed harvest	Seven days a week	By hand, hand rakes, hand tongs, dip net, and scoops	Last Monday in January to April 1st
50% or greater of target	1/2 bushel per person per day not to exceed 1 bushel per recreational fishing operation			

Table 4. Fishery Independent sampling annual lnCPUE and standard error. Pamlico Sound sampling is conducted in January with a m^2 quadrat, all other areas are sampled in October with a scallop dredge.

	Pamlico Sound		Core Sound		Back Sound		Bogue Sound		South	
Year	LnCPUE	Standard Error	lnCPUE	Standard Error	lnCPUE	Standard Error	lnCPUE	Standard Error	lnCPUE	Standard Error
2006			-2.3026	0.0000	-1.5419	0.4975	-1.0241	0.3366		
2007			-1.2432	0.4958	-2.0040	0.2986	-1.5685	0.3366		
2008			2.9378	0.3485	-1.4067	0.4006	1.2051	0.5700		
2009	-0.1766	0.7908	-1.0071	0.4207	-1.3057	0.4549	1.3421	0.2676	0.9372	0.7512
2010	0.3238	0.6701	-0.5450	0.3887	-1.1036	0.5362	-1.1168	0.5366	-2.3026	0.0000
2011	-1.9941	0.1273	-0.6323	0.5705	0.8260	0.2581	0.3793	0.3429	-1.7652	0.3704
2012	-1.6620	0.2626	-1.7053	0.3777	-0.5607	0.7793	1.1833	0.2450	-0.9060	0.3599
2013	-1.2115	0.1091	-2.3026	0.0000	-2.3026	0.0000	-0.4116	0.7131	-1.1949	0.4186
2014	-1.5395	0.3130	-2.0040	0.2986	-1.0071	0.4207	-2.0040	0.2013	-1.6380	0.3374
2015	-1.8590	0.3865								

Table 5. Summary of the management strategies and their implementation status from Amendment 2 of the Bay Scallop Fishery Management Plan.

Management Strategy	Implementation Status
ENVIRONMENTAL CONCERNS	
Status quo (manage fishing gear based on scallop densities)	No action required
Continue to support CHPP recommendations that enhance protection of existing bay scallop habitat	No action required; Already support the CHPP
Support programs that enhance bay scallop habitat by planting sea grass or other suitable settlement substrate	No action required; Already support CHPP
Identify and designate SHAs that will enhance protection of the bay scallop	Existing authority through CHPP implementation plan
Remap and monitor SAV coverage in North Carolina to assess distribution and change over time.	Existing authority through CHPP implementation plan
Restore coastal wetlands to compensate for previous losses and enhance water quality conditions for the bay scallop	Existing authority through CHPP implementation plan
Work with CRC to revise shoreline stabilization rules to adequately protect riparian wetlands and shallow water habitat and significantly reduce the rate of shoreline hardening	Existing authority through CHPP implementation plan
Develop and implement a comprehensive coastal marina and dock management plan and policy to minimize impacts to SAV and other fish habitats	Existing authority through CHPP implementation plan
Evaluate dock criteria siting and construction to determine if existing requirements are adequate for SAV survival and growth, and modify if necessary	Existing authority through CHPP implementation plan
Assess the distribution, concentration, and threat of heavy metals and other toxic contaminants in freshwater and estuarine sediments and identify the areas of greatest concern to focus water quality improvement efforts	Existing authority through CHPP implementation plan
Shallow areas where trawling is currently allowed should be re-examined to determine if additional restrictions are necessary	Existing authority through CHPP implementation plan
Accelerate and complete mapping of all shell bottom in coastal North Carolina	Existing authority through CHPP implementation plan
Improve methods to reduce sediment and nutrient pollution from construction sites, agriculture, and forestry	Existing authority through CHPP implementation plan
Reduce impervious surfaces and increase on-site infiltration of stormwater through voluntary or regulatory measures	Existing authority through CHPP implementation plan
Provide more incentives for low-impact development	Existing authority through CHPP implementation plan
Aggressively reduce point source pollution from wastewater through improved inspections of wastewater treatment facilities, improved maintenance of collection infrastructure, and establishment of additional incentives to local governments for wastewater treatment plant upgrading	Existing authority through CHPP implementation plan
Aggressively reduce point and non-point nutrient and sediment loading in estuarine waters, to levels that will sustain SAV habitat, using regulatory and non-regulatory actions	Existing authority through CHPP implementation plan

Management Strategy	Implementation Status
ENVIRONMENTAL CONCERNS	
Provide proper disposal of unwanted drugs, reduce insecticide and heavy metal run-off, and develop technologies to treat wastewater for antibiotics and hormones	Existing authority through CHPP implementation plan
Discourage use of detergents in coastal waters, especially detergents with antimicrobial components	Existing authority through CHPP implementation plan
INSUFFICIENT DATA	
Support improving the reliability of the data for the recreational scallop harvest	Dependent on available funding to improve current survey design
MANAGEMENT	
Eliminate the August 1 through September 15 season open period in rule	Rule change required to 15A NCAC 03K .0501; Rule change completed on May 1, 2015
Expand sampling in all regions and manage harvest conditionally in areas south of Bogue Sound until adequate sampling can determine a harvest trigger for management.	Existing authority
Continue current progressive triggers with adaptive harvest levels in all areas, except areas south of Bogue Sound, and modify harvest management measures as shown in Table 12.7 and Table 12.8 in the issue paper. And continue to improve the statistical rigor of the abundance index.	Existing proclamation authority.
Keep dredges at the 75% trigger harvest level in Table 12.7	Existing proclamation authority.
Modify the daily commercial harvest possession limit in Rule 15A NCAC 03K .0501 to a quantity of no more than 15 standard U.S. bushels per person per day not to exceed 30 standard U.S. bushels in any combined commercial fishing operation per day to be consistent with the adaptive management measures trip limits.	Requires rule change to rule 15A NCAC 03K .0501; Rule change completed on May 1, 2015.
Exempt bay scallop harvest from leases from the regular season and harvest limits	Requires rule change to rules 15A NCAC 03K .0111, 03K .0206, 03K .0303, 03K 0501, 03K .0502, 03K .0507, 03K .0508, 03O .0501; Rule changes completed on May 1, 2015
Support an exemption from G.S. 113-168.4 (b) (3) when the sale is to lease or Aquaculture Operations permit holders for further rearing	Requires statutory change to G.S. 113-168.4; NCDMF will take this suggested change to legislators at the next short session.
STOCK ENHANCEMENT	
Establish a pilot program with the Shellfish Research Hatchery to distribute cultured seed on private bottoms	Will need to start communicating with Shellfish Hatchery staff and interested private culturists interested in establishing this pilot work
Contingent on results to distribute seed on private bottom, expand the pilot program to include public bottom	Dependent on results from previous management strategy.

FIGURES

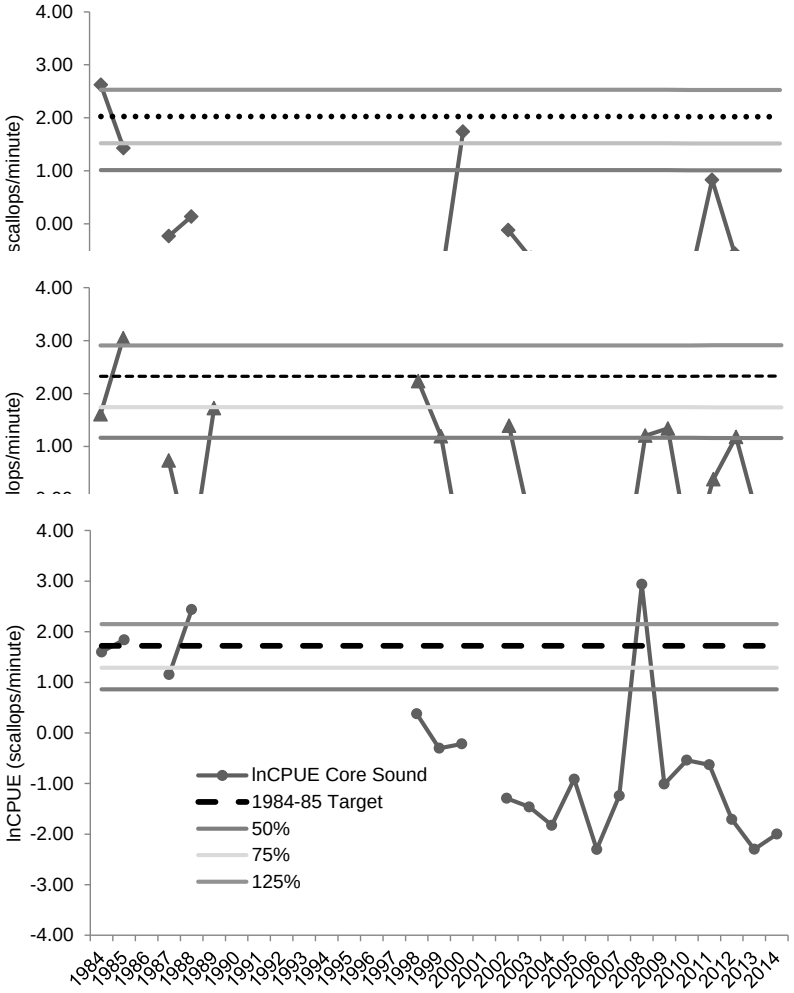


Figure 1. The mean number of scallops (lnCPUE)(scallops/minute) for Back, Bogue, and Core sounds during the October-December sampling time period and average lnCPUE (target) for the 1984-1985 period showing progressive triggers at 50%, 75%, and 125% of the target. Year indicates the sampling year which is used to determine the harvest season for the next calendar year.

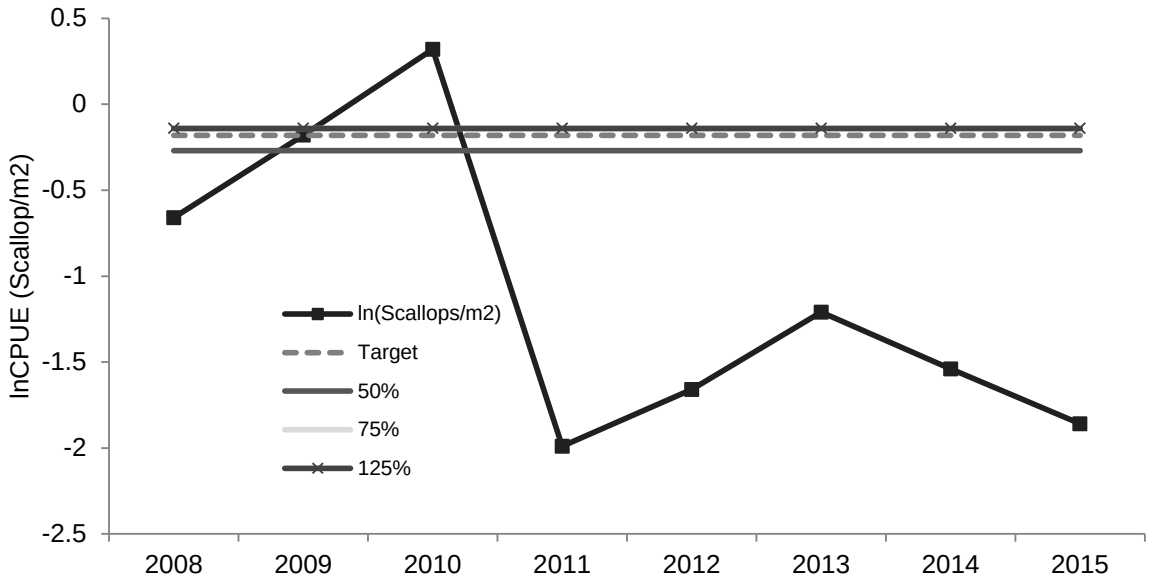


Figure 2. The mean number of bay scallops, lnCPUE (ln(scallops/m^2)), for Pamlico Sound during the January sampling time period and target for the January 2009 period showing progressive triggers at 50%, 75%, and 125% of the target. Year indicates the sampling year which is used to determine the harvest season for the same calendar year.

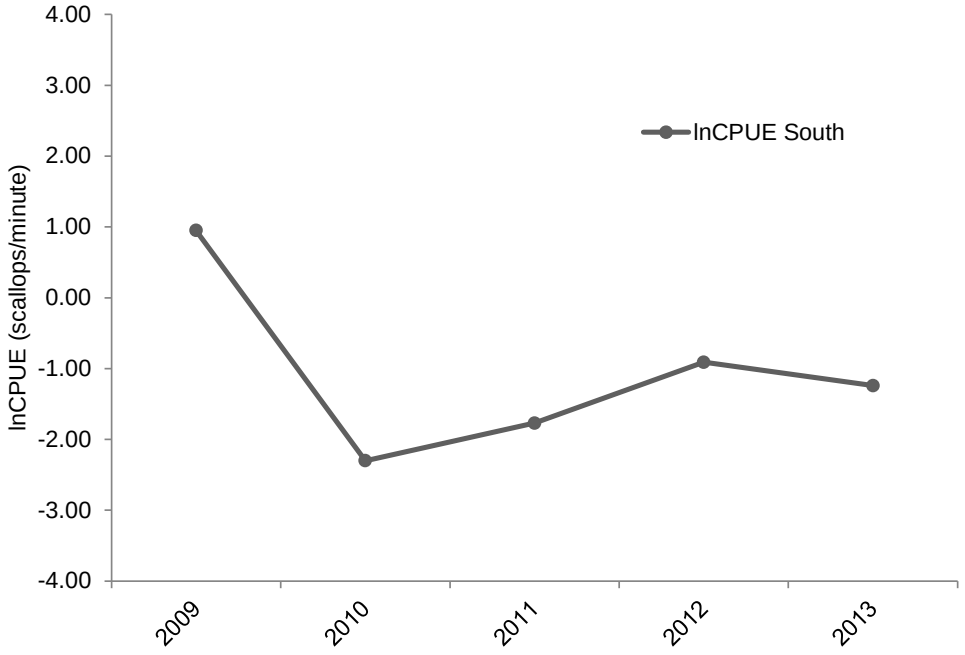


Figure 3. The mean number of scallops (lnCPUE)(scallops/minute) for areas south of Bogue Sound in October, 2009-2014. Target opening estimates and progressive triggers are not defined for this region until sampling is expanded and a longer time series is established.

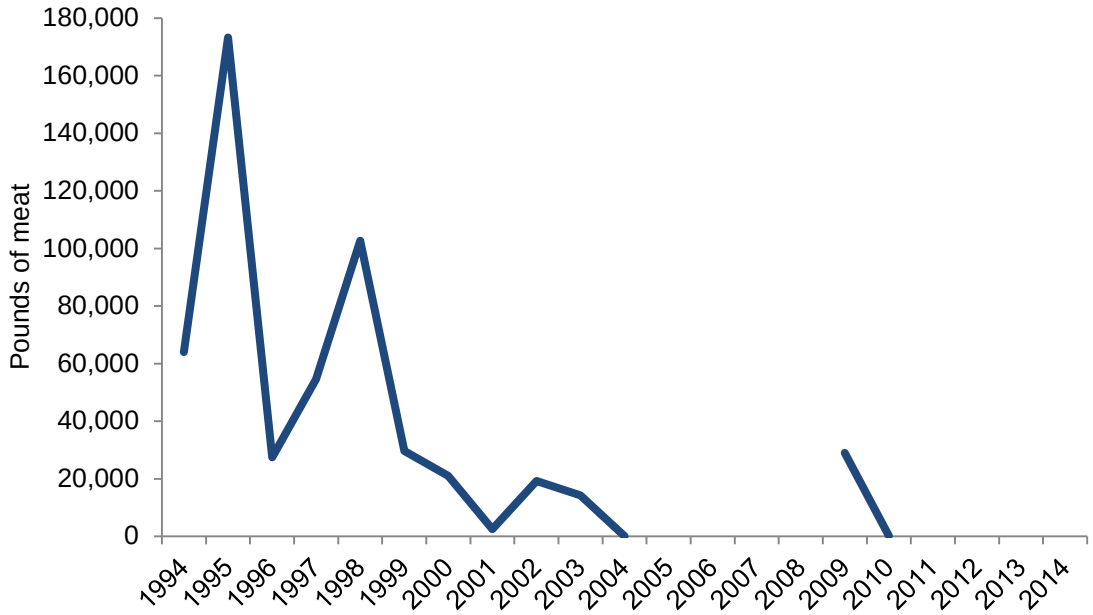


Figure 4. Bay scallop landings (pounds of meat) in North Carolina, 1994-2014. Landings occurred in 2010 and 2013 but are not evident in the figure due to the scale required to show the range of landings for the time series.

FISHERY MANAGEMENT PLAN UPDATE
BLUE CRAB
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	December 1998
Amendments:	December 2004, November 2013
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	November 2018

The original Blue Crab Fishery Management Plan (FMP) was adopted in December 1998. The plan adopted several management changes including: 1) requiring sinking lines to be used on all crab pot buoys, 2) prohibited commercial gears (except attended gill nets) in crab spawning sanctuaries from March 1 through August 31, 3) prohibited baiting peeler pots except with live legal male blue crabs, 4) repealed the exemption for culling peelers before reaching shore in the hard crab fishery, 5) prohibiting the possession of white line peelers from June 1 through September 30, 6) changed the unattended pot rule from 10 days to 7 days, 7) prohibiting setting pots in any navigation channel marked by State or Federal agencies, 8) modified crab pot area regulations to use depth instead of distance from shore, 9) implemented marking requirements for recreational pots, 10) defined collapsible traps as non-commercial gear, and 11) established a permit for shedding operations (NCDMF 1998).

Amendment 1 was adopted in December 2004. The amendment implemented several management changes including: 1) establishing a 6.75-inch maximum size limit for mature females from September 1 through April 30 if the spawner index fell below the threshold for two consecutive years, 2) establishing a 5.25-inch maximum size limit for female peeler crabs from September 1 through April 30 if the spawner index fell below the threshold for two consecutive years, 3) prohibiting the sale of white-line peelers but allow possession by licensed peeler operations and requiring white-line peelers to be kept separate from pink and red-line peelers, 4) extending the pot cleanup period by nine days, 5) change the unattended pot rule from 7 days to 5 days, 6) requiring a 4-inch stretch mesh tail bag for crab trawls in western Pamlico Sound (including the Pamlico, Pungo, Bay, and Neuse rivers), 7) separate hard and peeler crab trawl landings on trip ticket, 8) modifying channel net rule to incorporate limited blue crab bycatch provisions identical to those for shrimp trawls, 9) modifying user conflict rule to resolve user conflicts on a regional basis, 10) rule change to allow crab pots in all designated long haul areas in the Hyde, Beaufort, and Pamlico counties, 11) modifying the dates for designated crab pot areas from May 1 through October 31 to June 1 through November 30, 12) change

designated pot area boundary description to a standardized 6 foot depth contour in many areas, and 13) prohibit the use of trawls in designated pot areas (NCDMF 2004).

Amendment 2 was adopted in November 2013. The amendment implemented several management changes including: 1) repealing the spawner index trigger and replacing it with adaptive management framework based on the Traffic Light Stock Assessment, 2) open long haul areas in the Pungo River to pots, 3) add Lower Broad Creek to non-pot areas in rule, 4) modify crab dredging rule to conform to current harvest management, 5) incorporate Pamlico Sound four-inch crab trawl line into rule, 6) redefine criteria for exempting escape rings in crab pots from the 1½-inch pot mesh size to unbaited pots and pots baited with a male crab, 7) repeal proclamation authority that allowed for the exemption of escape ring requirement to allow harvest of peeler crabs, 8)adopt no trawl line in Pamlico Sound and Newport River boundary in rule as new boundary for areas where closure of escape rings to take small mature female crabs is allowed, 9) modify trawl nets rule to identify Pamlico, Back, and Core sounds as areas that can open to peeler trawling by proclamation, 10) modify rule to clearly state the intent of the exceptions, culling tolerance, and separation requirements for various crab categories, and 11) establish proclamation authority to require terrapin excluders in crab pots and establish a framework for developing criteria and terrapin excluder specifications (NCDMF 2013).

Management Unit

The management unit includes the blue crab (*Callinectes sapidus*) and its fisheries in all coastal fishing waters of North Carolina.

Goal and Objectives

The goal of the North Carolina Blue Crab FMP is to manage the blue crab fishery in a manner that promotes its ecological and economic value, and the long-term viability of the resource through sustainable harvest. The following objectives will be utilized to achieve this goal.

1. Utilize a management strategy that provides resource protection and sustainable harvest, promotes blue crab ecological and economic value, provides opportunity for resource utilization, and considers the needs of all users.

2. Promote harvesting practices that minimize waste of the resource and environmental damage.

3. Promote the protection, restoration, and enhancement of habitats and environmental quality necessary for the perpetuation of the blue crab resource.

4. Maintain a clear distinction between conservation goals and allocation issues.

5. Minimize conflicts among and within user groups, including non-crabbing user groups.

6. Identify and promote research to improve the understanding and management of the blue crab resource.

7. Promote education and public information to help users understand the causes and nature of problems for blue crabs in North Carolina, its habitats and fisheries, and the rationale for efforts to address resource management.

STATUS OF THE STOCK

Stock Status

Results of the current stock assessment suggest the North Carolina blue crab stock is not overfished. The stock status of blue crabs is still considered to be of "Concern" because of declining landings and evidence of reduced adult and recruit abundance in the traffic light. Even though there is now a more robust assessment of the stock condition, overfishing status cannot be determined at this time.

Stock Assessment

The Traffic Light method was used to assess the blue crab stock in 2011. The Traffic Light Stock Assessment method is capable of synthesizing a variety of information to provide a description of the stock condition. The nature of the Traffic Light method does not allow for a quantitative assessment of sustainable harvest for the North Carolina blue crab stock since overfishing cannot be calculated.

The blue crab stock is considered overfished when the proportion of red in the production characteristic of the Traffic Light method is greater than or equal to the third quartile (>0.75) for three consecutive years. Based on this definition, the results of the Traffic Light through 2014 suggest the North Carolina blue crab stock is not overfished.

Though the overfished definition is based only on the production characteristic, the adult abundance and recruit abundance characteristics are evaluated annually for warning signs that the stock may be approaching an unfavorable state. If a series of negative trends is evident in the adult abundance and production characteristics for three consecutive years, management action may be taken to reduce the unfavorable condition of the stock. Only the adult abundance and production characteristics will be utilized to trigger management actions; the recruit abundance characteristic will be used as a supplement to further direct conservation management actions, if deemed necessary. A review by the Crustacean Advisory Committee would be maintained to consider management options, evaluate their merits, and gain approval by the North Carolina Marine Fisheries Commission (NCMFC) before the Director's proclamation authority (expanded under the adaptive management framework) would be used to implement any changes to the fisheries.

The NCMFC preferred adaptive management strategy for blue crabs (Table 1) relies on the Traffic Light Stock Assessment as the tool to provide information on the relative condition of the stock. The base years (1987 to 2009) for assigning the signals in the Traffic Light Stock Assessment will remain constant until the next amendment of the FMP. The Traffic Light Stock Assessment will be updated annually by July of each year.

STATUS OF THE FISHERY

Current Regulations

General Statutes

All management authority for North Carolina's blue crab fishery is vested in the State of North Carolina. Statutes that have been applied to the blue crab fishery include:

- Definitions relating to resources. G.S.113-129.
- Definitions relating to activities of public. G.S.113-130.
- Jurisdiction of fisheries agencies. G.S.113-132.
- It is unlawful for any person without the authority of the owner of the equipment to take fish from said equipment. G.S. 113-268 (a).
- It is unlawful for any vessel in the navigable waters of the State to willfully, wantonly, and unnecessarily do injury to any seine, net or pot. G.S. 113-268 (b).
- It is unlawful for any person to willfully destroy or injure any buoys, markers, stakes, nets, pots, or other devices or property lawfully set out in the open waters of the state in connection with any fishing or fishery. G.S. 113-268 (c).

Marine Fisheries Commission Rules

The North Carolina Marine Fisheries Commission has established several rules that directly govern the harvest of blue crabs. Below are rules and excerpts from rules that directly affect the blue crab fishery. The rules below do not cover any gear, area, or other rules which may impact the blue crab fishery. As regulations may change, please contact the North Carolina Division of Marine Fisheries (NCDMF) for the most current regulations.

Definitions

Blue Crab Shedding: The process whereby a blue crab emerges soft from its former hard exoskeleton. A shedding operation is any operation that holds peeler crabs in a controlled environment. A controlled environment provides and maintains throughout the shedding process one or more of the following: (i) food, (ii) predator protection, (iii) salinity, (iv) temperature controls, or (v) water circulation, utilizing technology not found in the natural environment. A shedding operation does not include transporting pink or red-line peeler crabs to a permitted shedding operation. 15A NCAC 03I .0101 (2) (c).

Peeler Crab: A blue crab that has a soft shell developing under a hard shell and having a white, pink, or red-line or rim on the outer edge of the back fin or flipper. 15A NCAC 03I .0101 (2) (f).

Commercial Fishing Equipment or Gear: All fishing equipment used in coastal fishing waters except: (i) Cast nets; (ii) Collapsible crab traps, a trap used for taking crabs with the largest open dimension no larger than 18 inches and that by design is collapsed at all times when in the water, except when it is being retrieved from or lowered to the bottom; (iii) Dip nets or scoops having a handle not more than eight feet in length and a hoop or frame to which the net is attached not exceeding 60 inches along the perimeter; (iv) Gigs or other pointed implements which are propelled by hand, whether or not the implement remains in the hand; (v) Hand operated rakes no more than 12 inches wide and weighing no more than six pounds and hand operated tongs; (vi) Hook and line and bait and line equipment other than multiple hook or

multiple bait trotline; (vii) Landing nets used to assist in taking fish when the initial and primary method of taking is by the use of hook and line; (viii) Minnow traps when no more than two are in use; (ix) Seines less than 30 feet in length; (x) Spears, Hawaiian slings or similar devices, which propel pointed implements by mechanical means, including elastic tubing or bands, pressurized gas or similar means. 15A NCAC 03I .0101 (3) (c).

Mesh Length: The diagonal distance from the inside of one knot to the outside of the other knot, when the net is stretched hand-tight. 15A NCAC 03I .0101 (3) (k).

Crab Harvest Restrictions

Hard crab minimum size limit of 5 inches measured from tip of spike to tip of spike for male and immature female hard blue crabs. Soft crabs shall be separated where taken and placed in a separate container. Peeler crabs shall be separated where taken and placed in a separate container. White-line peeler crabs shall be separated from pink and red-line peeler crabs where taken and placed in a separate container. Male crabs to be used as peeler bait are exempt from the 5 inch size limit from March 1 through October 31 and hall be placed in a separate container. A culling tolerance of not more than five percent by number shall be allowed for white-line peelers in the pink and red-line peeler container. It is unlawful to: sell white-line peelers, possess white-line peelers unless they are to be used by the harvester in the harvester's permitted blue crab shedding operation, possess male white line peelers from June 1 through September 1. It is unlawful to possess more than 50 crabs per person per day not to exceed 100 blue crabs per vessel per day for recreational purposes. To comply with management measures I the N.C. Blue Crab Fishery Management Plan, the Director, may by proclamation, close the harvest of blue crabs and may impose any or all of the following restrictions on the commercial and recreational blue crab harvest: specify, areas, season; time periods, means and methods, culling tolerance, and limit harvest based on size, quantity, sex, reproductive stage, or peeler stage. 15A NCAC 03L .0201 (a) (b) (1) (2) (3) (4) (c) (d) (1) (2) (3) (e) (f).

Spawning Sanctuaries

It is unlawful to set or use trawls, pots, and mechanical methods for oysters or clams or take crabs with the use of commercial fishing equipment from crab spawning sanctuaries [3R .0110 (1) (2) (3) (4) (5)] from March 1 through August 31. During the remainder of the year the Director may, by proclamation, close these areas and may impose any or all of the following restrictions: areas, time periods, means and methods, and limit harvest based on size, quantity, sex, reproductive stage, or peeler stage. 15A NCAC 03L .0205 (a) (b) (1) (2) (3) (4).

Peeler and Soft Crabs

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. 15A NCAC 03O .0503 (c).

Recreational Harvest

- Blue crabs may be taken without a commercial license if the following gears are used; cast nets, collapsible crab traps with the largest open dimension no larger than 18 inches, a dip net having a handle not more than 8 feet in length and a hoop or frame to which the net is attached not exceeding 60 inches along the perimeter; single bait-and-line equipment, or seines less than 30 feet. 15A NCAC 03I .0101 (3) (c) (i) (ii) (iii) (vi) (ix)

- Recreational crab pot buoys must be any shade of hot pink in color, and be no less than 5 inches in diameter and length and be engraved with the owner's last name and initials. If a vessel is used the buoy must also be engraved with the gear owners current motorboat registration number or owner's U.S. vessel documentation name. 15A NCAC 03J .0302 (a) (1) (2).
- It is unlawful for a person to use more than one crab pot attached to the shore along privately owned land or to a privately owned pier without possessing a valid Recreational Commercial Gear License. 15A NCAC 03J .0302 (b).
- Up to five crab pots may be used by holders of the Recreational Commercial Gear License. 15A NCAC 03O .0302 (a) (3).
- Peeler pots are not permitted to be used by holders of the Recreational Commercial Gear License. 15A NCAC 03O .0302 (a) (3).
- One multiple hook or multiple bait trotline up to 100 feet in length may be used to harvest blue crabs. 15A NCAC 03O .0302 (a) (4).
- Trotlines must be marked at both ends with any shade of hot pink in color, and be no less than 5 inches in diameter and length and be engraved with the owner's last name and initials. If a vessel is used the buoy must also be engraved with the gear owners current motorboat registration number or owner's U.S. vessel documentation name. 15A NCAC 03J .0302.

Trawls

- It is unlawful to use trawl nets in designated pot areas opened to the use of pots and within an area bound by the shoreline to the depth of six feet. 15A NCAC 03J .0104 (b) (6).
- It is unlawful to use shrimp trawls for the taking of blue crabs in internal waters, except that it shall be permissible to take or possess blue crabs incidental to commercial shrimp trawling provided that the weight of the crabs shall not exceed; 50 percent of the total weight of the combined crab and shrimp catch; or 300 pounds, whichever is greater. For individuals using shrimp trawls authorized by a Recreational Commercial Gear License, 50 blue crabs, not to exceed 100 blue crabs if two or more Recreational Commercial Gear License holders are on board. The Fisheries Director may, by proclamation, close any area to trawling for specific time periods in order to secure compliance with this rule. 15A NCAC 03J .0104 (f) (1) (2) (A) (B) (g).
- From December 1 through March 31 it is unlawful to possess finfish caught incidental to shrimp and crab trawling in the Atlantic Ocean unless the weight of the combined catch of shrimp and crabs exceeds the weight of finfish; except that trawlers working south of Bogue Inlet may keep up to 300 pounds of kingfish, regardless of their shrimp or crab catch weight. 15A NCAC 03J .0202 (5).
- It is unlawful to take or possess crabs aboard a vessel in internal waters except in areas and during such times as the Fisheries Director may specify by proclamation. 15A NCAC 03L .0202 (a).
- It is unlawful to take crabs with crab trawls with a mesh less than three inches, except in areas of western Pamlico Sound the minimum mesh length is four inches; the Director may, by proclamation, specify other areas for trawl mesh length and increase the minimum mesh length to no more than four inches. 15A NCAC 3L .0202 (b) (1) (2).
- It is unlawful to use trawls with a mesh length less than two inches or with a combined total headrope length exceeding 25 feet for taking soft or peeler crabs. 15A NCAC 03L .0202 (c).
- It is unlawful to use trawl nets for any purpose in any of the special secondary nursery areas, except that the Fisheries Director, may, by proclamation, open any or all of the special secondary nursery areas, or any portion thereof to crab trawling from August 16

through May 14. 15A NCAC 03N .0105 (b), 15A NCAC 03R .0105, 15A NCAC 03L .0100 and .0200.

- It is unlawful to use trawl nets in areas listed in 15A NCAC 3R .0106, except that certain areas may be opened to peeler trawling for single-rigged peeler trawls or double-rigged boats whose combined total headrope length does not exceed 25 feet. 15A NCAC 3J .0104 (b) (4); 15A NCAC 03R .0106 (1).

Crab Pots

- It is unlawful to leave pots in any coastal fishing waters for more than five consecutive days, when such pots are not being employed in fishing operations, except upon a timely and sufficient showing of hardship. 15A NCAC 03I .0105 (b) (1) (2) (A) (B) (3) (c).
- All pots shall be removed from internal waters from January 15 through February 7. Areas may be reopened, by proclamation, to the use of pots after January 19 if it is determined that such areas are free of pots. 15A NCAC 03J .0301 (a) (1).
- From June 1 through November 30 the use of crab pots is restricted in certain areas north and east of the Highway 58 Bridge at Emerald Isle. These areas are describe in 15A NCAC 03R .0107 (a). To allow for the variable spatial distribution of crustacea and finfish, the Fisheries Director may, by proclamation, specify time periods for or designate the areas described in 15A NCAC 03R .0107(b); or any part thereof, for the use of pots. From May 1 through November 30 in the Atlantic Ocean and west and south of the Highway 58 Bridge at Emerald Isle in areas and during time periods designated by the Fisheries Director by proclamation.15A NCAC 03J .0301 (a) (2) (A) (B) (3) and 03R .0107 (a) (b).
- It is unlawful to use pots in any navigation channel maintained and marked by State or Federal agencies. 15A NCAC 03J .0301 (b) (1).
- It is unlawful to use pots in any turning basin maintained and marked by the North Carolina Ferry Division. 15A NCAC 03J .0301 (b) (2).
- It is unlawful to use pots in a commercial fishing operation unless each pot is marked by attaching a floating buoy which shall be of solid foam or other solid buoyant material no less than five inches in diameter and no less than five inches in length. Buoys may be any color except yellow or hot pink or any combination of colors that include yellow or hot pink. The pot owner's N.C. motorboat registration number, or U.S. vessel documentation name, or last name and initials shall be engraved in the buoy, or on a metal or plastic tag attached to the buoy. 15A NCAC 03J .0301(c) (1) (2) (3).
- It is unlawful to use crab pots in coastal fishing waters unless each pot contains no less than two unobstructed escape rings that are at least 2 5/16 inches inside diameter and located in the opposite outside panels of the upper chamber of the pot except: unbaited pots, pots baited with a male crab, and pots set in areas described in 15A NCAC 03R .0118. 15A NCAC 03J .0301 (g).
- The Fisheries Director may, by proclamation, exempt the escape ring requirement describe in paragraph (g) in order to allow the harvest of mature female crabs and may impose any or all of the following restrictions: specify time, areas, means and methods, seasons, and quantity. 15A NCAC 03J .0301 (h).
- It is unlawful to use more than 150 pots per vessel in the Newport River.15A NCAC 03J .0301(i).
- It is unlawful to remove crab pots from the water or remove crabs from pots between one hour after sunset and one hour before sunrise. 15A NCAC 03J .0301(j).
- It is unlawful to use pots to take crabs unless the line connecting the pot to the buoy is non-floating. 15A NCAC 03J .0301(k).

Crab Dredging

- It is unlawful to use any dredge weighing more than 100 lb except in the Atlantic Ocean. 15A NCAC 03J .0303 (a).
- It is unlawful to use more than one dredge per vessel to take crabs or to use any dredges between sunset and sunrise. 15A NCAC 03J .0303 (b).
- It is unlawful to take crabs with dredges except from January 1 through March 1 in portions of Pamlico Sound. 15A NCAC 03L .0203 (a) (1) and 15A NCAC 03R .0109.
- Crabs may be taken incidental to lawful oyster dredging provided the weight of the crabs shall not exceed 50% of the total weight of the combined oyster and crab catch; or 500 lb, whichever is less. 15A NCAC 03L .0203 (a) (2) (A) (B).
- It is unlawful to take crabs with dredges between sunset and sunrise and between sunset on any Saturday and sunrise on the following Monday, except in the Atlantic Ocean. 15A NCAC 03L .0203 (b).

Miscellaneous

- It is unlawful to possess, sell, or purchase fish under four inches in length except for use as 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. 15A NCAC 03M .0103 (1).

Wildlife Resources Commission Rules

Manner of Taking Nongame Fish Purchase and Sale

- Blue crabs shall have a minimum carapace width of five inches (point to point) and it is unlawful to possess more than 50 crabs per person per day or to exceed 100 crabs per vessel per day. 15A NCAC 10C .0401 (a) (1).
- Blue crab taken by hook and line, grabbling or by licensed special devices may not be sold. 15A NCAC 10C .0401 (c).

Taking Nongame Fish, Crustaceans, and Mollusks for Bait or Personal Consumption

- A single, multiple bait line for taking crabs not to exceed 100 feet in length that is under the immediate control and attendance of the user and is limited to one line per person and no more than one line per vessel. The line is required to be marked on each end with a solid float no less than five inches in diameter and bearing legible and indelible identification of the user's name and address. 15A NCAC 10C .0402 (a) (6).
- A collapsible crab trap with the largest opening not greater than 18 inches and which, by design, collapses at all times when in the water, except when being retrieved or lowered to the bottom. 15A NCAC 10C .0402 (a) (7).
- Nongame fishes, crustaceans (crayfish and blue crabs), and mollusks taken for bait or personal consumption may not be sold. 15A NCAC 10C .0402 (b).
- No more than 50 crabs per person, per day or 100 per vessel, per day with a minimum carapace width of five inches (point to point) from inland fishing waters or in designated waterfowl impoundments located on game lands. 15A NCAC 10C .0402 (d) (3).

Special Device Fishing

- It is unlawful to use crab pots in inland fishing waters, except by persons owning property adjacent to the inland fishing waters of coastal rivers and their tributaries who are permitted to set two crab pots to be attached to their property and not subject to special device license requirements. 15A NCAC 10C .0404 (e).

Commercial Landings

Commercial blue crab landings (hard, soft, and peeler crabs) averaged 40.5 million pounds from 1987 – 2009 (base years used in the traffic light; Figure 1). The majority of blue crab landings are hard blue crabs. Landings for 2014 were 26.2 million pounds, under the base year average. Generally landings have been declining since 2003, although landings for 2014 were 18 percent higher than 2013. Landings have been below the base year average since 2004. Landings data from 1987 – 1994 were collected under the NCDMF/National Marine Fisheries Service Cooperative Statistics Program which was based on voluntary dealer reporting. Since 1994, landings data have been collected under the NCDMF Trip Ticket Program which instituted mandatory dealer reporting. Landings data should be viewed only as a general indicator of fishing trends since they are influenced by market demand, price, fishing effort, weather, availability of alternate species, regulations, and data collection techniques as well as stock abundance.

Recreational Landings

A survey of Recreational Commercial Gear License (RCGL) holders conducted from 2002 – 2008 by the NCDMF indicated blue crabs were the most abundant species landed (by weight) by RCGL participants. During this time, on average, blue crabs accounted for 20% (116,797 pounds) of the total poundage (587,172 pounds) landed by RCGL holders. This survey was discontinued in 2009 so more recent estimates of RCGL harvest are unavailable. The harvest of RCGL exempted shore and pier based pots, as well as other non-commercial gear, is unknown. While current data is not available, NCDMF has recently started a new program to survey and estimate recreational blue crab landings from RCGL exempt gear (NCDMF 2013)

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The traffic light, used to monitor the health of the blue crab stock, uses commercial crab sampling data (combined with fishery-independent data) to determine the annual length of fifty percent maturity for female blue crabs. This index is used in the Production characteristic of the traffic light. The annual length of fifty percent maturity is compared to the mean length of fifty percent maturity for the base years of 1987 – 2009 (112.1mm carapace width; CW). In 2014, the length of fifty percent maturity was 122.2mm CW and was above the mean for the base years. The length of fifty percent maturity has been above the base year mean since 2005 (Figure 2).

Fishery-Independent Monitoring

The traffic light, used to monitor, the health of the blue crab stock, uses several fishery-independent indices for the Adult Abundance, Recruit Abundance, and Production characteristics. The status of each indicator is compared to the mean of that indicator over a set of base years. The base years used for the blue crab traffic light were 1987 – 2009.

Adult Abundance

The adult abundance characteristic uses data from the Juvenile Anadromous Trawl Survey (P100), the Estuarine Trawl Survey (P120), and the Pamlico Sound Survey (P195) to monitor adult blue crab abundance. Indices from P120 and P195 consist of blue crabs greater than or equal to 100mm CW; an index of total abundance (no size restrictions) is derived from P100. Two indices are derived from P120, a Pamlico index using data from tributaries in and around Pamlico Sound and a Southern index using data collected from Core Sound and south (Figure 3).

Adult abundance for P100 was above the mean for the base years (0.27 crabs/minute) from 2006 – 2012, both 2013 (0.266 crabs/minute) and 2014 (0.23 crabs/minute) adult abundance estimates were below the base year mean. Adult abundance for P120 in the Pamlico region was below the base year mean (0.62 crabs/tow) in 2013 (0.31 crabs/tow) and 2014 (0.27 crabs/tow). In the Southern region, adult abundance has been below the base year mean (0.15 crabs/tow) since 2011. In 2014, adult abundance was 0.096 crabs/tow in the Southern region. Adult abundance for P195 has been below the base year mean (4.52 crabs/tow) since 2000. Adult abundance in 2014 was 0.33 crabs/tow and was the lowest in the 28 year time series. Figure 4 shows the individual traffic lights for each index as well as the composite adult abundance traffic light.

Recruit Abundance

The recruit abundance characteristic uses data from the Estuarine Trawl Survey (P120) and the Pamlico Sound Survey (P195) to monitor blue crab recruit abundance. Each index consists of blue crabs less than 100mm CW and greater than or equal to 30mm CW. Two indices are derived from P120, a Pamlico index using data from tributaries in and around Pamlico Sound and a Southern index using data collected from Core Sound and south. Two indices are also derived from P195, a summer (June) and a fall (September) index (Figure 5).

Recruit abundance for P120 in the Pamlico region was below the base year mean (1.93 crabs/tow) in 2013 (0.66 crabs/tow) and 2014 (0.66 crabs/tow). In the Southern region, recruit abundance has been below the base year mean (0.44 crabs/tow) since 2005. In 2014, recruit abundance was 0.33 crabs/tow in the Southern region. Recruit abundance for P195 in the summer has been below the base year mean (29.66 crabs/tow) since 2011. In the fall, recruit abundance has been below the base year mean (3.49 crabs/tow) since 1998. In 2014, recruit abundance was 0.74 crabs/tow in the fall. Figure 6 shows the individual traffic lights for each index as well as the composite recruit abundance traffic light.

Production

The production characteristic uses data from the Juvenile Anadromous Trawl Survey (P100), the Estuarine Trawl Survey (P120), and the Pamlico Sound Survey (P195) to monitor the blue crab stock's production potential. The production indicators include measures of median

carapace width, pre-recruit abundance (blue crabs less than 30mm CW), length at fifty percent maturity (see fishery-dependent monitoring section), spawning stock (mature female mm/minute), and frequency of occurrence of mature females (percent of samples with mature female blue crabs).

Three indices are derived from P100 including median carapace width, spawning stock, and frequency of occurrence of mature females (Figure 7). Median carapace width has been below the base year mean (114.2mm) since 2009. In 2014, the median carapace width was 98mm in P100. The spawning stock index has been below the base year mean (19.54 mm/minute) since 2012. In 2014, the spawning stock index was 1.67 mm/minute in P100. The frequency of occurrence of mature females was above the base year mean (23.4 percent) from 2005 – 2013; in 2014 the frequency of occurrence of mature females was 7.9 percent, below the base year mean.

Three indices are derived from P120 including Pamlico and Southern region median carapace width and a statewide pre-recruit abundance index (Figure 8). Median carapace width was below the base year mean (34.3mm) in 2013 (19mm) and 2014 (22mm) in the Pamlico region. In the Southern region, median carapace width was below the base year mean (32.7mm) in 2013 (29mm) and 2014 (32mm). The statewide pre-recruit index has been below the base year mean (1.09 crabs/tow) since 2010; in 2014 the pre-recruit index was 0.71 crabs/tow.

Four indices are derived from P195 including summer and fall median carapace width, fall spawning stock, and fall frequency of occurrence of mature female indices (Figure 9). The summer median carapace width index was below the base year mean (72.1mm) in 2013 (54mm) and 2014 (58mm). The fall median carapace width index was above the base year mean (107.7mm) from 2010 - 2013; in 2014 the fall median carapace width was 56mm, below the base year mean. The fall spawning stock index has been below the base year mean (741.7 mm/tow) since 2004; in 2014 the fall spawning index was 49.4 mm/tow. The frequency of occurrence of mature females has been below the base year mean (55.9 percent) since 2004; in 2014 the frequency of occurrence of mature females was 18.5 percent and was the lowest in the 28 year time series. Figure 10 shows the individual traffic lights for each index as well as the composite production traffic light.

MANAGEMENT STRATEGY

Traffic Light

The NCMFC preferred management strategy for blue crabs relies on the Traffic Light Stock Assessment approach to provide information on the relative condition of the stock. The base years (1987 to 2009) for assigning the signals in the Traffic Light Stock Assessment will remain constant until the next amendment of the FMP. The Traffic Light Stock Assessment is updated annually by July of each year to gauge the current status of the stock. To trigger management actions, either the adult abundance or production characteristic of the assessment must be above the 50 percent red threshold for three consecutive years to trigger the moderate management actions and must be above the 75 percent red threshold for two of three consecutive years to trigger the elevated management actions established in the plan (Table 1). The recruit abundance indicator, while not used to trigger initial management action, may be used to supplement any management actions taken if the adult abundance or production triggers are activated.

The current assessment update indicates the adult abundance characteristic has exceeded the moderate threshold for the second consecutive year and has exceeded the elevated threshold for the first year. Currently the adult abundance characteristic is at 79 percent red. The production characteristic has exceeded the moderate threshold for the second consecutive year. Currently the production characteristic is at 71 percent red. The recruit abundance characteristic has exceeded the moderate threshold for the fourth consecutive year and has exceeded the elevated threshold for the second consecutive year. Currently the recruit abundance characteristic is at 96 percent red (Figure 11).

This serves as the second of the three consecutive years above the moderate threshold, for both the adult and production characteristics, that is required before moderate management action must be taken. This also serves as the first of two years in a three year period above the elevated threshold for the adult abundance characteristic that is required before elevated management action must be taken.

Principal Issues

Several management issues were explored in Amendment 2; Table 2 outlines the specific issue explored and the implementation status of each management strategy.

MANAGEMENT AND RESEARCH NEEDS

Several management and research needs were identified in N.C. Blue Crab Fishery Management Plan Amendment 2; Table 3 outlines the specific needs and highlights the progress made towards each management and research need.

FISHERY MANAGEMENT PLAN RECOMMENDATION

The NCDMF recommendation is to maintain the timing of the Benchmark Review “as is” on the current FMP schedule. Currently the review is scheduled to begin in November 2018.

LITERATURE CITED

NCDMF. 1998. North Carolina Blue Crab Fishery Management Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 178 pp.

NCDMF. 2004. North Carolina Blue Crab Fishery Management Plan Amendment 1. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 411 pp.

NCDMF. 2013. North Carolina Blue Crab Fishery Management Plan Amendment 2. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 528 pp.

TABLES

Table 1. 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. Summary of management strategies and outcomes from N.C. Blue Crab Fishery Management Plan Amendment 2.

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Stock Protection			
11.1 Adaptive management framework for the North Carolina blue crab stock	1. Repeal the current female stock conservation management trigger.	1	Rule change to 03L .0201 **Completed**
	2. Continue existing sampling programs to maintain baseline information for the Traffic Light Stock Assessment method.	1 and 6	No action required.
	3. Adopt the adaptive management framework based on the Traffic Light Stock Assessment and the proposed moderate and elevated management levels for recruit abundance, adult abundance, and production characteristics. Initial management action will only be implemented when either the adult abundance or production characteristic reach the management trigger of 50% red or greater for three consecutive years. The recruit abundance characteristic will be used as a supplement to further direct conservation management actions, if deemed necessary.	1 and 6	Rule change to 03L .0201, 03L .0203, 03L .0204, 03L .0205, 03L .0206, 03L .0209, and 03J .0301. **Completed**
User Conflicts			
11.2 Crab pot limit for southern Bogue Sound	Status quo, continue with no crab pot limit in southern Bogue Sound.	1, 4, and 5	No action required.
11.3 Consider allowing non-pot areas in the Pungo River area to be re-designated as open to pots	Open the non-pot (long haul net) areas all the time by rule in the Pungo River and keep status quo in the Long Point area on the Pamlico River.	1, 4, and 5	Rule change to 03R .0107. **Completed**
Clarification of Rules			
11.4 Incorporate the lower Broad Creek closure of pot area into rule	Modify the rule to include the lower Broad Creek area that is closed to crab pots from June 1 through November 30.	1, 4, and 5	Rule change to 03R .0107. **Completed**
11.5 Clarify crab dredging restrictions	Amend the rule to match harvest management for crab dredging.	2	Rule change to 03L .0203. **Completed**

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Clarification of Rules			
11.6 Incorporate the Pamlico Sound crab trawling proclamation into rule 15A NCAC 03L .0202	Modify Rule 15A NCAC 03L .0202 to incorporate the long-standing provisions of Proclamation SH-5-2007 (Pamlico Sound four inch mesh crab trawl line), and retain the Director's proclamation authority to restrict crab trawl mesh size.	1 and 2	Rule change to 03L .0202 **Completed**
11.7 Explore options for escape ring exemptions in hard crab pots to harvest peeler crabs	1. Amend the current rule to redefine criteria for exempting escape rings in crab pots from the 1½-inch pot mesh size to unbaited pots and pots baited with a male crab.	1, 2, and 5	Rule change to 03J .0301 and 03L .0301. **Completed**
	2. Repeal the proclamation authority that allows for exempting the escape ring requirement in order to allow the harvest of peeler crabs.	1 and 5	Rule change to 03J .0301. **Completed**
11.8 Convert crab pot escape ring proclamation exemptions for mature females into rule	Adopt the no trawl line along the Outer Banks in Pamlico Sound as the new boundary in Pamlico Sound, and the Newport River boundaries as delineated in the proposed rule as new boundaries for the area where closure of escape rings to take small mature females is allowed.	1 and 4	Rule change to 03J .0301. Add new rule 03R .0118. **Completed**
11.9 Correction of peeler trawl exception rule	Modify Rule 15A NCAC 03J .0104 (b)(4) TRAWL NETS to correctly reference the Pamlico, Back and Core sounds as the areas in which the Director can open peeler trawling by proclamation.	1 and 2	Rule change to 03J .0104. **Completed**
11.10 Blue crab size limit and culling tolerance	Modify rule to clearly state the intent of the exceptions, culling tolerance, and separation requirements for the various categories of crabs.	1	Rule change to 03L .0201. **Completed**
Harvest Practices			
11.11 Allow floating crab pot lines in areas where obstructions exist	Status quo, continue with non-floating line on crab pots.	1, 2, and 5	No action required.

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Harvest Practices			
11.12 Diamondback terrapins interactions with the blue crab fishery in North Carolina	1. Establish proclamation authority for requiring terrapin excluder devices in crab pots.	2 and 5	Rule change to 03L .0204. **Completed**
	2. Establish a framework for developing proclamation use criteria and terrapin excluder specifications which may extend until after adoption of the amendment. The strategy is contingent on: a. Consultation with the Crustacean Advisory Committee on developing criteria; and b. No use of the proclamation authority until criteria is approved by the Marine Fisheries Commission.	2 and 5	Staff is developing an issue paper to be presented later this year.
11.13 Multiple pots to a single buoy	Status quo, do not allow multiple pots to a single buoy.	1 and 5	No action required.
11.14 Pot loss and ghost pot bycatch mortality	1. Encourage crab potters in areas of high pot loss to incorporate methods to reduce pot loss. Develop and provide information on potential methods to reduce pot loss.	6 and 7	Develop and provide information on potential methods to reduce pot loss.
	2. Encourage crab potters in areas of high pot loss to incorporate escape panel designs in pots to reduce potential ghost fishing impacts. Develop and provide information on potential methods and materials to reduce ghost fishing impacts.	6 and 7	Develop and provide information on potential methods and materials to reduce ghost fishing impacts.
Environmental Factors			
10.4 Habitat	1. Identify and designate Strategic Habitat Areas that will enhance protection of the blue crab.	1, 3, and 6	Existing authority through the Coastal Habitat Protection Plan (CHPP).

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Environmental Factors			
10.4 Habitat	2. Identify, research, and designate additional areas as Primary Nursery Areas that may be important to blue crabs as well as other fisheries.	1, 3, and 6	Existing authority through the CHPP.
	3. Continue to map blue crab spawning areas and evaluate any that need to adjust or expand the boundaries or restrictions of the crab spawning sanctuaries based on recent research.	1, 3, and 6	Existing authority through the CHPP.
	4. Remap and monitor submerged aquatic vegetation in North Carolina to assess distribution and change over time.	3 and 6	Existing authority through the CHPP.
	5. Restore coastal wetlands to compensate for previous losses and enhance habitat and water quality conditions for the blue crab.	3 and 6	Existing authority through the CHPP.
	6. Work with Coastal Resource Commission to revise shoreline stabilization rules to adequately protect riparian wetlands and shallow water habitat and significantly reduce the rate of shoreline hardening.	3	Existing authority through the CHPP.
	7. Develop and implement a comprehensive coastal marina and dock management plan and policy to minimize impacts to submerged aquatic vegetation, wetland edge, and other habitat important to blue crab.	3	Existing authority through the CHPP.
	8. Assess the distribution, concentration, and threat of heavy metals and other toxic contaminants in freshwater and estuarine sediments and identify the areas of greatest concern to focus water quality improvement efforts.	3 and 6	Existing authority through the CHPP.
	9. Support oyster shell recycling and oyster sanctuary programs to provide areas of enhanced or restored shell bottom habitat.	3	Existing authority through the CHPP.

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Environmental Factors			
10.4 Habitat	10. Consider if prohibition of crab dredging is advisable.	2	Existing authority through the CHPP.
	11. Protect “recruitment bottlenecks”, like inlets for the blue crab, from trawling or other impacts including natural channel modification using hardened structures like groins and jetties.	2 and 3	Existing authority through the CHPP.
	12. Shallow areas where trawling is currently allowed should be re-examined to determine if additional restrictions are necessary.	2	Existing authority through the CHPP.
10.4 Water Quality	1. Improve methods to reduce sediment and nutrient pollution from construction sites, agriculture, and forestry.	3	Existing authority through the CHPP.
	2. Increase on-site infiltration of storm water through voluntary or regulatory measures.	3	Existing authority through the CHPP.
	3. Provide more incentives for low-impact development.	3	Existing authority through the CHPP.
	4. Aggressively reduce point source pollution from wastewater through improved inspections of wastewater treatment facilities, improved maintenance of collection infrastructure, and establishment of additional incentives to local governments for wastewater treatment plant upgrading.	3	Existing authority through the CHPP.
	5. Provide proper disposal of unwanted drugs, prevent the use of harmful JHA insecticides near-surface waters or in livestock feed, and develop technologies to treat wastewater for antibiotics and hormones.	3, 6, and 7	Existing authority through the CHPP.

Table 3. Summary of research needs and outcomes from N.C. Blue Crab Fishery Management Plan Amendment 2.

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Continue to support research to determine the status of protected species (e.g., migration patterns, habitat utilization) along the North Carolina coast to better anticipate and prevent interactions.	2 and 5	No Action
Support research on blue crab fishery interactions with protected species (e.g., identifying any seasonal or spatial peaks in potential for interactions).	2 and 5	Ongoing; Began an observer program for Pamlico Sound in 2000, and expanded into other areas of state. Recently began using observers on alternative platforms which may reduce the type of finfish bycatch data collected. Currently monitoring set gill net fisheries statewide.
Support gear modification research and testing that could reduce protected species interactions.	2 and 5	No Action
Continue socioeconomic surveys of blue crab harvesters and include wholesale and retail benefits, the entire support industry for this fishery including suppliers, picking houses, and restaurants..	1, 6, and 7	Ongoing
Update Recreational Commercial Gear License (RCGL) survey.	6	No Action
Continue survey and compile data of recreational crabbers not possessing a RCGL license.	6	Ongoing
Determine the economic effects of imported crabmeat, including the mixture of imported meat with local crabmeat, on processing and demand.	1 and 6	No Action
Determine the costs associated with crab processing. Identify the factors and their relative importance in predicting processor closures.	1 and 6	No Action
Research the changing demographics of the commercial blue crab fishery.	1 and 6	No Action
Continue research on the impacts of endocrine disrupting chemicals (EDCs) on the various life stages of the blue crabs and way to reduce introduction of EDCs into estuarine waters.	1, 3, 6, and 7	No Action
Assess the impact of winter inlet deepening dredge activities on the overwintering female blue crabs and their habitat.	1, 3, and 6	No Action

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Determine the spatial and biological characteristics of SAV beds that maximize their ecological value to the blue crab for restoration or conservation purposes.	1, 3, and 6	Ongoing CHPP and SHA work group
Identify, research, and map shallow detrital areas important to blue crabs.	1, 3, and 6	Ongoing CHPP and SHA work group
Additional research is needed on the extent, causes, and impacts of hypoxia and anoxia on blue crab behavior and population abundance in North Carolina's estuarine waters.	1, 3, and 6	Ongoing CHPP
Conduct research on the water quality impacts of crab pot zincs, bait discard, and alternative crab baits in the pot fishery.	1, 3, and 6	No Action
Develop methods to expand sampling effort to more accurately assess the status of the blue crab stock and its fisheries.	1 and 6	Ongoing
Continue research on blue crab discards in the shrimp trawl fishery.	1, 2, and 6	Ongoing
Expand research state wide on the use of terrapin excluder devices in crab pots	1, 3, and 5	Ongoing
Implement outreach programs to inform state agencies, the public, and the commercial and recreational fishing industries about issues relating to protected species and fishery management.	1, 2, and 7	Ongoing
Continue gear development research to minimize species interactions.	1, 2, and 6	Ongoing
Continue existing programs that have been used to monitor North Carolina's blue crab stock to maintain baseline data	1 and 6	Ongoing
Identify key environmental factors that significantly impact North Carolina's blue crab stock and investigate assessment methods that can account for these environmental factors	1 and 6	Ongoing
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	1 and 6	No Action

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
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	1 and 6	No Action
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	1 and 6	No Action
Expand spatial coverage of Pamlico Sound Survey (Program 195) to include deep water 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	1 and 6	No Action
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	1 and 6	No Action
Implement 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.	1 and 6	No Action

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Continue surveys of recreational harvest and effort to improve characterization of the recreational fishery for blue crabs	1 and 6	Ongoing
Identify programs outside the NCDMF that collect data of potential use to the stock assessment of North Carolina's blue crabs	1 and 6	Ongoing
Perform in-depth analysis of available data; consider standardization techniques to account for gear and other effects in development of indices; explore utility of spatial analysis in assessing the blue crab stock	1, 6	Ongoing

FIGURES

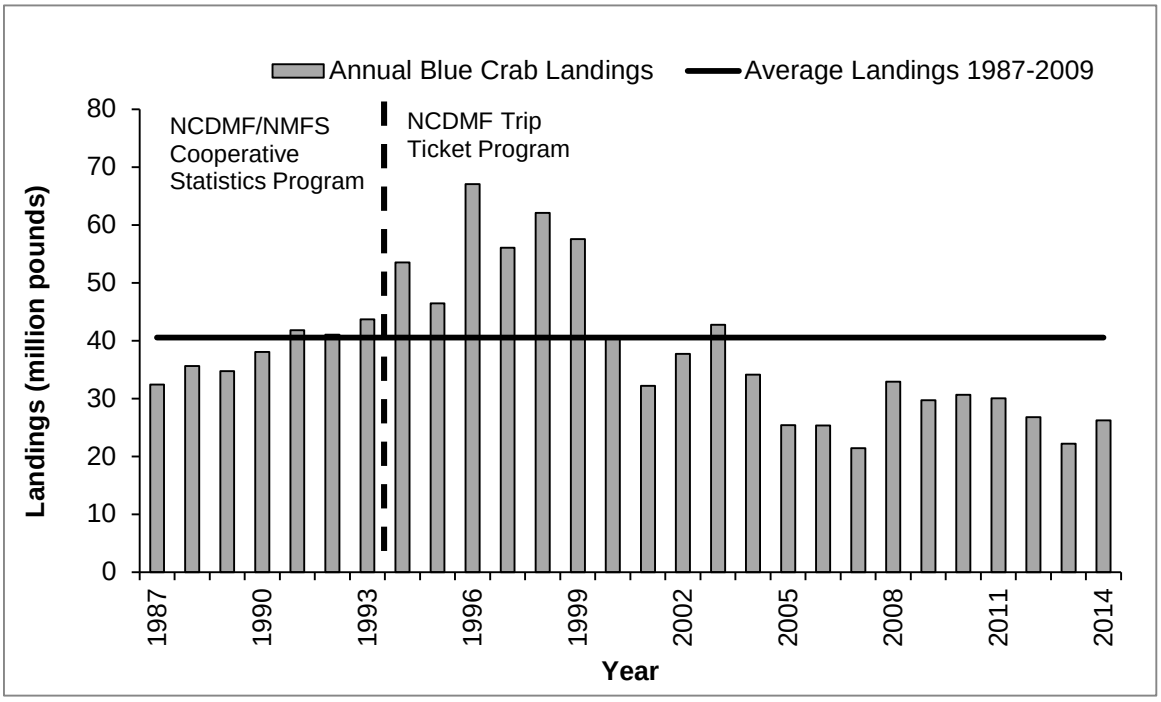


Figure 1. Annual blue crab commercial landings, 2004-2014. Landings include hard, soft, and peeler crabs. The vertical dashed line denotes the change from a voluntary to a mandatory commercial landings reporting program.

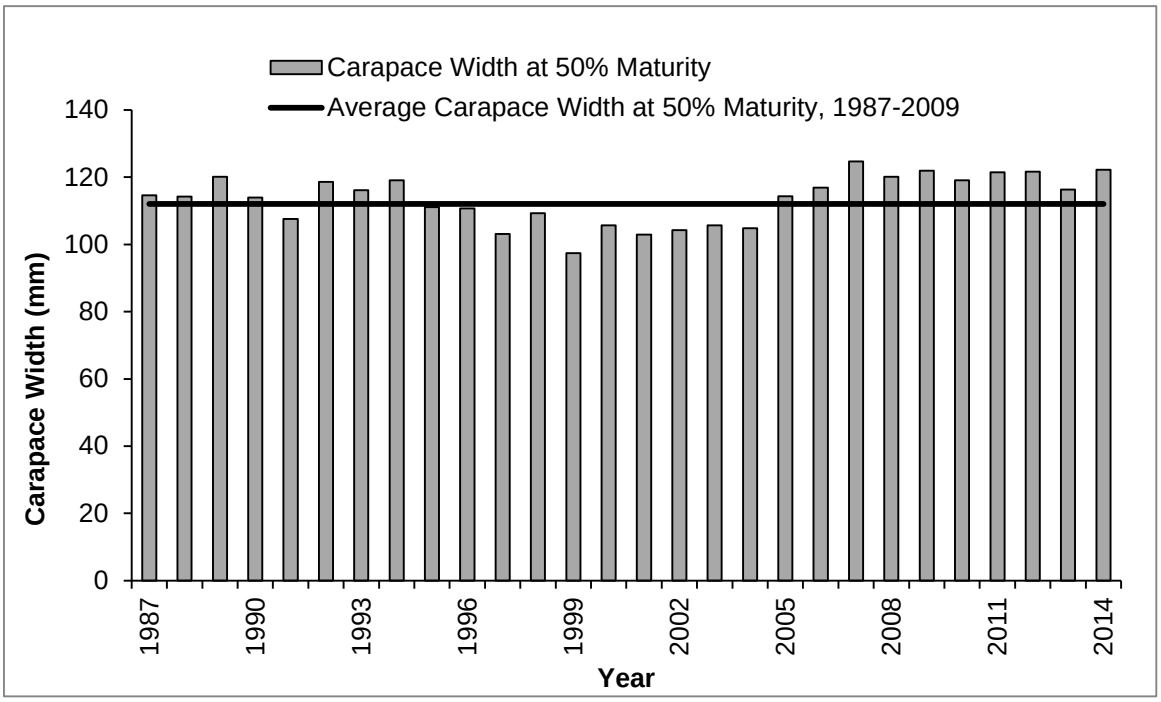


Figure 2. Length at 50% maturity for female blue crabs used in the production characteristic of the Blue Crab Traffic Light, 1987-2014. Fishery-dependent and independent data were included in the analysis.

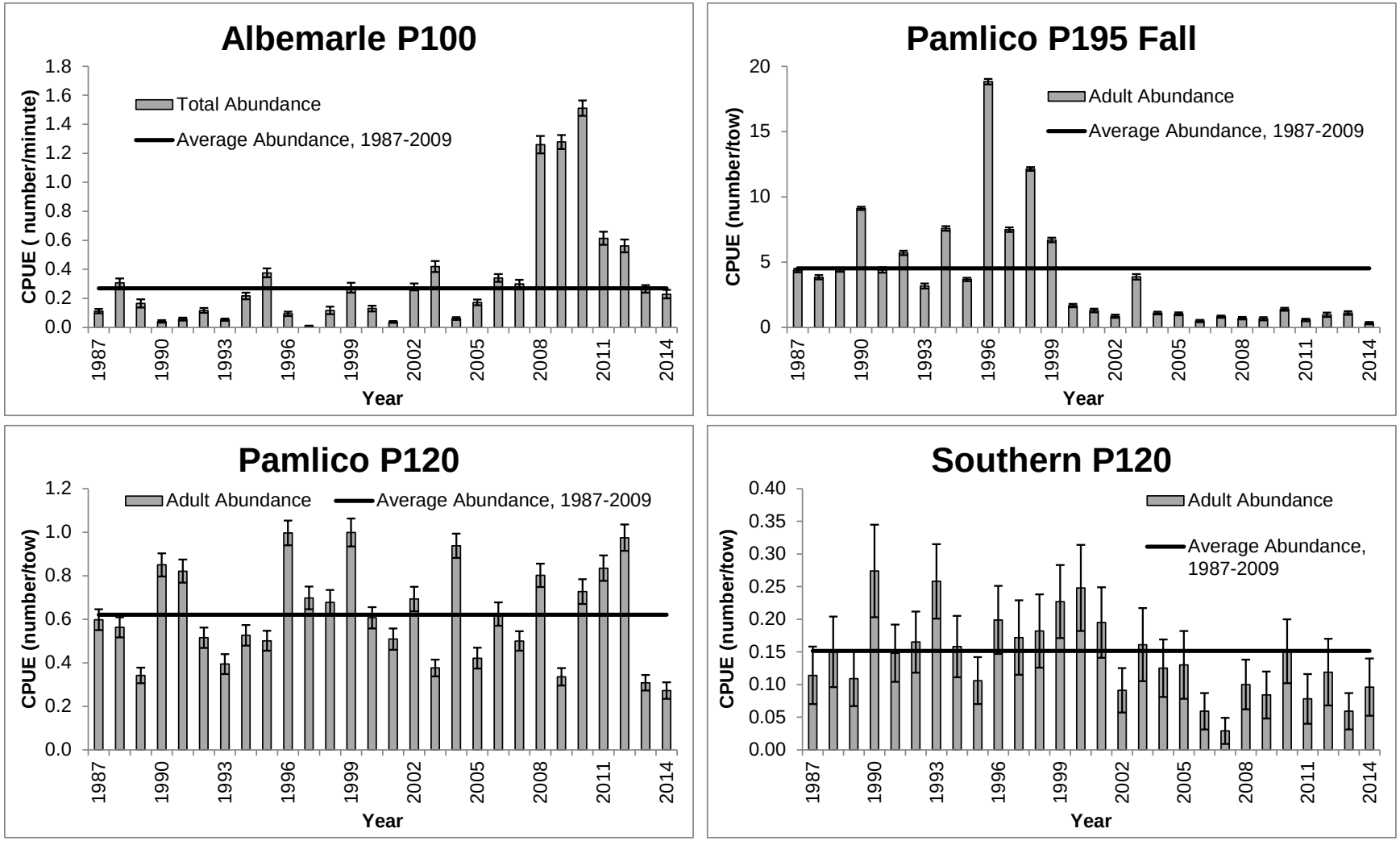


Figure 3. Indices from NCDMF programs P100, P120, and P195 used for the adult abundance characteristic of the Blue Crab Traffic Light, 1987-2014. Error bars represent one standard error of the mean.

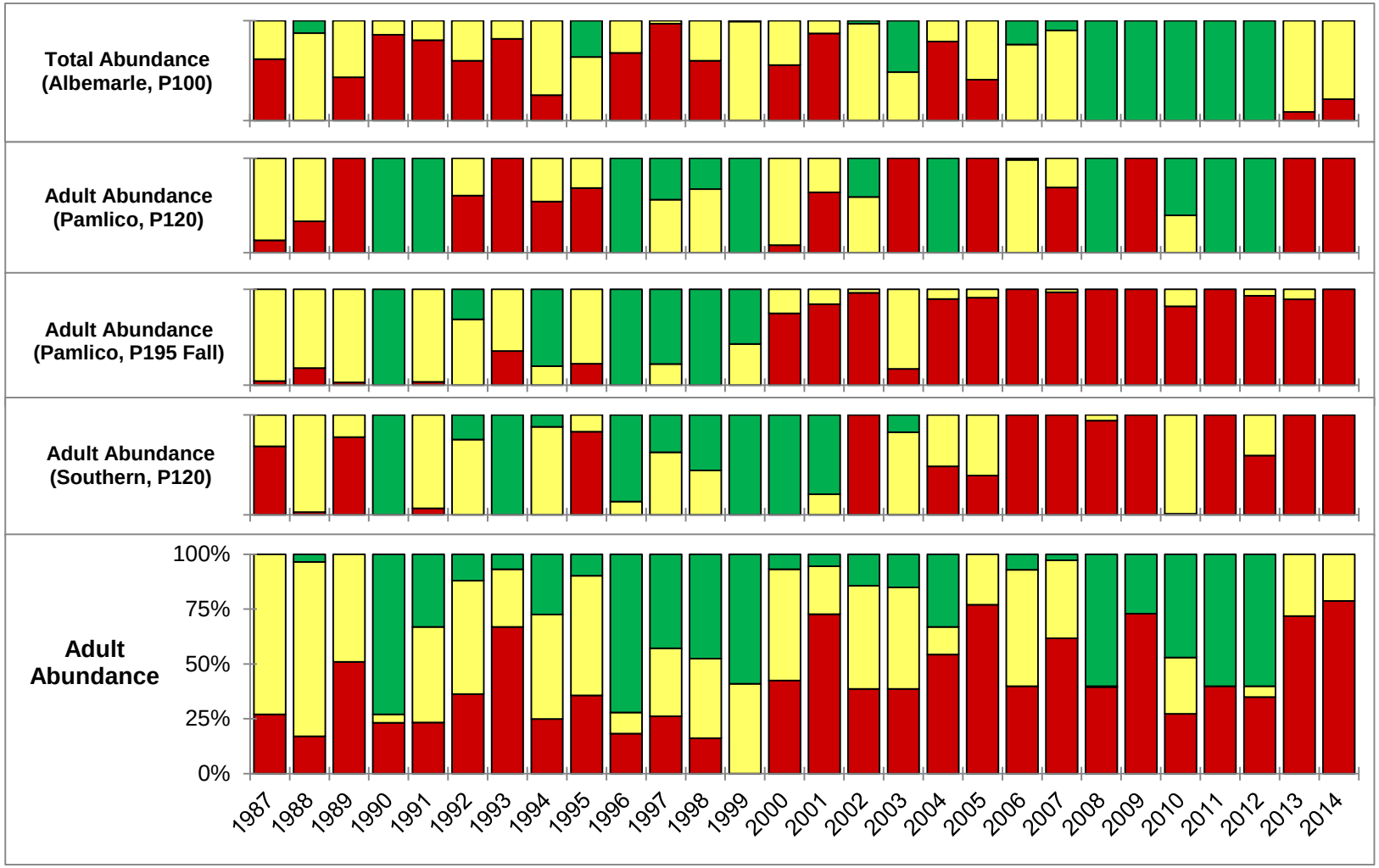


Figure 4. Blue Crab Traffic Light individual adult abundance indicators and the integrated summary (bottom figure), 1987-2014.

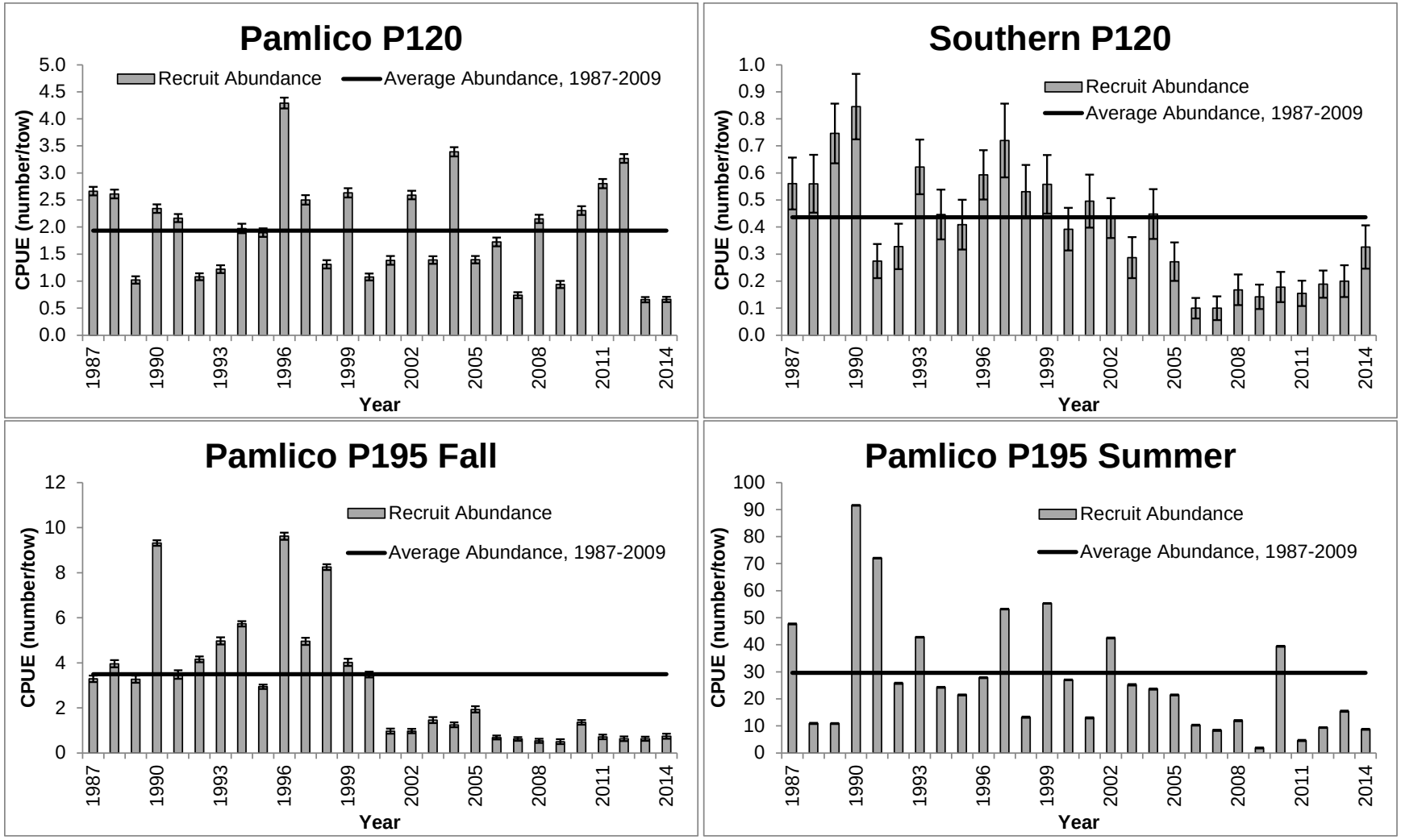


Figure 5. Indices from NCDMF programs P120 and P195 used for the recruit abundance characteristic of the Blue Crab Traffic Light, 1987-2014. Error bars represent one standard error of the mean.

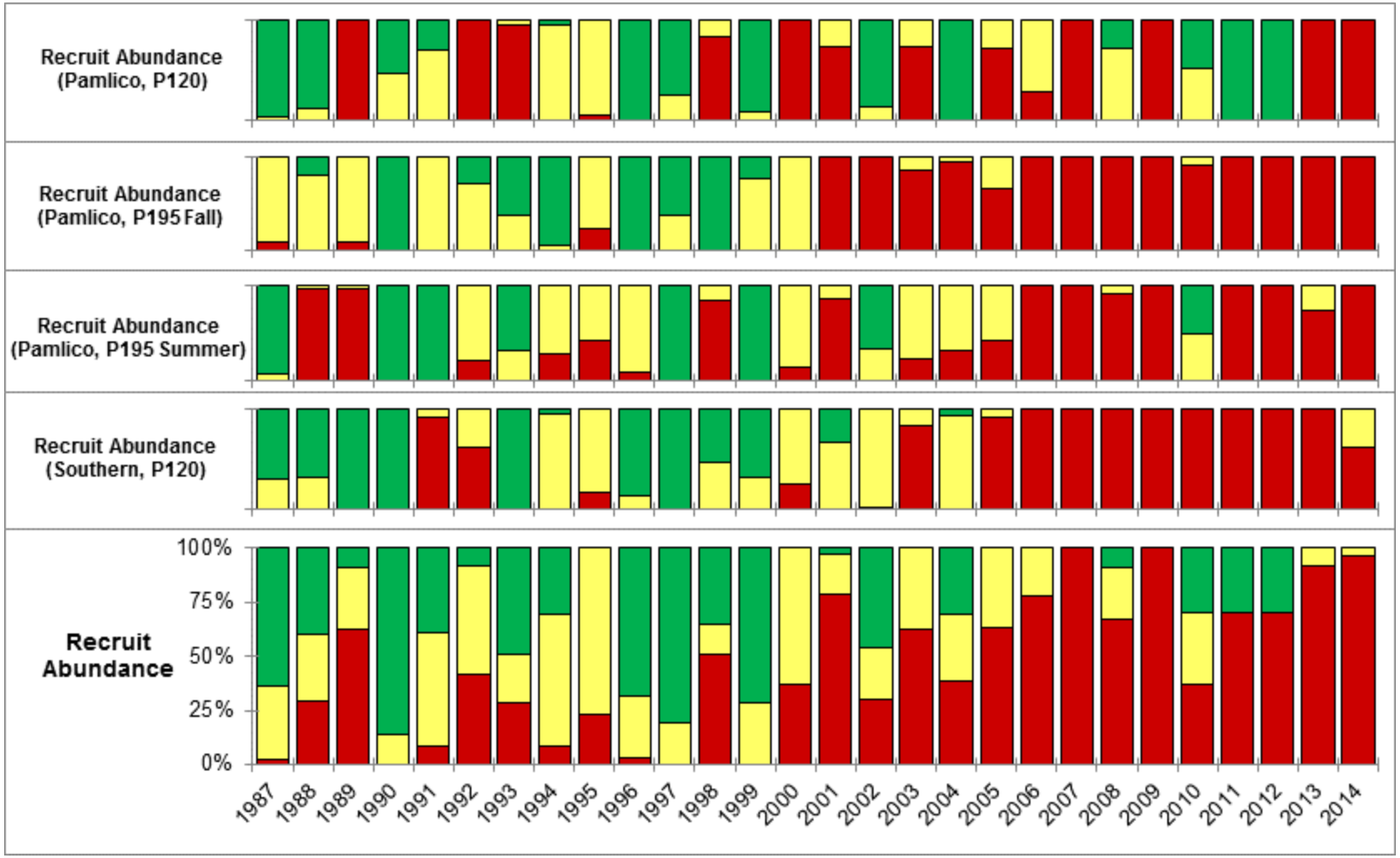


Figure 6. Blue Crab Traffic Light individual recruit abundance indicators and the integrated summary (bottom figure) 1987-2014.

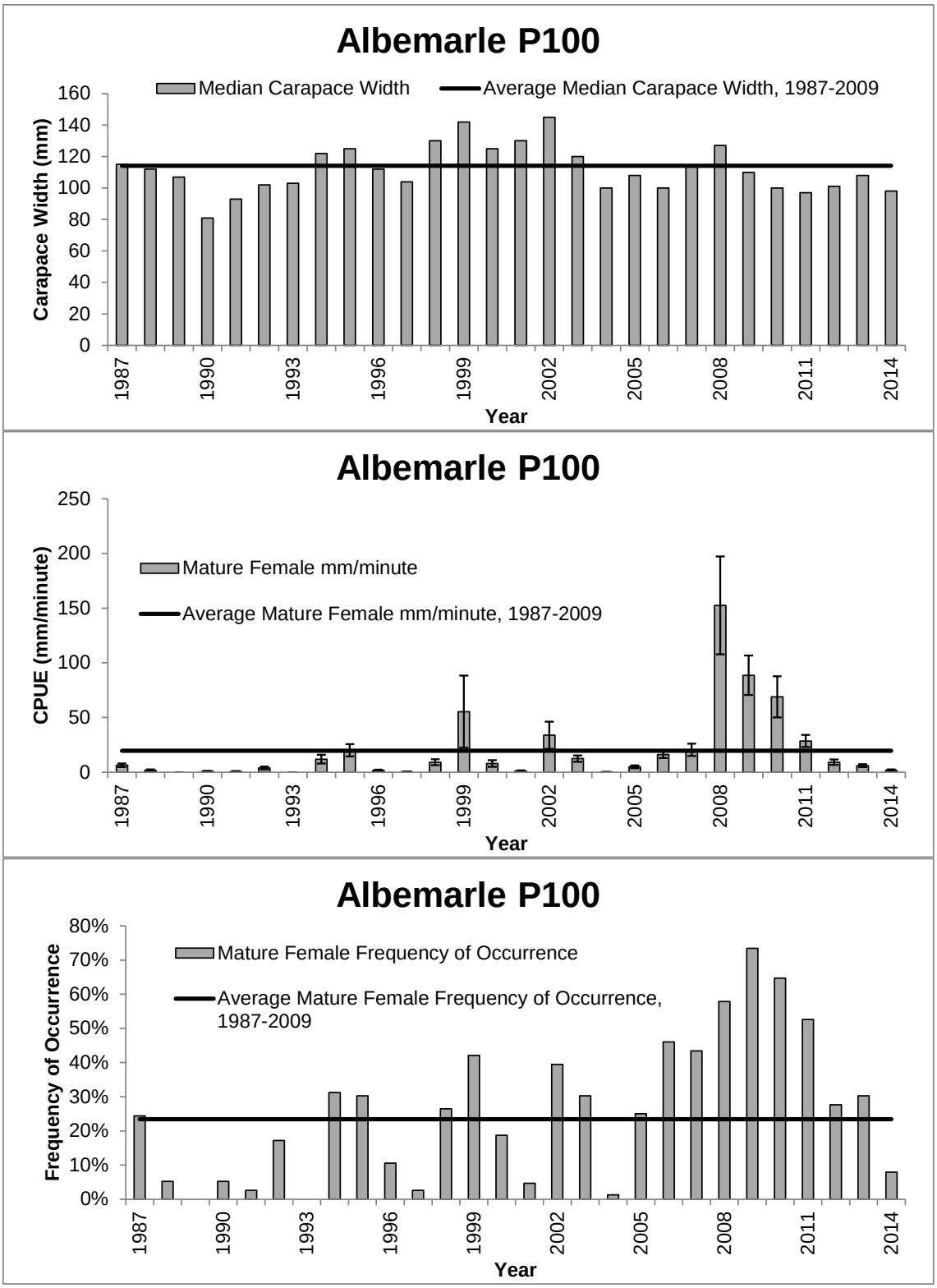


Figure 7. Indices from NCDMF program P100 used for the production characteristic of the Blue Crab Traffic Light, 1987-2014. Error bars represent one standard error of the mean.

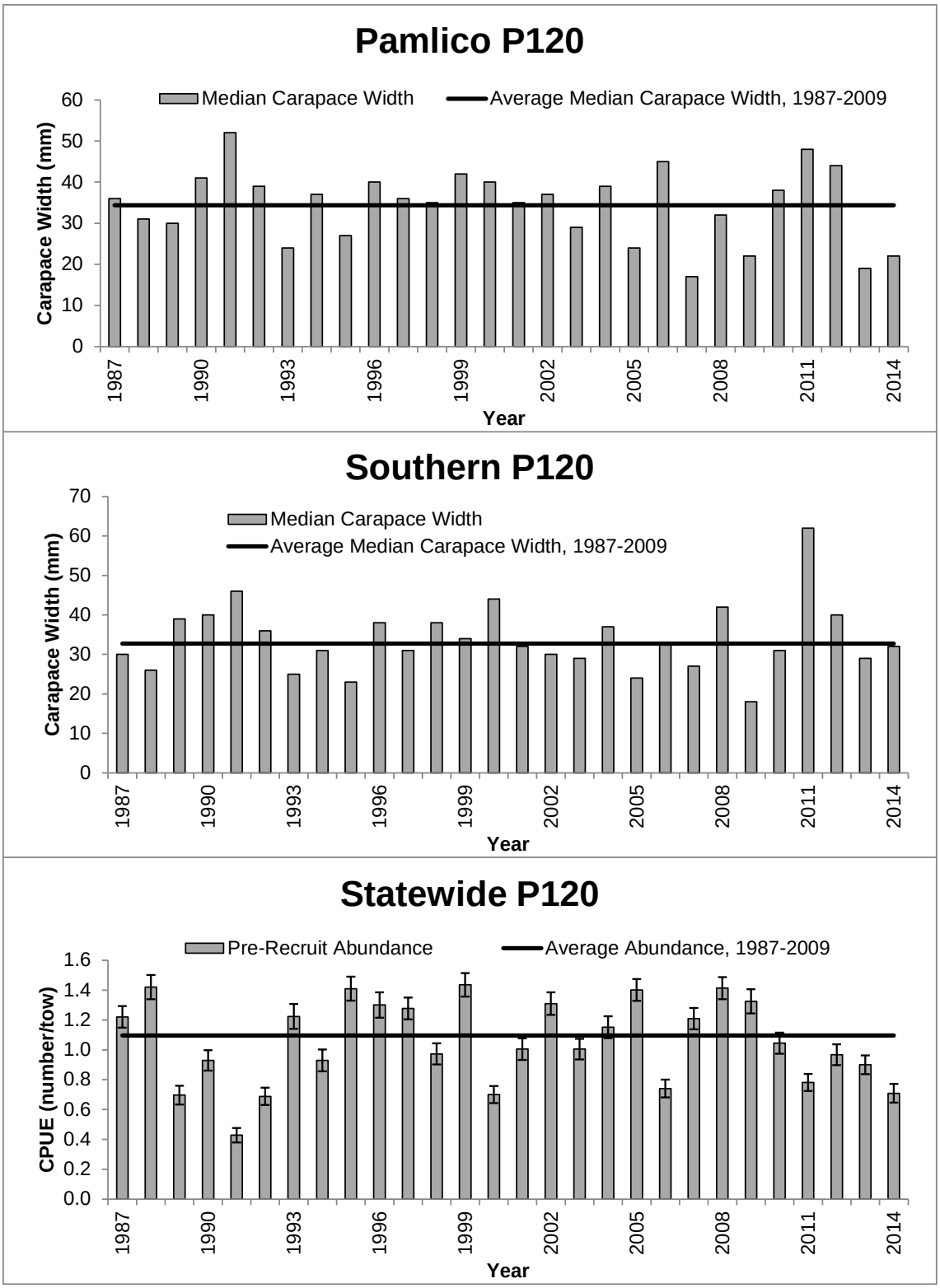


Figure 8. Indices from NCDMF program P120 used for the production characteristic of the Blue Crab Traffic Light, 1987-2014. Error bars represent one standard error of the mean.

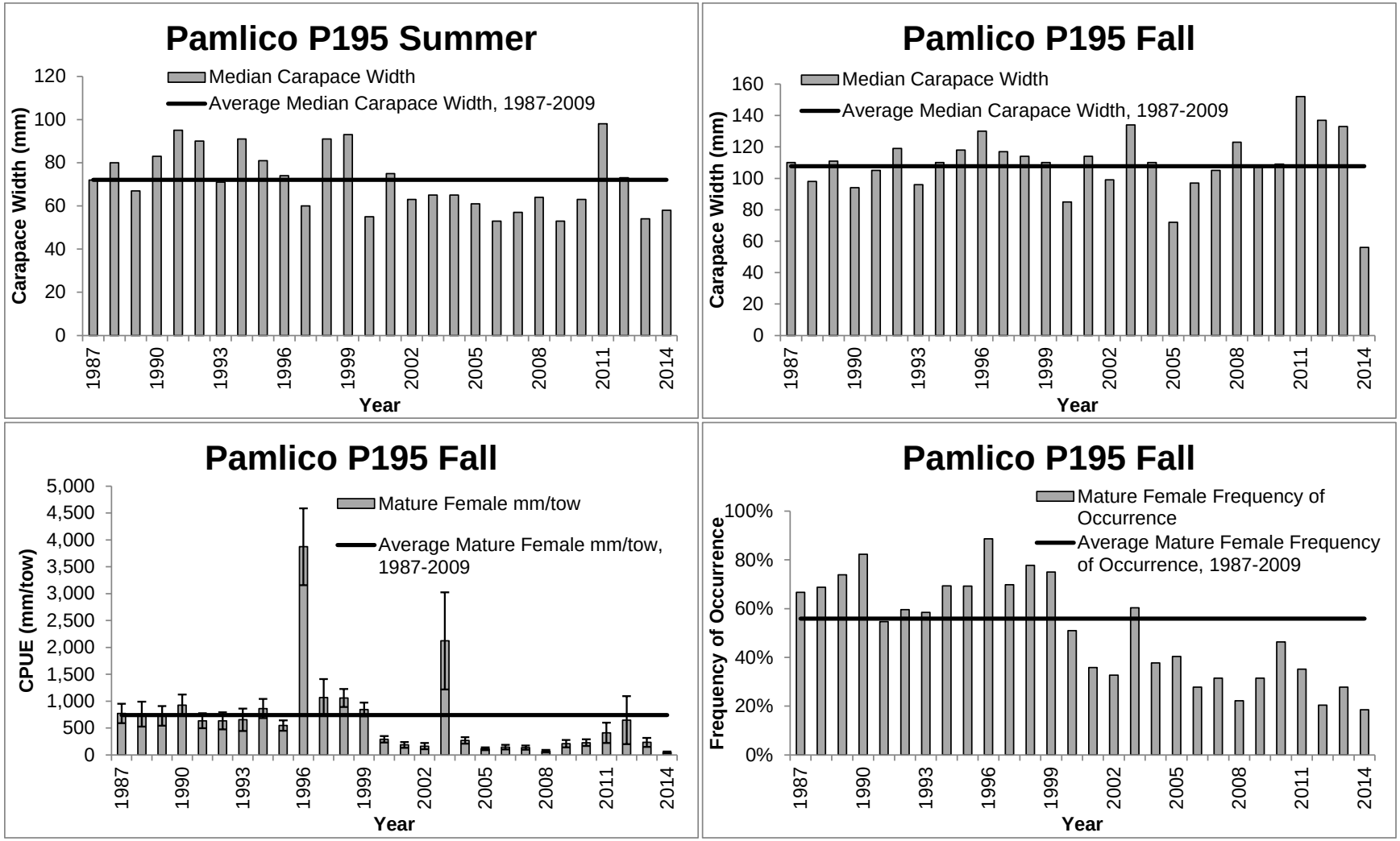


Figure 9. Indices from NCDMF program P195 used for the production characteristic of the Blue Crab Traffic Light, 1987-2014. Error bars represent one standard error of the mean.

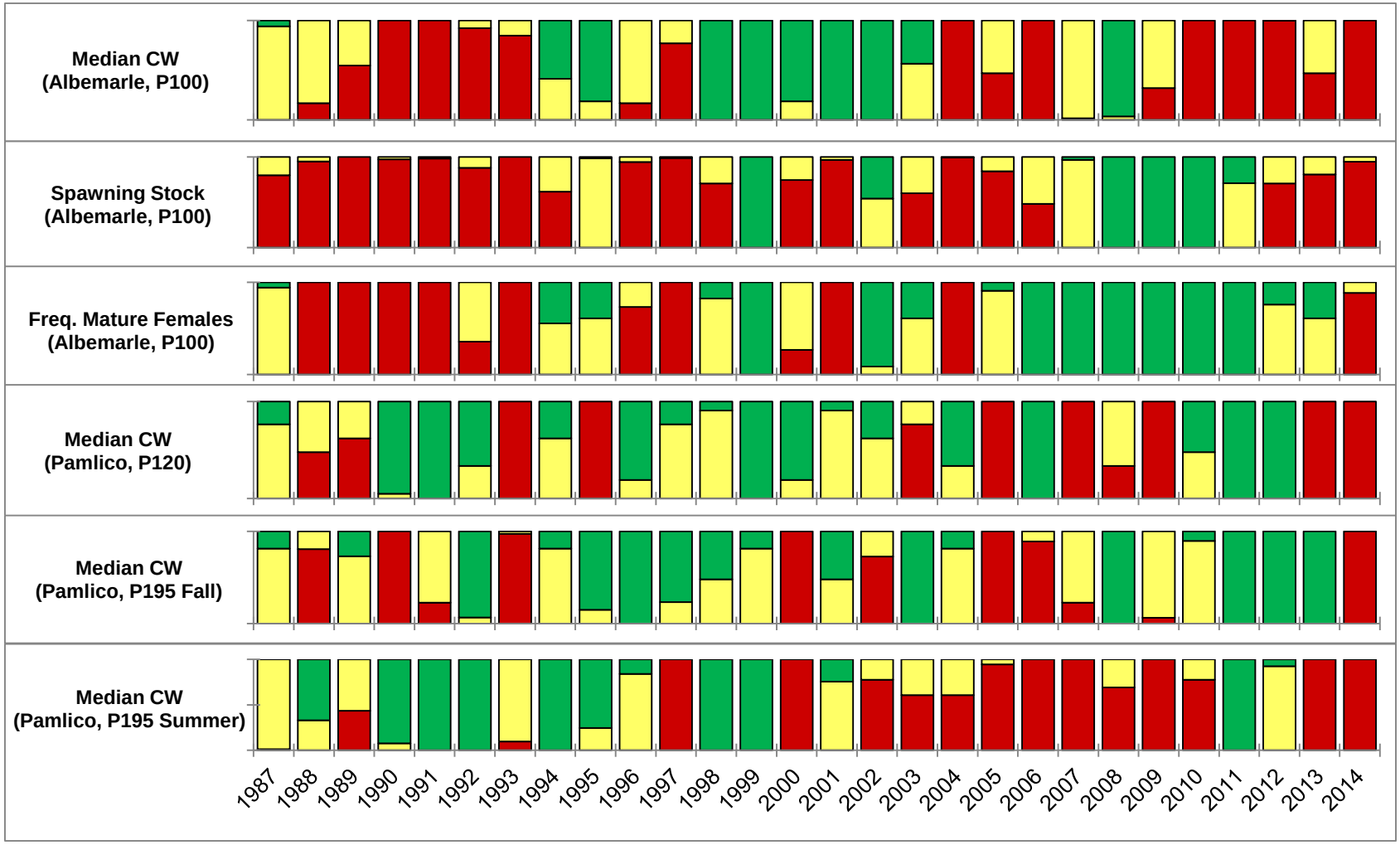


Figure 10. Blue Crab Traffic Light individual production indicators and integrated summary (bottom figure, next page), 1987-2014.

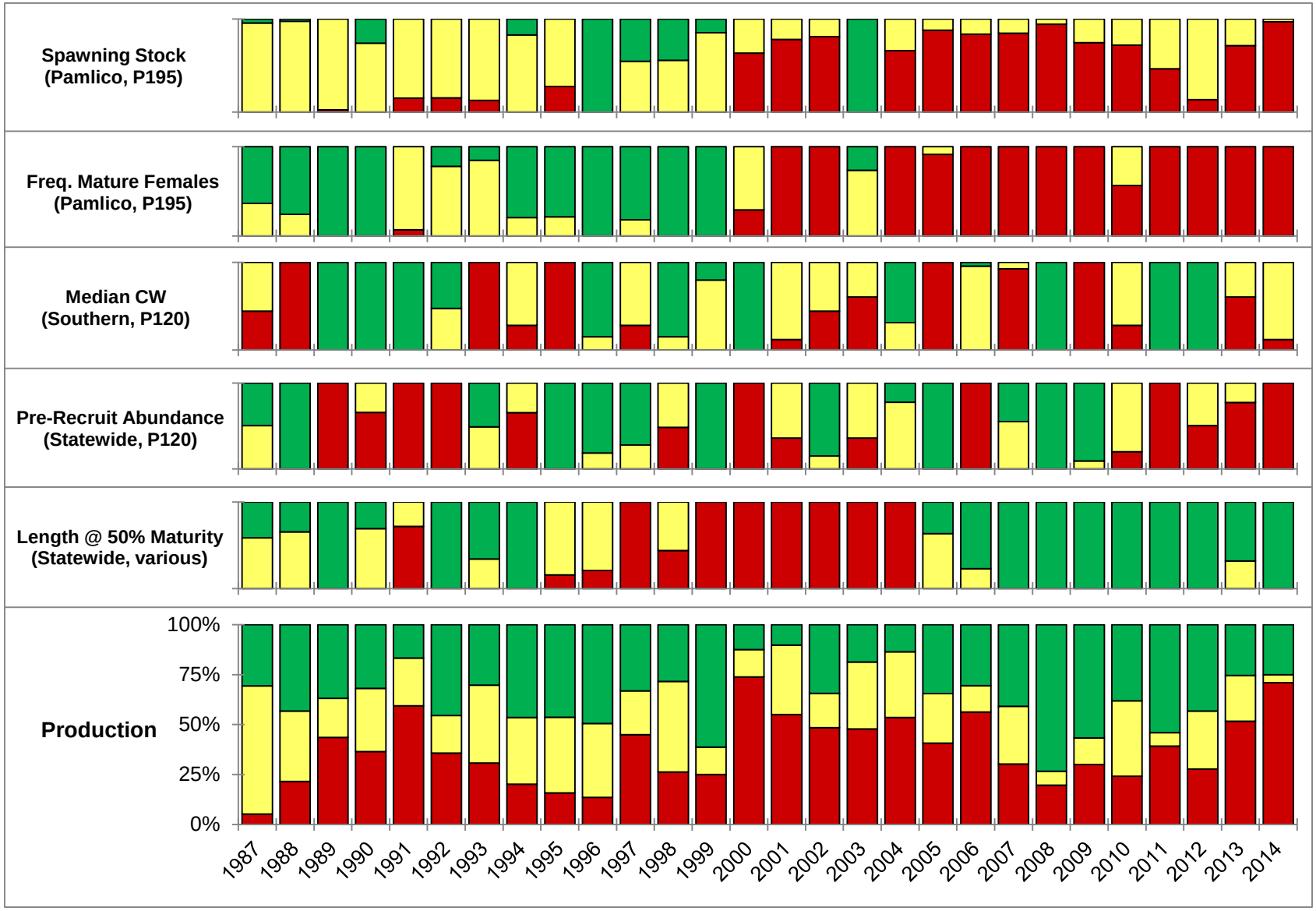


Figure 10 (cont.). Blue Crab Traffic Light individual production indicators and integrated summary (bottom figure), 1987-2014.

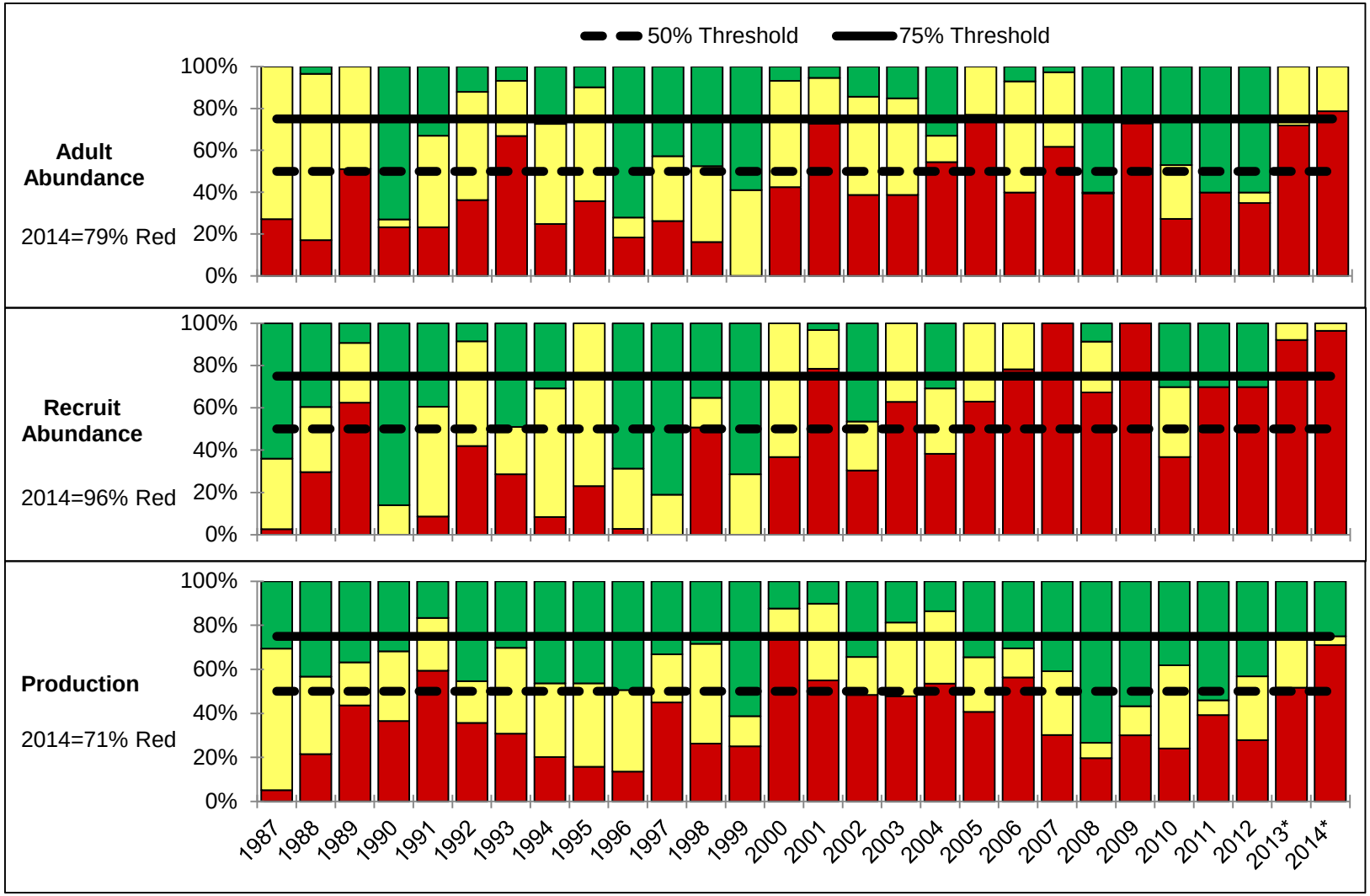


Figure 11. Blue Crab Traffic Light indicators for the adult abundance, recruit abundance, and production characteristics, 1987-2014. The dashed line represents the second quartile (50%) moderate management trigger and the solid line represents the third quartile (75%) elevated management trigger relative to the proportion of red.

FISHERY MANAGEMENT PLAN UPDATE
EASTERN OYSTER
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	August 2001
Amendments:	Amendment 1 – January 2003 Amendment 2 – June 2008 Amendment 3 – April 2014
Revisions:	None
Supplements:	Supplement A to Amendment 2 – November 2010
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	Amendment 4 is currently in development and scheduled for adoption in November 2016

The original N.C. Oyster Fishery Management Plan (FMP) was adopted by the North Carolina Marine Fisheries Commission (NCMFC) in 2001 and set up a process for designation of additional areas limited to hand harvest methods around Pamlico Sound and recommended several statutory changes to the shellfish lease program including higher fees, training requirements, and modified lease production requirements. The N.C. Oyster FMP Amendment 1 simply changed one of the criteria for designation of hand harvest areas from waters generally less than 10 feet deep to waters less than six feet deep. Highlights of the management measures developed in the N.C. Oyster FMP Amendment 2 include adopting a 15 bushel harvest limit in Pamlico Sound and a 10 bushel harvest limit for all gears in designated areas around the sound, reducing the available harvest season, changed the way lease production averages are calculated, limited lease applications to five acres and a recommendation to expand oyster sanctuary construction efforts. Supplement A raised the potential harvest limit in Pamlico Sound to 20 bushels and created a monitoring system for when to close mechanical harvest in that area. The N.C. Oyster FMP Amendment 3 created two seed oyster management areas in Onlsow County. The N.C. Oyster FMP Amendment 4 along with the N.C. Hard Clam FMP Amendment 2 is in development and scheduled for final adoption in November 2016.

Management Unit

The management unit includes the Eastern oyster (Crassostrea virginica) and its fisheries in all waters of coastal North Carolina.

Goal and Objectives

From the draft Amendment 4, approved by the North Carolina Marine Fisheries Commission in August 2014:

The goal of the N.C. Oyster FMP is to manage the state's oyster population so that it achieves sustainable harvest and maximizes its role in providing ecological benefits to North Carolina's estuaries. To achieve this goal, it is recommended that the following objectives be met:

1. Identify, restore, and protect oyster populations as important estuarine habitat.

2. Manage and restore oyster populations to levels capable of maintaining sustained production through judicious use of natural oyster resources, enhancement of oyster habitats, and development and improvement of oyster production on shellfish leases and franchises.

3. Minimize the impacts of oyster parasites and other biological stressors through better understanding of oyster disease, better utilization of affected stocks, and use of disease resistant and biological stress resistant oysters.

4. Consider the socioeconomic concerns of all oyster resource user groups, including market factors.

5. Recommend improvements to coastal water quality to reduce bacteriological-based harvest closures and to limit other pollutants to provide a suitable environment for healthy oyster populations.

6. Identify and encourage research to improve understanding of oyster population ecology and dynamics, habitat restoration needs, and oyster aquaculture practices.

7. Identify, develop, and promote efficient oyster harvesting practices that minimize damage to the habitat.

8. Initiate, enhance, and continue studies to collect and analyze economic, social, and fisheries data needed to effectively monitor and manage the oyster resource.

9. Promote public awareness regarding the ecological value of oysters and encourage public involvement in management and enhancement activities.

STATUS OF THE STOCK

Stock Status

There are insufficient data to conduct a traditional stock assessment for the Eastern oyster in North Carolina. Until that time, the NCDMF Oyster Plan Development Team recommends that the status of Eastern oyster in North Carolina continue to be defined as a species of concern. North Carolina commercial oyster landings have been in decline for most of the past century. This decline was likely initiated by overharvest and compounded by habitat disturbance, pollution, and biological and environmental stressors. Species designated by the NCDMF with a concern status exhibit one or more of the following: increased effort, declining landings,

truncated age distribution, or are negatively impacted by biotic and/or abiotic factors (e.g., water quality, habitat loss, disease, life history, predation, etc.). Oysters are believed to be vulnerable to overharvest because several factors negatively impact their survival.

Stock Assessment

An oyster stock assessment was attempted in 1999, but the necessary data were lacking to determine levels of sustainable harvest. Since there were no significant changes in the types and quantity of data collected, an oyster stock assessment could not be achieved in 2006 and again in 2014. Collection of appropriate data should be initiated in order to conduct a stock assessment and determine levels of sustainable harvest (NCDMF 2008).

Data are not available to perform a traditional assessment so it was not possible to estimate population size or fishing mortality rates in the latest update in 2014. The only data representative of the stock were the commercial landings and associated effort. For this reason, the current assessment focused on trends in catch rates in the commercial oyster fishery. These catch rates should not be considered an unbiased representation of trends in population size; fisheries-dependent data are often not proportional to population size due to a number of caveats and should be interpreted with caution if the interest is relative changes in the population. In order for a fisheries-dependent index to be proportional to abundance, fishing effort must be random with respect to the distribution of the population and catchability must be constant over space and time. Other factors affecting the proportionality of fishery-dependent indices to stock size include changes in fishing power, gear selectivity, gear saturation and handling time, fishery regulations, gear configuration, fishermen skill, market prices, discarding, vulnerability and availability to the gear, distribution of fishing activity, seasonal and spatial patterns of stock distribution, changes in stock abundance, and environmental variables. Many agencies, such as the NCDMF, do not require fishermen to report records of positive effort with zero catch; lack of these “zero catch” records in the calculation of indices can introduce further bias.

The North Carolina commercial Eastern oyster fishery is subject to trip limits, which could bias catch rates (Mike Wilberg, UMCES, pers. comm.; John Walter, NOAA Fisheries, pers. comm.); that is, the trip limits affect the amount of catch that is observed per unit effort—the true value of the variable cannot be observed. A censored regression approach was attempted to calculate an index of relative abundance (numbers harvested per transaction) using data collected from a fishery with trip limits.

Data were obtained from the North Carolina Trip Ticket Program for 1994 through 2013. The censored response variable (catch per unit effort) was fit within a Generalised Additive Models for Location Scale and Shape (GAMLSS) framework using the ‘gamlss.cens’ (Stasinopoulos et al. 2014) and ‘survival’ (Therneau 2014) packages in R (R Core Team 2014). Catch rates were estimated for both hand harvest and mechanical harvest in each of the major water bodies from which Eastern oysters are harvested where sufficient data were available. Data were summarized by fishing year (October through March for hand harvest and November through March for mechanical harvest). Only landings from public bottom were examined.

Catch rates were expressed as bushels harvested per transaction. The censored regression approach failed for both hand and mechanical harvest data despite trying three different distributional assumptions (lognormal, gamma, t). This failure was believed to be due to the large number of trips (transactions) that meet or exceed the trip limit in both fisheries. Similar work found that when about 50% or more of the trips equaled or exceeded the trip limits, there

was not enough information from the uncensored trips to produce a reliable model. Here, 51.4% of trips by hand gears equaled (39.3%) or exceeded (12.1%) the trip limits over all water bodies and fishing years combined; the number of trips equaling or exceeding the trip limits for mechanical gears was 43.5% (42.9% equaled and < 1% exceeded).
Available data are considered insufficient for estimating reliable fishing mortality rates.

STATUS OF THE FISHERY

Current Regulations

Oysters cannot be taken from any public or private bottom in areas designated as prohibited (polluted) by proclamation except for special instances for: Shellfish Management Areas (NCMFC Rule 15A NCAC 03K .0103), with a permit for planting shellfish from prohibited areas (NCMFC Rule 15A NCAC 03K .0104), and for the depuration of shellfish (NCMFC Rule 15A NCAC 03K .0107). Oysters cannot be taken between the hours of sunset and sunrise of any day. Beginning in April 2014, time and temperature control measures were initiated for oysters to prevent post-harvest growth of naturally-occurring Vibrio bacteria that can cause serious illness in humans.

Public Bottom:

The minimum size limit for oysters from public bottom is 3-inch shell length. Both the hand and mechanical oyster harvest season from public bottom are opened annually by proclamation. It is unlawful to sell oysters taken on Saturday and Sunday from public bottom.

The hand-harvest season for commercial and recreational harvest begins on October 15 each year with commercial harvest limited to Monday through Friday each week and recreational harvest allowed seven days a week. Mechanical methods are only allowed from sunrise to 4:00 p.m. Recreational harvest is only allowed by hand methods. The season typically continues until closed by rule on March 31 although some locations may close earlier due to perceived excessive harvest. Brunswick County is the only area frequently closed early due to this concern and it was closed by proclamation on March 15, 2015 during the 2014/15 harvest season on public bottom. The daily hand harvest limit for oysters in Pamlico Sound outside the bays is 15 bushel per day per commercial fishing operation and 10 bushels per day per commercial fishing operation in the bays and in the Mechanical Methods Prohibited area along the Outer Banks of Pamlico Sound. Areas from Core Sound south have a daily hand harvest limit of 5 bushels per person not to exceed 10 bushels in any combined fishing operation regardless of the number of persons, license holders, or boats involved. Recreational daily harvest limits in 2014/15 were one bushel per person per day not to exceed two bushels per vessel per day.

The mechanical harvest season for oysters in 2014/15 was opened November 10, 2014, and areas where mechanical harvest gear was allowed were restricted to deeper portions of the sounds, rivers and bays north of Core Sound. These areas are designated in N.C. Marine Fisheries Commission Rule 15A NCAC 03R .0108. The bays around Pamlico Sound are opened for a six-week season, and were opened from November 10 to December 19, 2014 with a 10-bushel-per-commercial-fishing-operation-per-day harvest limit. Areas outside the bays open to mechanical harvest were limited to a daily harvest limit of 15 bushels of oysters per operation. The mechanical harvest season can close sooner for areas in Pamlico Sound if sampling by NCDMF indicates that oysters of legal size have been reduced below 26% of the

sampling for two consecutive sampling trips, as directed by Supplement A to Amendment 2 of the Oyster FMP.

There are also further restrictions noted in the proclamation for mechanical oyster harvesters to make sure that cultch material and culled oysters are either put back into the water where they were taken or remain on the existing rocks. North Carolina has a rule in place (Marine Fisheries Commission Rule 15A NCAC 03K .0202) requiring culling on site. The following restrictions were put in place beginning with the 2012-13 oyster season to discourage those practices.

> It is unlawful to possess more than **five** bushels of unculled catch onboard a vessel. Only material on the culling tray is exempt from culling restrictions.
>
> It is unlawful to possess unculled catch or culled cultch material while underway and not engaged in mechanical harvesting.

Also some harvesters did not have vessels or dredges rigged for circular dredging patterns which work best with towing points over the side of the vessel or for short tows to allow for culling between pickups. The following restrictions were put in place to encourage circular dredging patterns and shorter tows to keep the cultch and culled oysters on the existing rocks.

> It is unlawful for the catch container (bag, cage) attached to a dredge to extend more than **two** feet in any direction from the tooth bar.
>
> It is unlawful to tow a dredge unless the point where the tow line or cable exits the vessel and goes directly into the water is on the port or starboard side of the vessel forward of the transom.

Private Bottom**:**

The minimum size limit for oysters from private bottom 3-inch shell length and culling requirements only occurs during the open public harvest season, the rest of the year there is no minimum size requirement for oysters taken from private bottom. There is no daily maximum harvest limit applied to the taking of oysters from private bottom in internal waters.

Possession and sale of oysters by a hatchery or aquaculture operation and purchase and possession of oysters from a hatchery or aquaculture operation are exempt from the daily harvest limit and minimum size restrictions. The possession, sale, purchase and transport of such oysters must be in compliance with the Aquaculture Operation Permit.

Commercial Landings

Data on landings by gear indicate that, prior to 1960, most of the oysters were taken by dredge when compared to all hand methods. Chestnut (1955) reported that ninety percent of the oysters landed in North Carolina came from Pamlico Sound. The Pamlico Sound area is largely dependent on dredging. The resurgence of the dredge landings in 1987 was due, in part, to increased oyster populations and in part to increased effort, as displaced mechanical harvest clam harvesters turned to oyster dredging due to closure of southern clam areas by a red tide. These closures affected 98% of the clam harvesting areas and had its greatest impact on the clam fishermen. The red tide was a dinoflagellate bloom that caused closure of over 361,000 acres of public bottoms to shellfish harvest from November 1987 to May 1988. The

dinoflagellate (*Karenia brevis*) produced a neurotoxin, which was concentrated in shellfish, making them unfit for consumption. Hand harvest landings of oysters failed to reach their potential that same year due to the fact that a majority of the hand-harvest-only areas were also closed because of the red tide (Figure 1). Hand harvest landings are the most consistent contributor to the State's oyster fishery. Hand harvest landings exceeded the dredge landings for significant periods between 1961 and 1970 and between 1989 and 2008 (Figure 1).

The oyster parasite *Perkinsus marinus*, also known as Dermo disease, has been responsible for major oyster mortalities in North Carolina during the late 1980s to mid-1990s. Dermo, a protist, similar to dinoflagellates, causes degradation of oyster tissue. Once infected, oysters suffer reduced growth, poor condition, diminished reproductive capacity and ultimately mortality resulting from tissue lysis and occlusion of hemolymph vessels (Ford and Figueras 1988; Ford and Tripp 1996; Haskin et al. 1966; Ray and Chandler 1955). Chestnut (1955) may have been the first to report its occurrence in North Carolina. However, no extensive assessments were attempted until large-scale oyster mortalities prompted investigations during the fall of 1988. Oyster samples from 11 sites were sent to the Virginia Institute of Marine Science (VIMS) and the Cooperative Oxford Laboratory. Results showed that Dermo infection was the major cause of mortalities (NCDMF 2008).

Staff observed in the southern estuaries while the Dermo infections were on the rise, that during late summer, moderate and high Dermo infection levels did not reduce oyster populations. Hand harvest landings in the south from 1991 through 2002 did not decline in the same manner as landings from Pamlico Sound during the same time. It is suspected that the small, high salinity estuaries may inhibit mortality by flushing out parasites at a higher rate or by exceeding the salinity tolerance of the Dermo parasite, allowing for a higher survival rate compared to Pamlico Sound. The link between low dissolved oxygen, increased availability of iron and increased parasite activity may also be a factor in the different mortality rates as the smaller, high salinity estuaries are less prone to low dissolved oxygen events than the Pamlico Sound (Leffler et al. 1998). Dermo infection intensity levels since 2005 have remained low; however prevalence appears to be increasing (NCDMF unpublished data). Dermo infection intensity has remained low and mechanical harvest landings in Pamlico Sound continued to recover from the extremely high Dermo mortality levels and hurricane impacts of the mid-1990s until additional environmental impacts began affecting the fishery in 2011 (Figure 1).

Overall oyster landings have been increasing in the last ten years (Figure 2). Hand harvest has shown a slight increasing trend in landings for the past ten years, but the most significant increase occurred during the 2009/10 and 2010/11 mechanical harvest season (Figures 1 and 2). During the early 2009/10 mechanical harvest oyster season, the Great Island Narrows area between Great Island and the mainland in Hyde County in Pamlico Sound experienced intensive oyster harvest (Figures 1 and 2). Some of the operations were harvesting the 15-bushel limit, offloading, returning to the area with a new crew and harvesting another limit the same day. The harvest limit of 15 bushels per commercial fishing operation per day did not apply to vessels that replaced the crew since the new crew constituted a new commercial fishing operation according to standing division policy. Staff investigation of this intensive harvest indicated that substantial shell damage was occurring on the remaining oysters and the area was closed after six weeks of harvest. The oyster dredge fleet moved out into the open sound and continued to have good catches for the rest of the 2009/10 mechanical harvest oyster season.

The 2010/11 season began with a 2:00 pm time limit on dredging to stop the two-trips-per-day loophole but it probably had little impact on mechanical harvest since experienced dredgers

could take their limit in a few hours and there appeared to be many new entrants into the fishery. The traditionally harvested oyster rocks in the deeper waters of western Pamlico Sound contributed greatly to the increased landings in the 2009/10 and 2010/11 seasons but the Middle Ground area in 2010/11 provided another unexpected source of significant oyster production similar to the Great Island Narrows in 2009 (Figures 1 and 2). Also, interest in taking advantage of expected high market demand caused by closure of oyster harvest areas in the Gulf of Mexico due to the Deepwater Horizon oil spill lengthened the season slightly with a November 1 mechanical harvest season opening in the fall of 2010.

The last significant production of oysters from a non-traditional harvest area was reported by local fishermen to have occurred more than 20 years prior to the 2010/11 season or around the time of another large increase in mechanical harvest landings in 1987/88 (Figure 1). That production came from Brant Island Shoal and like the Middle Ground is an area in western Pamlico Sound generally around 12 feet deep and characterized by hard sandy bottom. Dredge samples and sonar observations from the Middle Ground oyster producing area revealed that there were no typical oyster rock formations and the cultch material producing the oysters was typically large “fossil” clam shells. Nearby oyster rocks are found in areas around 18 feet deep and on mounds of oyster shell cultch. The oysters tended to be very large with most samples averaging more than the 3-inch (76 mm) size limit and up to 80 percent of some samples legal for harvest. There were reports that some shucking houses complained the oysters were too large. These Middle Ground oysters also displayed an unusual shell characteristic with very long, thin umbos, or beaks, not normally seen on Pamlico Sound oysters.

Hurricane Irene hit the North Carolina coast on August 27, 2011 and had major impacts on the mechanical harvest area for oysters. The oyster resources on the Middle Ground could not be located after the storm probably due to sedimentation or physical relocation caused by waves or currents. Many of the deeper water oyster resources located near Brant Island Shoal were also significantly damaged (Figure 3). Most of the damage was oyster mortality caused by detritus covering the oyster rocks. Oyster resources in the Neuse and Pamlico rivers did not appear to suffer much damage but also did not show any of the typical growth characteristics during the following fall and winter months. These factors had a pronounced effect on the mechanical harvest oyster season in 2011/12 and the mechanical harvest area in western Pamlico Sound was closed on January 2, 2012. Mechanical harvest landings declined to near 2008/09 levels (Figure 1 and 3). Regular sampling of oyster sizes to fulfill the requirements of Supplement A to the N.C. Oyster FMP has made it clear that oyster growth during the harvest season is essential to sustain acceptable harvest levels.

Prior to the 2012/13 mechanical harvest season, an apparent, severe low dissolved oxygen event occurred in the Neuse River that caused virtually a 100 percent mortality of the oyster resources at 18 feet or greater depths. A few oyster rocks in shallower waters between Maw Point Shoal and Light House Shoal were spared as well as some division oyster habitat enhancement projects in other shallow areas (Figure 3). The Pamlico River area also had not recovered from the effects of Hurricane Irene at this time. The Neuse River area was available for mechanical harvest until the adjacent bays closed on December 21 although there was no harvest activity in the river during the time it was open. The Pamlico River area closed to mechanical harvest on February 1, 2013 based on failure to meet the 26-percent trigger although effort was much reduced since early January. The 2012/13 mechanical harvest oyster landings declined further.

There was little evidence of any recovery of the Neuse River oyster resources prior to the 2013/14 season but the Pamlico River area appeared to be recovering and growth indicators

were good during the season. The Dare County area in northern Pamlico Sound also supported some significant mechanical harvest activity throughout the season and when oyster harvests began to decline in the western sound in early February, 20 to 25 boats moved to Dare County to finish the season. The remaining productive areas in the Neuse River closed on February 28, 2014 and most of the harvesters left the Pamlico River area by mid-February. Mechanical harvest in Dare County continued until the season ended on March 31, 2014. The overall result was some increase in the combined gear oyster landings with over 725,000 pounds of meats landed in 2014 (Figure 2).

The 2014/15 mechanical harvest season opened on November 10, 2014, all areas were above the percentage of legal-sized oysters during preseason sampling. Effort was still consistently low in the Neuse River due to limited amounts of oysters available for harvest and this area was closed on March 23. The Pamlico River area also showed promise for growth and maintaining the number of legal sized oysters to stay open, but fishing effort was much higher in the Pamlico River area with the fleet scattered from the mouth of the river to Brant Island (Figure 3). Pamlico River closed on March 9 and did not re-open for the rest of the season. At the beginning of the season, effort in Hyde County was mostly in Wysocking Bay while effort in Dare County was from Sandy Point to the Crab Hole. After Christmas, more effort shifted into the Crab Hole area off of Stumpy Point Bay due to Hyde County boats joining the Dare County fishery. Dealers reported that fishermen were bringing in their limits by mid-day. After the fleet shift to Northern Dare, sampling resulted in less than 26 percent legal-size oysters for two consecutive sampling trips in both Dare and Hyde Counties which resulted in a closure of these areas on January 12, 2015. Sampling continued and it was decided to stop sampling Hyde County because of no improvement. Staff continued to sample Dare County and the area was re-opened on March 9, 2015 and closed by rule on March 31, 2015. The fleet encountered what was described as a “crust” covering much of the oyster rocks fished on opening day and took several days to break up this “crust”. Effort was high in the Northern Dare area for the re-opening with approximately 50 boats fishing on the first day and dropping off to around 20 boats. The 2014/15 peaked in December. Closures of the Northern Hyde and Dare areas resulted in declines in harvest in January and in combination with weather impacts in February.

Recreational Landings

Unknown

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Currently, the only data available for the stock in all areas are the commercial landings and associated effort from the Trip Ticket Program. No fishery dependent monitoring programs occur for oysters.

Fishery-Independent Monitoring

There are two independent programs for oysters. One is a long-term spatfall sampling program conducted by the Habitat and Enhancement section to estimate recruitment of spat (P610). The second program is an indicator for habitat disturbance and damage of the commercial dredge fishery on public bottom to determine closure of the season for habitat protection of oyster rocks.

Mechanical Harvest Area Oyster Sampling

Supplement A to Amendment 2 established the trigger for closing areas to mechanical harvest to protect the resource and habitat. The management trigger was established and defined as when the sampling indicates the number of legal-sized (3-inch) oysters in the area has declined to 26% of the live oysters sampled. The management areas are divided geographically into four areas; the Neuse River Area, Pamlico River Area, Northern Hyde Area, and Northern Dare Area (Figure 4). Sampling targets areas and oyster rocks being worked by commercial oystermen, directly before the opening of and throughout the mechanical harvest oyster season. The sampling sites are selected based on the presence/absence of commercial oystermen working in the area. Only areas where commercial oystermen are working are sampled to determine localized depletion and address habitat protection. From each sample, the first 100 live oysters, including spat and any boxes, are collected for workup. Each oyster, up to a maximum of 100, is measured to the nearest mm and inspected for any damage. Shell damage is denoted as none, minor, or substantial for further evaluation.

Sampling began on September 23, 2009 with preseason oyster sampling, in five management areas, using mechanical harvesting methods. Sampling has consistently continued with a target of 10 sites per management area, throughout the four management areas. All sampling is conducted using NCDMF vessels and standard oyster dredges with comparable construction to those used by commercial oystermen. Samples are collected at least bi-monthly in each management area before, during, and after the open mechanical oyster harvest season. More intensive sampling is conducted if samples are near the trigger percentage. Sampling continues after an area is closed to assess the possibility of reopening. Sampling is discontinued when it is apparent that reopening is not likely to occur. Mean oyster shell height (commonly referred to as length) is calculated for each 100-oyster sample. The number of legal-sized (≥76 mm) and undersized (<76 mm) oysters is determined for each sample. The total legal-sized oysters for all the samples taken in a management area on a sampling trip is divided by the total of all oysters sampled on that trip to calculate the percentage used to assess compliance with the harvest closure trigger. Oyster sizes are also sorted into 5 mm size bins and the size distribution for the area is presented as a line graph. Box/gaper size distribution is sorted and displayed similarly. Sampling results are reported to interested dealers/fishermen after each sampling event.

This sampling is not intended for use as a species abundance index, but instead to reflect the conditions of the habitat during the open oyster mechanical harvest season to determine closure of an area as a protection measure. For the purpose of this update only the prior open mechanical harvest season data will be provided with a brief overview of the season.

All areas were above the percentage of legal-sized oysters during preseason sampling of the 2014/15 mechanical harvest season. Pamlico River closed on March 9 and did not re-open for the rest of the season. The areas in the northern region of Dare and Hyde Counties closed on January 12, 2015. Sampling continued and it was decided to stop sampling Hyde County because of no improvement. Staff continued to sample Dare County and the area was re-opened on March 9, 2015. Effort was consistently low in the Neuse River throughout the season due to limited amounts of oysters available for harvest and this area was closed on March 23. Table 1 shows the percentages of legal-sized oysters taken by area throughout the 2014/15 mechanical harvest season.

Spatfall Evaluation

Division staff conduct spatfall sampling annually, on cultch planting sites from the previous three years, during January but samples may be collected through April, if required. Subtidal sites are sampled by towing a standard oyster dredge over the planting site until, at a minimum, 30 pieces of cultch are collected. Normally a 75-pound, 36-inch toothed bar dredge is used; however, various other dredges may be used. On rare occasions, patent tongs and hand tongs may be used to obtain planting samples. Intertidal sites are sampled by hand at low tide in all applicable intertidal areas of the Southern District and hand tongs are used in the more northerly subtidal areas of Stump Sound and New River. Three tong grabs per location are usually taken to obtain the minimum amounts of cultch required. Gear type and any other valuable gear parameters are recorded. Prior to 2005, data was not collected south of New River.

Thirty pieces of cultch are randomly selected from each sample and the type of cultch (oyster, calico scallop, surf clam, marl, or sea scallop) is noted. The total number of spat on each piece of cultch is enumerated, with each spat being measured to nearest millimeter shell length. The average number of spat per piece of cultch is calculated by summing the number of spat per cultch piece, divided by the total number of cultch pieces sampled. Annual Juvenile Abundance Index (JAI) is calculated as the average number of spat per site and then averaged across all sites within that year. The ten year average is calculated by averaging the annual JAI over the last 10 years.

The JAI has been somewhat variable from year to year in the more recent years in the time series, but overall showing an increasing trend for the past ten years (Table2; Figure 5). The 2014 JAI was the second highest in the ten year time series (Table 2).

MANAGEMENT STRATEGY

There are no management triggers or methods to track stock abundance, fishing mortality, or recruitment between benchmark reviews from the current FMP.

Highlights of the management measures developed in Amendment 2 include adopting a 15 bushel harvest limit in Pamlico Sound and a 10 bushel harvest limit for all gears in designated areas around the sound, reducing the available harvest season, changed the way lease production averages are calculated, limited lease applications to five acres and a recommendation to expand oyster sanctuary construction efforts. Supplement A raised the potential harvest limit in Pamlico Sound to 20 bushels and provided a monitoring system for determining the closure of mechanical harvest areas when sampling indicates the number of legal-sized oysters in the area has declined to 26 percent of the live oysters sampled for two consecutive sampling occurrences. This trigger is to protect the resource and habitat and not a measure to track stock abundance or removals from the stock (fishing mortality). Amendment 3 established two seed oyster management areas in Onslow County.

See Tables 3, 4, and 5 for current management strategies and implementation status in Amendment 2, Supplement A to Amendment 2, and Amendment 3 of the Oyster FMP.

MANAGEMENT AND RESEARCH NEEDS

Table 3, provides the NCMFC selected management strategy from Amendment 2 and Table 4 provides the NCMFC selected management strategy for Supplement A to Amendment 2. Table 5 provides the selected management strategy for Amendment 3. The specific research recommendations from Amendment 2 and Supplement A for Amendment 2, with the status of need provided in parenthesis, include:

Amendment 2

- Develop peer reviewed, standardized monitoring metrics and methodologies for oyster restoration and stock status assessments (standards that are strived for in all assessments and monitoring programs in NCDMF)
- Conduct studies on the impacts of current oyster dredging practices on oyster habitat (needed)
- Conduct studies on the effects of oyster dredge weight and size on habitat disturbance and oyster catches (needed)
- Determine a protocol and triggers for closures of oyster harvesting areas (ongoing through Supplement A in under development in draft Amendment 4)
- Conduct stock assessments of oysters located within polluted areas to determine feasibility of depuration operations (needed)
- Review current DEH rules to update to current depuration technologies (needed)
- Explore new technologies for off-bottom oyster culturing methods (needed)
- Develop new types of biomarkers that can be used to select more effectively for disease-resistant genetic oyster stock (needed)
- Develop disease-resistant or fast-growing strains of oysters (needed)
- Establish an oyster brood stock development program (work ongoing through UNCW hatchery)
- Develop methods to determine resistance of shellfish stocks to various diseases(needed)
- Assess survival and productivity of relayed oysters vs. natural recruitment on planted cultch (needed)
- Investigate timing of oyster spatfall, larval dispersal and transport (needed)
- Determine the hydrodynamics of areas for oyster restoration, culture activities and sanctuaries (needed)
- Collect population information on cownose rays (needed)
- Explore uses of cownose rays for food in the pet food industry and the human food industry (some work completed in Virginia but did not work out long-term)
- Explore uses of cownose rays as a source of chondroitin/glucosamine or oil for pet and human supplements (needed)
- Investigate markets for cownose rays (Some work in Virginia but did not work out for long-term)
- Investigate areas of sanctuary placement (shallow/deep), size, and impacts to the local fishing grounds (ongoing through NCDMF)
- Determine sanctuary size, profile, and amount of material needed (ongoing through NCDMF)
- Determine the cost of an oyster sanctuary project (private vs. state) (ongoing through NCDMF)
- Investigate larval oyster dispersal and transport (needed)

- Investigate oyster spat settlement success on different cultch materials (some research conducted through UNC-IMS)
- Continue research on means and methods for reduction of non-point source pollution and mitigation of pollutant effects in the estuary (ongoing through the CHPP)
- Determine the effect of shellfish filtering capacities on water quality parameters, such as bacteria, nutrients and sediments (unknown)
- Support collaborative research to more efficiently track bacterial sources for land-based protection and restoration efforts (ongoing through the CHPP)
- Quantify the impact of current fishing practices on oyster habitat suitability in North Carolina (needed)
- Determine the impact of docks siting practices and bottom disturbing activities on nearby habitats and on the shifting boundaries of habitat itself so that protective buffer distances can be established (ongoing through the CHPP)
- Quantify the relationship between water quality parameters and the cumulative effect of shoreline development units (i.e., docks, bulkhead sections) (ongoing through the CHPP)

Supplement A

- Further studies on the impacts of oyster dredging on oyster habitat (needed)
- Further studies on the effects of dredge weight and size on habitat disturbance and oyster catches (needed)
- Determine a protocol and triggers for closures of oyster harvesting areas (needed)
- Research providing a more timely management response to harvest pressure (ongoing through NCDMF)
- Evaluate a harvest closure (needed)
- Develop a program to monitor oyster reef height (needed)
- Evaluate methods to assess oyster resource and habitat condition prior to the season to determine a baseline for harvest levels in a season (e.g. oyster reef height, legal/sublegal abundance and general health of oyster stocks) (needed)

FISHERY MANAGEMENT PLAN RECOMMENDATION

Recommend maintain the current timing of the Benchmark Review. Amendment 4 of the N.C. Oyster FMP is currently in development and scheduled for NCMFC adoption in November 2016 with any recommended rules changes in effect by April 2017,

LITERATURE CITED

Chestnut, A. F. 1955. A report of the mollusc studies conducted by the University of North Carolina Institute of Fisheries Research, 1948-1954. University of North Carolina, Institute of Fisheries Research, 66 p.

Chestnut, A. F. and H. S. Davis. 1975. Synopsis of Marine Fisheries of North Carolina. Part I: Statistical Information, 1880-1973. University of North Carolina Sea Grant Publication, UNC-SG-75-12, 425 p.

Ford, S. E. and A. J. Figueras. 1988. Effects of sublethal infection by the parasite *Haplosporidium nelsoni* (MSX) on gametogenesis, spawning, and sex ratios of oysters in Delaware Bay, USA. Diseases of Aquatic Organisms 4(2): 121-133.

Ford, S. E. and M.R. Tripp. 1996. Diseases and defense mechanisms. p. 581-660 *in* Kennedy, V. S., Newell, R. I. E., and Eble (eds.), A. F. The eastern oyster *Crassostrea virginica*. Maryland Sea Grant, College Park, MD.

Haskin, H. H., L.A. Stauber, and G. Mackin. 1966. *Minchinia nelsoni* n. sp. (Haplosporida, Haplosporidiidae): causative agent of the Delaware Bay oyster epizootic. Science 153: 1414-1416.

Leffler, M., J. Greer, G. Mackiernan, and K. Folk. 1998. Restoring Oysters to U.S. Coastal Waters: A National Commitment. UM-SG-TS-98-03, www.mdsg.umd.edu/MDSG/ or VSG-98-05, www.people.Virginia.EDU/~gmsc-web/ . 21p.

NCDMF. 2010. Supplement A to Amendment II of the NC Oyster Fishery Management Plan. Changing Management Measures for Harvest Limits in the Mechanical Harvest Oyster Fishery. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries.. Morehead City, NC. 14 p.

NCDMF. 2008. North Carolina Oyster Fishery Management Plan. Amendment 2. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 283 pp.

Ray, S. M. and A.C. Chandler. 1955. Parasitological reviews: *Dermocystidium marinum*, a parasite of oysters. Experimental Parasitology 4: 172-200.

R Core Team. 2014. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Stasinopoulos, M., B. Rigby, and N. Mortan. 2014. gamlss.cens: fitting an interval response variable using gamlss.family distributions. R package version 4.2.7.

Therneau, T. 2014. A package for survival analysis in S. R package version 2.37-7.

TABLES

Table 1. Percentage of legal-sized oysters by area for the 2014/15 season in the mechanical fishery. *Includes samples from Wysocking Bay which closed December 19

Neuse River		Pamlico River		Northern Hyde County		Northern Dare County	
Date	Percent	Date	Percent	Date	Percent	Date	Percent
Sep. 22, 2014	24.6	Sep. 22, 2014	23.8	Oct. 1, 2014	31.0	Sep. 16, 2014	28
Nov. 5, 2014	32.0	Oct. 10, 2014	37.0	Dec. 1, 2014	30.0	Dec. 3, 2014	34
Dec. 3, 2014	31.2	Nov. 5, 2014	33.4	Dec. 15, 2014	21.3	Dec. 16, 2014	23
Dec. 15, 2014	36.0	Nov. 19, 2014	34.7	Jan. 5, 2015	24.6	Jan. 6, 2015	22
Jan. 6, 2015	32.0	Dec. 3, 2014	39.6	Jan. 29, 2015	22.0	Jan. 26, 2015	24
Jan. 21, 2015	23.3	Dec. 15, 2014	34.3	Feb. 12, 2015	22.7	Feb. 9, 2015	25.7
Jan. 29, 2015	29.2	Jan. 6, 2015	30.0	Mar. 31, 2015*	28.5	Feb. 25, 2015	26.2
Feb. 9, 2015	27.3	Jan. 21, 2015	30.3			Mar. 3, 2015	27.9
Mar. 9, 2015	19.1	Feb. 4, 2015	22.2			Mar. 25, 2015	28.8
Mar. 17, 2015	15.7	Feb. 27, 2015	23.7				
Apr. 13, 2015	13.9						

Table 2. The annual average number of oyster spat across all sampling sites, 2005-2014 (NCDMF Habitat and Enhancement Section).

Year	Number of sites sampled	Annual average number of spat across all sampling sites	Standard error
2005	110	1.4130	0.1329
2006	130	1.7736	0.1054
2007	132	1.8890	0.1308
2008	107	2.3810	0.1599
2009	111	3.1462	0.1935
2010	112	2.7676	0.1974
2011	99	2.1027	0.2196
2012	89	3.0416	0.3050
2013	82	1.8955	0.1898
2014	76	2.9216	0.2488

Table 3. Summary of the NCMFC management strategies and their implementation status for Amendment 2 of the Oyster Fishery Management Plan.

Management Strategy	Implementation Status
HARVEST ISSUES	
Recommend no change to the open shellfish harvest license	Accomplished
Recommend a 15 bushel hand/mechanical harvest limit in Pamlico Sound mechanical harvest areas outside the bays, 10 bushel hand/mechanical harvest limit in the bays and in the Mechanical Methods Prohibited area along the Outer Banks of Pamlico Sound.	Accomplished
Define recreational shellfish gear	Accomplished
Allow no sale of weekend shellfish harvest except from leases	Accomplished
Propose repeal of G.S. 113-169.2 license exemption.	Accomplished
Set recreational limits in rule and proclamation	Accomplished
Require all shellfish to be tagged at the dealer level	Accomplished
Adopt a new rule limiting mechanical harvest of other shellfish to areas where and season when mechanical harvest gear for shellfish is allowed in existing fisheries	Accomplished
10 bushel mechanical gear harvest limit in the Pamlico Sound bays with a six week (mid-November through December) season (until triggers are established)	Accomplished
Collect more data comparing the effects of 50 and 100 pound dredges prior to making a decision on this issue	Accomplished
Change existing rule to set the latest season closure date at March 31	Accomplished
PRIVATE CULTURE ISSUES	
Leave regulations as is for depuration facilities.	Accomplished
Utilize user coordination plans for shellfish lease issuance coast wide	Funding required but was not sought due to budget situation
Support private oyster larvae monitoring programs	Accomplished
Support construction of an integrated system of shellfish hatcheries and remote-setting sites	Accomplished
Develop a subsidized, fee-for-service disease diagnosis program.	Not under consideration at this time
Update seed oyster management in statutes and rule.	Accomplished
Monitor seeded oyster sanctuaries for cownose ray predation.	Research underway
Propose an exemption from G.S. 113-168.4(b)(1) when the sale is to lease, UDOC permit, or Aquaculture Operations Permit holders for further rearing	Accomplished
Require an examination with a passing score based on pertinent information in the training package irrespective of whether the applicant has obtained instruction voluntarily or is reviewing the information independently	Accomplished
Request that appropriate agencies such as the Oyster Hatchery and N.C. Sea Grant conduct shellfish lease training as part of their educational and outreach activities	Needed
Modify G.S. 113–201 to include a requirement of an examination with a passing score for persons acquiring shellfish leases by lawful transfers unless they have a shellfish lease that is currently meeting production requirements	Accomplished

Management Strategy	Implementation Status
Encourage harvesters to take volunteer time and temperature control measures on their product.	Covered by new permit requirement
Change the current rule specifying a three year running production average to a five year production average and change the statutory provision for a ten year lease contract to a five year contract	Accomplished
Limit acreage per shellfish lease application to 5 acres	Accomplished
A leaseholder holding at least 5 acres of shellfish bottom is required to meet shellfish lease production requirements before being approved for any additional lease acreage	Accomplished
Require Lat./Long. coordinates on lease corner locations as part of the requirement of a registered land survey	Accomplished
Develop regional lease acreage caps based on established use of water bodies	Accomplished Statute change – No NCMFC Action
Rewrite the statutory provision limiting the amount of shellfish lease acreage that can be held by an individual to include acreage held by corporations where the individual is a member, or any combination of corporate or family holdings	Accomplished
No change to rules affecting the issuance of permits for culturing shellfish in closed harvest areas	Accomplished
INSUFFICIENT DATA	
Recommend no change (status quo) to collect information on recreational harvest of shellfish through a license	Accomplished
ENHANCEMENT ACTIVITIES	
Expand and evaluate the number of designated oyster sanctuaries to increase oyster populations	Ongoing
Include current and future oyster sanctuaries into North Carolina Fisheries Rules For Coastal Waters Subchapter 03R.	Accomplished
Plant and monitor seed oysters on existing oyster sanctuary/artificial reef sites.	Accomplished
ENVIRONMENTAL ISSUES	
Review the results of the completed USACE EIS on the proposed introduction of Suminoe oysters in Chesapeake Bay and consult with sister states concerning use of these non-native oysters	Accomplished
Support DWQ's efforts to improve stormwater rules through permit comments and CHPP implementation and co-ordinate with sister agencies	Accomplished
Recommend DWQ to designate Use-Restoration waters in conditionally closed waters where moderate contamination and healthy shellfish beds are present and develop strategies to restore and protect those waters	Accomplished URW coordinator hired by DWQ
Recommend DWQ designate Use-restoration waters in areas where moderate contamination and appropriate shellfish culture conditions are present and develop strategies to restore and protect those waters	Accomplished URW coordinator hired by DWQ
Recommend to the DWQ to accept a lower threshold of 10,000 square feet to coastal stormwater rules	Accomplished
Recommend a naturally vegetative riparian buffer width of 50 feet	Accomplished

Management Strategy	Implementation Status
Recommend the exclusion of all wetlands (coastal and non-coastal), from the built-upon area calculations	Accomplished
Provide educational materials to harvesters in license offices and on DMF webpage, through other training opportunities, and through DMF Port Agent contact with harvesters and dealers and include other state and federal regulatory agencies to reach all coastal waters users	Partially Accomplished
Leave current management practices in place for Ward Creek	Accomplished
Recommend repeal of G.S. 113-207 (a) and (b) to end the requirement that all oyster rocks must be posted by the Department	Accomplished
Recommend that conservation leasing for constructed oyster rock habitat be studied by DENR counsel for development of a proper mechanism and to develop siting criteria	Not under consideration at this time

Table 4. Summary of the NCMFC management strategies and their implementation status for Supplement A to Amendment 2 of the Oyster Fishery Management Plan.

Management Strategy	Implementation Status
Proclamation authority up to 20 bushels per fishing operation with a harvest closure trigger when sampling indicates the number of legal-size oysters in the area has declined to 26% of the live oysters sampled	Accomplished

Table 5. Summary of the NCMFC management strategies and their implementation status for Amendment 3 of the Oyster Fishery Management Plan.

Management Strategy	Implementation Status
Create seed oyster management areas at Swan Point and Possum Bay in Onslow County	Accomplished

FIGURES

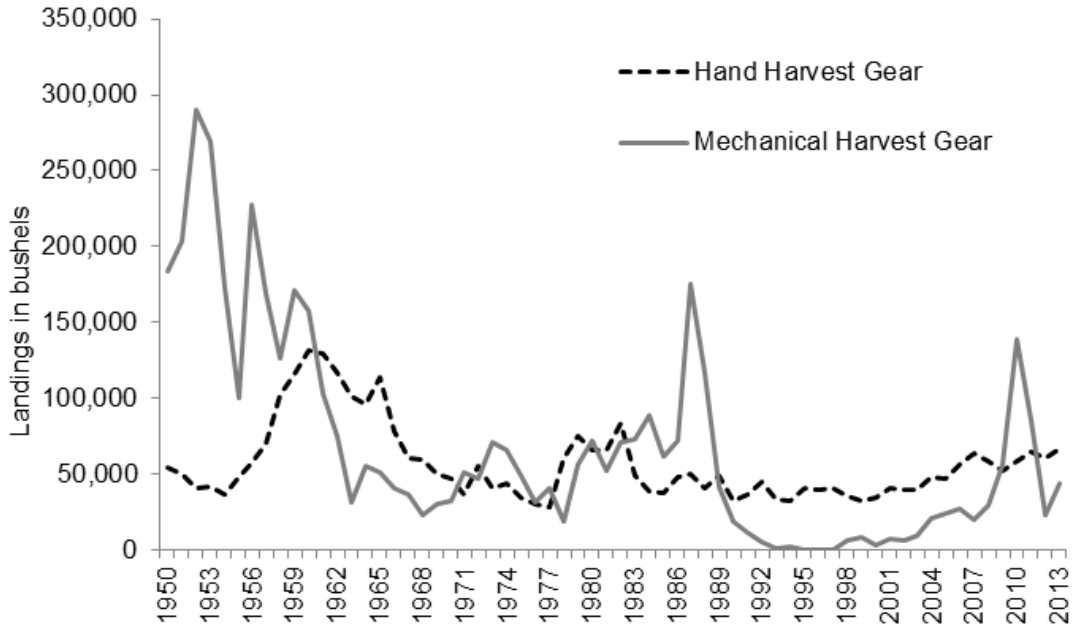


Figure 1. Annual commercial oyster landings (bushels)from both public and private bottom by gear 1950-2013 (Chestnut and Davis 1975; National Marine Fisheries Service unpublished data; NCDMF Trip Ticket Program).

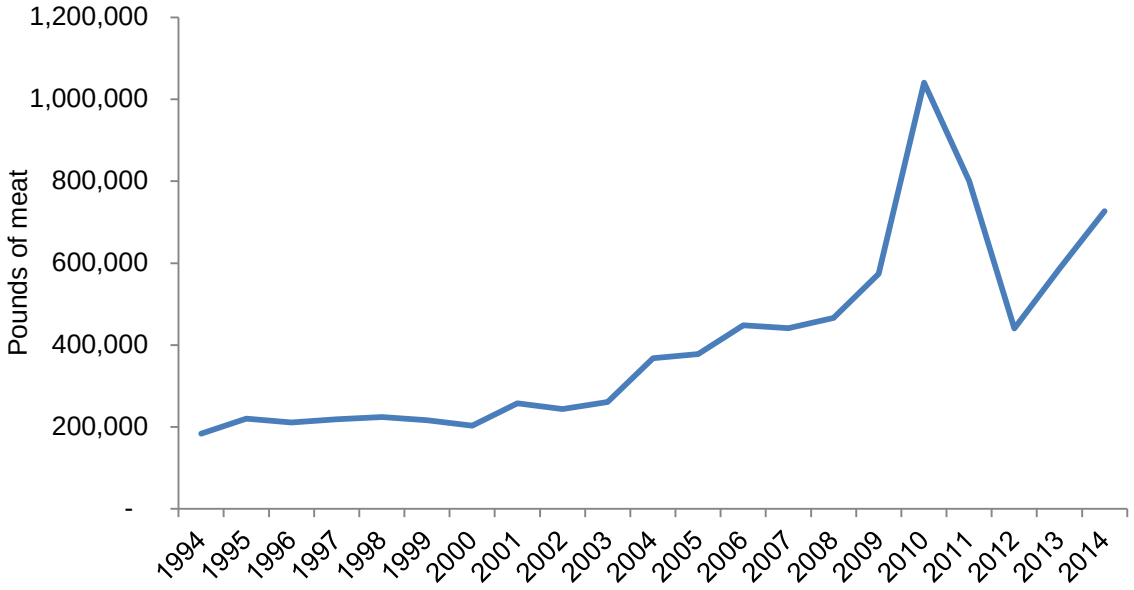


Figure 2. Annual commercial oyster landings (Pounds of meat) from private and public bottom in North Carolina, 1994-2014 (NCDMF Trip Ticket Program).

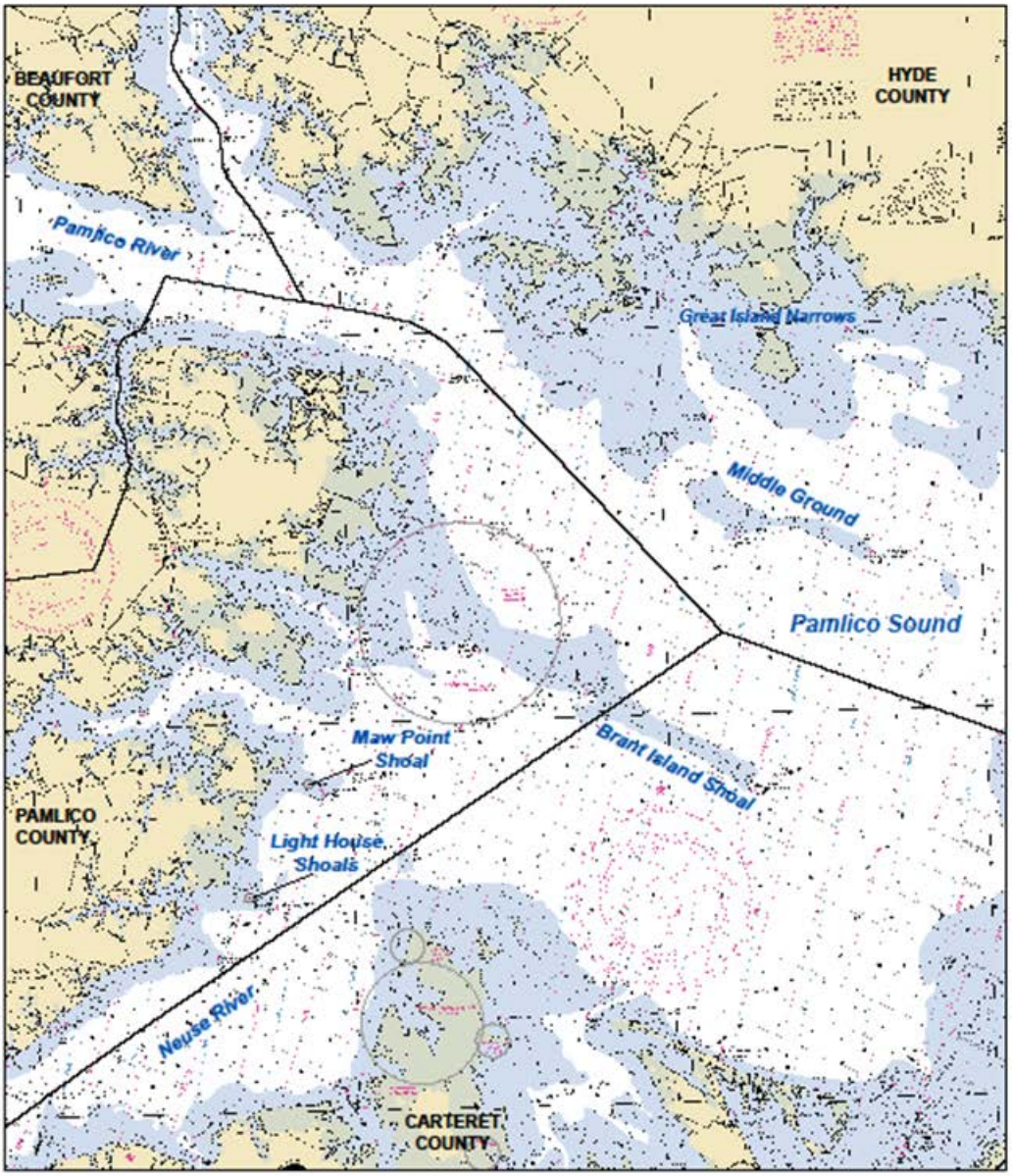
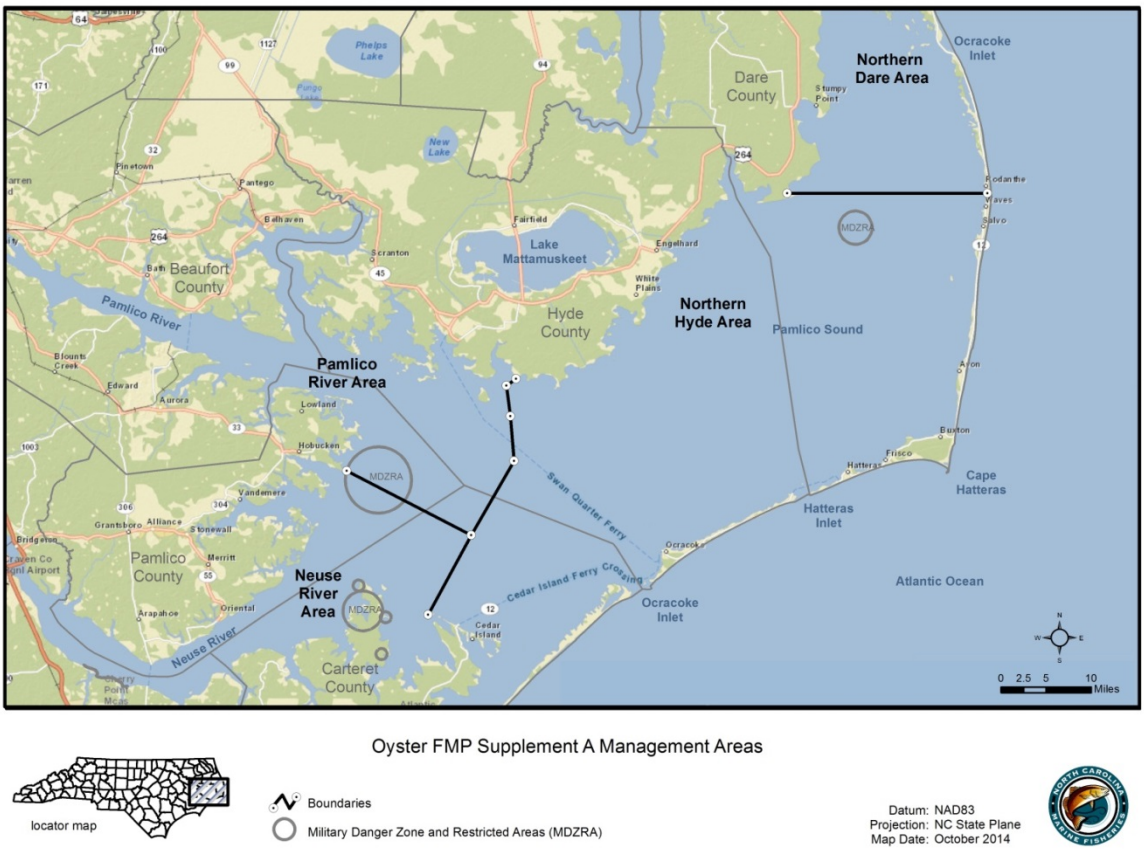


Figure 3. Map of areas referenced in the commercial landings section (NCDMF GIS database).



Oyster FMP Supplement A Management Areas

Boundaries

Military Danger Zone and Restricted Areas (MDZRA)

Datum: NAD83
Projection: NC State Plane
Map Date: October 2014

Figure 4. Mechanical harvest management areas from Supplement A to Amendment 2 of the Oyster FMP.

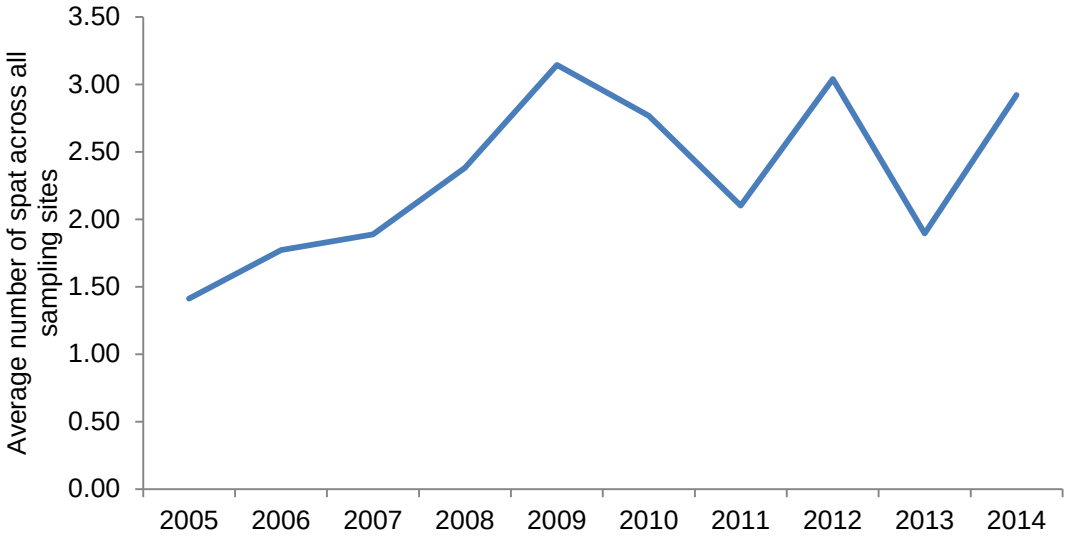


Figure 5. The annual average number of oyster spat across all sampling sites, 2005-2014 (NCDMF Habitat and Enhancement Section).

FISHERY MANAGEMENT PLAN UPDATE
NORTH CAROLINA ESTUARINE STRIPED BASS
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	1994
Amendments:	Amendment 1 – May 2013
Revisions:	November 2014
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	July 2018

Estuarine striped bass *(Morone saxatilis)* in North Carolina are currently managed under Amendment 1 to the North Carolina Estuarine Striped Bass Fishery Management Plan (FMP) and its subsequent revision (NCDMF 2014). It is a joint plan between the North Carolina Marine Fisheries Commission (NCMFC) and the North Carolina Wildlife Resources Commission (NCWRC). Amendment 1, adopted in 2013, lays out separate management strategies for the Albemarle/Roanoke (A/R) stock and the Central and Southern stocks in the Tar/Pamlico, Neuse, and Cape Fear rivers. Management programs in Amendment 1 utilize annual total allowable landings (TAL), daily possession limits, open and closed harvest seasons, gill net mesh size and yardage restrictions, seasonal attendance requirements, barbless hook requirements in some areas, minimum size limits, and slot limits to maintain a sustainable harvest and reduce regulatory discard mortality in all sectors. Amendment 1 also maintains the stocking regime in the Central and Southern systems and the harvest moratorium on striped bass in the Cape Fear River and its tributaries (NCDMF 2013). Striped bass fisheries in the Atlantic Ocean of North Carolina are managed under ASMFC's Amendment 6 to the Interstate FMP for Atlantic Striped Bass and subsequent addenda.

In response to the results of the 2013 benchmark A/R striped bass stock assessment that indicated fishing mortality was above its target, the NCMFC approved a Revision to Amendment 1 in November 2014 (NCDMF 2014). The revision reduced the TAL for the A/R stock from 550,000 pounds to 275,000 pounds, to be split evenly between the commercial and recreational sectors. Stock assessment projections indicated a TAL of 275,000 pounds would maintain fishing mortality and spawning stock at their respective targets and provide a sustainable harvest. The Central and Southern stocks continue to be managed under a 25,000 pounds commercial TAL, daily possession limits and a closed summer season to control recreational harvest, and a total harvest moratorium in the Cape Fear River and its tributaries.

The North Carolina Estuarine Striped Bass FMP approved in May 2004 was the first FMP developed under the criteria and standards of the 1997 Fisheries Reform Act (NCDMF 2004).

The plan focused on identifying water flow, water quality, and habitat issues throughout the state, reducing discard mortality in the commercial anchored gill net fisheries, continued stocking of striped bass in the Central and Southern areas of the state, and developing creel surveys in the Tar/Pamlico, Neuse, and Cape Fear rivers to estimate recreational harvest in those systems.

The NCMFC and the NCWRC implemented a Memorandum of Agreement in 1990 to address management of striped bass in the Albemarle Sound and Roanoke River. The original Estuarine Striped Bass FMP was approved by the NCMFC in 1994 and was targeted at the continued recovery of the A/R stock, which at the time was at historically low levels of abundance and was experiencing chronic spawning failures (Laney et. al. 1993). The comprehensive plan for the first time addressed the management of all estuarine stocks of striped bass in the state. The plan also satisfied the recommendation, contained in the Report to Congress for the North Carolina Striped Bass Study (U.S. Fish and Wildlife Service 1992) that such a plan be prepared.

Management Unit

There are two geographic management units and four striped bass stocks included in Amendment 1 to the North Carolina Estuarine Striped Bass FMP. The northern management unit is comprised of two harvest management areas; the Albemarle Sound Management Area (ASMA) and the Roanoke River Management Area (RRMA). The ASMA includes the Albemarle Sound and all its coastal, joint and inland water tributaries, (except for the Roanoke, Middle, Eastmost and Cashie rivers), Currituck, Roanoke and Croatan sounds and all their joint and inland water tributaries, including Oregon Inlet, north of a line from Roanoke Marshes Point across to the north point of Eagle Nest Bay in Dare county. The RRMA includes the Roanoke River and its joint and inland water tributaries, including Middle, Eastmost and Cashie rivers, up to the Roanoke Rapids Dam. The striped bass stock in these two harvest management areas is referred to as the A/R stock, and its spawning grounds are located in the Roanoke River in the vicinity of Weldon, NC. Management of recreational and commercial striped bass regulations within the ASMA is the responsibility of the NCMFC. Within the RRMA commercial regulations are the responsibility of the NCMFC while recreational regulations are the responsibility of the NCWRC. The A/R stock is also included in the management unit of Amendment 6 to the Atlantic States Marine Fisheries Commission (ASMFC) Interstate FMP for Atlantic Striped Bass.

The southern geographic management unit is the Central Southern Management Area (CSMA) and includes all internal coastal, joint and contiguous inland waters of North Carolina south of the ASMA to the South Carolina state line. There are spawning stocks in each of the major river systems within the CSMA; the Tar/Pamlico, the Neuse, and the Cape Fear. These stocks are collectively referred to as the CSMA stocks. Spawning grounds are not clearly defined in these systems as access to spawning areas is influenced by low river flows as well as impediments to migration. Management of striped bass within the CSMA is the sole responsibility of the NCMFC and the NCWRC, and is not subject to compliance with the ASMFC Interstate FMP for Atlantic Striped Bass.

Goals and Objectives

The goals of Amendment 1 to the North Carolina Estuarine Striped Bass FMP are to achieve sustainable harvest through science based decision-making processes that conserve adequate spawning stock, provide and maintain a broad age structure, and protect the integrity of critical habitats. To achieve these goals, the following objectives must be met:

1. Identify and describe population attributes, including age structure, necessary to achieve sustainable harvest.

2. Restore, improve, and protect striped bass habitat and environmental quality consistent with the Coastal Habitat Protection Plan (CHPP) to increase growth, survival and reproduction.

3. Manage the fishery in a manner that considers biological, social, and economic factors.

4. Initiate, enhance, and/or continue programs to collect and analyze biological, social, economic, fishery, habitat, and environmental data needed to effectively monitor and manage the fishery.

5. Initiate, enhance, and/or continue information and education programs to elevate public awareness of the causes and nature of issues in the striped bass stocks, habitat, and fisheries, and explain management programs.

6. Develop management measures, including regulations that consider the needs of all user groups and provide sustainable harvest.

7. Promote practices that minimize bycatch and discard mortality in recreational and commercial fisheries.

STATUS OF THE STOCK

Stock Status

A/R stock
The A/R striped bass stock status is currently listed as “concern”. Although the 2014 A/R striped bass benchmark stock assessment indicated the resource is not overfished or experiencing overfishing relative to the new reference points, both reference points have crossed their targets and are approaching their thresholds, meaning the point estimate is very close to the overfishing and overfished definitions (Mroch and Godwin 2013). Declining trends in landings and independent indices of abundance also contribute to the “concern” designation.

CSMA stocks
The lack of adequate data causes the CSMA stocks to be quantitatively assessed as unknown and to be listed as “concern”. The need for continued conservation management efforts are supported by the truncated size and age distributions, low overall abundance, and the absence of older fish in the spawning ground surveys (NCDMF 2013, Appendix 14.7).

Stock Assessment

A/R stock
The most recent A/R stock assessment (data through 2012) utilized the ASAP3 statistical catch at age model. The benchmark assessment was peer reviewed and approved for management use by an outside panel of experts and the ASMFC Atlantic Striped Bass Technical Committee. The model incorporated all commercial and recreational harvest and discard data, as well as abundance data from fishery independent surveys conducted by North Carolina Division of Marine Fisheries (NCDMF) and NCWRC staff.

Results from the assessment indicated the stock is not overfished or experiencing overfishing relative to its biological reference points (Table 1, Figures 1 and 2). Although the stock is not overfished, female spawning stock biomass has declined steadily since its peak in 2003, and is estimated at 835,462 pounds, just above the threshold of 772,588 pounds. Albemarle/Roanoke striped bass experienced a period of unusually strong recruitment (number of age-1 fish entering the population) from 1994-2001 followed by a period of lower recruitment from 2002-2013 (Figure 1). Total stock abundance reached its peak in the late 1990s and has declined gradually since, averaging about 1.5 million fish in recent years. Additionally, fishing mortality is estimated at 0.34, just above the target of 0.33 (Figure 2).

An update of the A/R stock assessment with data through 2014 will begin in August 2015.

CSMA stocks

The index-based method of catch curve analysis was used to assess the status of striped bass populations in the CSMA (NCDMF 2013, Appendix 14.7). Exploitation and mortality were estimated for the Tar/Pamlico and Neuse river stocks using catch-per-unit-effort (CPUE) from the NCWRC electrofishing spawning grounds survey and the NCDMF Program 915 independent gill net survey. The large confidence intervals and lack of precision in the catch curves Z estimates (total mortality rate) make them unsuitable for making a stock determination (NCDMF 2013). For this reason, catch curve results (especially annual estimates of mortality) were supplemented with additional quantitative information (such as trends in mean CPUE). Improvements in the age structure of the CSMA striped bass stocks are expected from the regulatory restrictions implemented under the 2004 FMP and from the protective measures for endangered species implemented in May 2010 (NCDMF 2010).

STATUS OF THE FISHERY

Annual spawning success of anadromous fish and fish that spawn in or use estuaries for nursery habitat, is largely dependent upon environmental conditions, both natural and manmade. Even when female spawning stock biomass is very high, very poor reproductive success can still occur due to unfavorable environmental conditions. This fact is important to keep in mind when discussing trends in landings data and stock abundance. For species that have long term juvenile abundance surveys, this phenomenon is evident when we observe a year with tremendous spawning success (termed a “strong year class”) followed by a year when practically no eggs survive to the juvenile stage (a “weak year class”). This cycle of spawning success and failure results in annual harvests that increase and decrease depending on the abundance of the year classes available to the fishery.

Current Regulations

ASMA

Harvest in the commercial sector is limited by an annual TAL of 137,500 pounds (see the November 2014 Revision of Amendment 1 to the North Carolina Estuarine Striped Bass FMP for a thorough discussion of how the current TAL was determined). There is also an 18 inch minimum total length (TL) size limit. The commercial fishery is prosecuted as a non-directed bycatch fishery, with the majority of landings occurring in large mesh (≥ 5 inch stretched mesh (ISM)) floating gill nets during the spring American shad fishery. Pound nets and flounder nets account for the remainder of the harvest. Daily trip limits are set by proclamation. Daily reporting of the number and pounds of striped bass landed from all licensed striped bass dealers ensure the TAL is not exceeded. There is a fall harvest season from October 1 through December 31

and a spring harvest season from January 1 through April 30. The harvest season is closed from May 1 through September 30 each year. The seasons may be closed early by proclamation if the TAL is reached. There is mandatory attendance on all small mesh (< 5 ISM) gill nets during the summer closed season to reduce discard mortality in that fishery. There are areas within the ASMA that are closed to all gill netting to further reduce undersize discards and to protect females as they enter the mouth of the Roanoke River during their spring spawning migration.

Harvest in the recreational sector is limited by an annual TAL of 68,750 pounds. The recreational sector also has an 18 inch TL minimum size limit and a three fish per person daily possession limit. The harvest seasons are the same as the commercial sector. Harvest is estimated via a creel survey designed for striped bass in the ASMA. The daily possession limit may be changed and/or seasons closed early by proclamation to ensure the TAL is not exceeded.

Check with the NCDMF for the most recent proclamation on striped bass harvest limits including trip limits and bycatch requirements.

RRMA
Commercial harvest in the RRMA is prohibited. The RRMA recreational sector also has an annual TAL of 68,750 pounds. The harvest season is open from March 1 through April 30 each year. There is an 18 inch TL minimum size limit and a no possession slot where fish between 18 inch TL and 27 inch TL may not be possessed. There is a two fish per person daily possession limit and only one of those fish may be greater than 27 inches TL. Only a single barbless hook may be used.in inland waters of the RRMA upstream of the U.S. Highway 258 Bridge from April 1 – June 30.

CSMA
Both commercial and recreational fishermen are subject to an 18 inch TL minimum size limit for striped bass within the CSMA. As a protective measure in joint and inland CSMA waters, it is unlawful for recreational fishermen to possess striped bass between 22 to 27 inches TL. Recreational fishermen are subject to a two fish per person per day creel limit. Commercial fishermen are subject to 10 fish per person per day limit with a maximum of two limits per commercial operation. Recreational harvest season for striped bass within the CSMA is October 1 through April 30. The commercial season opens by proclamation and may occur between January 1 and April 30, and is closed by proclamation once the annual 25,000 pound TAL is reached or on April 30, whichever occurs first. After the closure of the commercial harvest season through December 31, commercial fishermen are required to use a 3 foot tie down in large mesh (>=5 inch stretch mesh) gill nets in internal coastal fishing waters west of the 76 28.0000’ W longitude line. They must also maintain a minimum distance from shore (DFS) of 50 yards for these nets upstream of the existing DFS line (see proclamation M-3-2015 for area descriptions). There is a harvest moratorium for all recreational and commercial fisheries in the Cape Fear River and its tributaries.

Commercial Landings

ASMA
Commercial landings in the ASMA have been controlled by an annual TAL since 1991 (Table 2). Due to gill net mesh regulations and minimum size limits in place since 1993, the majority of harvest consists of fish 4-6 years of age (Figure 3). From 1990 through 1997 the TAL was set at

98,000 pounds because the A/R stock was at historical low levels of abundance. The stock was declared recovered in 1997 and the TAL was gradually increased as stock abundance increased. The TAL reached its maximum level of 275,000 pounds in 2003 as the stock reached record levels of abundance.

Through 2004 the TAL was reached easily. As stock abundance started to decline, commercial landings no longer reached the annual TAL, even with increases in the number of harvest days and daily possession limits. From 2005 through 2009 landings steadily declined and averaged about 150,000 pounds, even though gill net trips remained steady during that period (Figure 4). Gill net trips in this instance are all anchored gill net trips occurring in the ASMA as reported through the North Carolina Trip Ticket Program. Because of several caveats, including this is not a directed fishery, the trip data cannot be used to calculate any type of catch per unit of effort, but are shown to provide a general idea about the trends in anchored gill net effort in the ASMA.

The decline in landings during 2005-2009 was due to poor year classes produced from 2001 to 2004. An increase in landings in 2010 to over 200,000 pounds was due to the fairly strong 2005 year class. In 2013 and 2014 landings were reduced in part because of a very weak 2009 year class and a shortened American shad season resulting from triggers being met in the American Shad Sustainable Fishery Plan.

CSMA

Commercial landings in the CSMA have been controlled by an annual TAL of 25,000 pounds since 1994. Over the past ten year period, landings have closely followed the annual TAL, with the exception of 2008 when less than half of the TAL was landed. The majority of landings have been split between the Pamlico / Pungo Rivers and the Neuse / Bay Rivers, with the remainder coming from the Pamlico Sound (Figure 5). Since 2004 there has only been a spring harvest season, recently opening March 1 each year and closing when the TAL is reached, usually near the end of March. Unlike the fishery in the ASMA, this is a directed fishery for striped bass primarily using anchored gill nets.

Recreational Landings

ASMA

The recreational sector's landings in the ASMA are dominated by fish age 3-6 due in part to a statewide rule that prohibits possession of river herring over six inches while engaged in fishing activities, the migratory nature of larger, older fish, and general angling techniques in the ASMA. Very few anglers use the large size artificial lures or natural bait required to catch striped bass over 28 inches, so very few fish over nine or ten years old are observed in the creel survey.

Landings in the ASMA have been controlled by a TAL since 1991 (Table 2). Starting in 1998 the TAL was split evenly between the commercial and recreational sectors. The recreational TAL increased incrementally from 29,400 pounds in 1997 to 137,500 pounds in 2003. The recreational sector reached its TAL consistently until 2002, when landings started declining. Recreational landings peaked in 2001 at 118,506 pounds. Landings have averaged about 32,000 pounds for years 2006-2014, well below the ASMA recreational TAL at the time of 137,500 pounds (Figure 6). The harvest season increased from four days a week to seven in the fall of 2005 and the daily recreational possession limit increased from two to three fish in the fall of 2006, but landings continued to decline. Several poor year classes produced since 2001 have accounted for the decline in stock abundance and recreational harvest since 2006.

RRMA
The recreational sector's landings in the RRMA are dominated by fish age 3-6 due to a no possession rule of fish between 22 and 27 inches TL in the RRMA, a statewide rule that prohibits possession of river herring over six inches while engaged in fishing activities, and general angling techniques in the RRMA. Very few anglers use the large size artificial lures or natural bait required to catch striped bass over 28 inches, so very few fish over nine or ten years old are observed in the creel survey.

The recreational TAL in the ASMA and RRMA has been split evenly since 1990. Landings in the RRMA followed the TAL closely through 2002. From 2003 through 2013 landings averaged 64,749 pounds, with a few noticeable low years (2003, 2008, and 2013) (Figure 7). The total number of fish caught per angler during the spring fishery in the RRMA can be large; catches of 100 fish per day are not uncommon. But angler catch rate can be impacted by spring water flows. The hydropower company operating the dams on the Roanoke River, along with the U.S. Army Corps of Engineers and biologists with the USFWS and NCWRC, coordinate releases to best mimic natural flow conditions during the spring spawn. However, droughts or heavy rainfall may still result in very low, i.e. 2,000-3,000 cubic feet per second (cfs) or very high, (20,000 cfs) flood stage flow conditions in some years. During these low or high flow years, angler success can be greatly diminished.

CSMA
Recreational landings since 2005 have ranged from a low in 2008 and 2009 averaging 3,026 pounds to a high of 20,003 pounds in 2013 (Table 3). Over the ten year time period both the number of trips and more recently the hours spent targeting striped bass within the CSMA have increased. Since 2011 harvest in the Tar/Pamlico and Neuse has been similar, ranging from about 4,000 pounds to 9,000 pounds, and has been two to three times greater than harvest in the Pungo River (Figure 8). Harvest on the Pungo River has remained consistent at a relatively low level compared to fluctuations experienced by Tar / Pamlico and Neuse Rivers. Legal sized striped bass discards have increased over the past five years, as well as fish released that are within the slot limit (Table 3). There is also a significant catch-and-release fishery during the summer in the middle reaches of the Tar/Pamlico and Neuse rivers.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

A/R Stock
The length, weight, sex, and age of the commercial harvest of striped bass has been consistently monitored through sampling at fish houses conducted by the division since 1982. For the last several decades anchored gill nets have accounted for >90% of the harvest in the ASMA. Pound nets account for most of the remaining landings with minor catches coming from fyke nets, hoop nets, and pots. The majority of annual landings were from age four to six year old fish (Table 4). The majority of harvest was between 21 and 26 inches TL (Table 5). The total number of fish sampled from the commercial fishery is presented in Table 6.

The recreational harvest of striped bass in the ASMA and RRMA has been consistently monitored by the NCDMF since 1990 and the NCWRC since 1988 respectively. Age length keys generated by staff are applied to the total annual recreational harvest to create recreational catch at age matrices used in stock assessments (Tables 7 and 8). The majority of harvest is

usually between 18 and 22 inches TL (Tables 9 and 10). The numbers of fish sampled from the ASMA and RRMA recreational fisheries are presented in Tables 11 and 12.

CSMA Stocks

Monitoring of the commercial fishery in the CSMA follows the same methodology as in the ASMA. The NCDMF started collecting recreational striped bass data in the major rivers of the CSMA in 2005. There has been a harvest moratorium in the Cape Fear River since 2008. Length data from the commercial harvest in the Pamlico Sound and tributaries shows that striped bass in the Neuse / Bay Rivers are slightly larger than fish harvested in the Pamlico / Pungo Rivers (Table 13).

Fishery-Independent Monitoring

A/R Stock

A young-of-year (age-0) A/R striped bass juvenile abundance index (JAI) was initiated by Dr. William Hassler of North Carolina State University in 1955. The NCDMF took over the survey in 1985 in preparation of Dr. Hassler's retirement so the long term dataset could continue. Sampling occurs at seven fixed stations in the western Albemarle Sound from July through mid-October. Sampling gear is an 18-foot semi-balloon trawl towed for 15 minutes. Catch per unit of effort is the number of striped bass captured per tow. The JAI provided by the survey is usually a reliable indicator of relative abundance and future harvest potential. Data from the survey reveal the highly variable interannual spawning success of striped bass. Years of great spawning success can be immediately followed by years of spawning failure. The long time series of data also clearly shows the extended period of spawning failure that occurred when the stock was at historical levels of low abundance during the 1980s. Starting in 1993 the stock began producing successful spawns once again, due to severe management restrictions, improved water quality, agreements about a water flow regime on the Roanoke River during the spawning season, and favorable environmental conditions during the spawning season. Within an eight year period spanning 1993-2000, the stock produced the four highest JAI values in the entire 46 year time series. The average JAI during 1993-2000 was 24.04, over three times higher than the average of the JAI prior to the stock crashing (1955-1977 JAI = 7.9; Figure 9). Based on this level of recruitment, the stock was declared recovered by the ASMFC in 1997. However from 2001 to 2013 spawning success has been below average for most years, with only two well above average spawns and several years, some back to back, considered spawning failures. This cycle since 1993 led to overall stock abundance increasing steadily through the mid-2000s followed by a period of stock decline from those all-time highs. The data generated from the survey is used in the A/R stock assessment as an independent measure of stock abundance (Table 14). The index is also used as a trigger. If the JAI is below 75% of all other values for three consecutive years, the ASMFC Striped Bass Technical Committee will make a recommendation to the ASMFC Striped Bass Management Board.

A fall/winter fishery independent gill net survey has been conducted by the NCDMF throughout the Albemarle and Croatan sounds since the fall of 1990. The survey utilizes a stratified random sampling design, employing mesh sizes from 2 ½ inch to 10 inch stretch mesh to characterize the resident and overwintering portion of the A/R stock. The survey is conducted from November through February. Catch per unit of effort is measured as the abundance of fish per 40 yard net soaked for 24 hours.

A spring survey employs the same methodology but is conducted in the western Albemarle Sound only, in the vicinity of the mouth of the Roanoke River. The goal of the survey is to characterize the spawning portion of the A/R stock. The survey is conducted from March

through May. Data from surveys are used in the A/R stock assessment as an independent measure of stock abundance (Tables 15 and 16).

The independent gill net surveys do a good job of tracking relative abundance, but the trend in total abundance is often masked by the highly variable and often very large number of two and three year old fish captured in the survey, so trends in total abundance are less informative than trends in 4-6 year old abundance. The trend in 4-6 year olds show the stock increasing in abundance through the early 2000s, then declining to levels similar to the late 1990s (Figure 10). The main weakness of the gill net surveys is they collect very few older fish, and under-represent the expansion of fish in the 9+ age group that has occurred since 2002. They also don't capture the decline in abundance of age 9+ fish that has occurred since the period of poor spawning success starting in 2001.

An electrofishing spawning ground survey has been conducted by the NCWRC since the spring of 1990. The survey goals are the same as the gill net survey but takes place on the Roanoke River in the vicinity of Weldon, the location of the fall line and historical center of spawning activity for A/R striped bass. The survey uses a stratified random sampling design. Catch per unit of effort is measured as the number of fish captured per hour of electrofishing. The survey is used in the A/R stock assessment as an independent measure of stock abundance.

The trend in total abundance from the electrofishing survey is similar to the trends of age 4-6 fish in the gill net surveys, increasing from low levels of abundance in the early 1990s to a peak in the early 2000s, then decreasing since (Figure 11). Both surveys exhibit a few years with high interannual variability, but this is common with fisheries surveys in which environmental conditions affect relative abundance in the survey area and the catch efficiency of the gear. The electrofishing survey does a better job at tracking the abundance of the age 9+ group, and clearly shows the emergence of the 1993 cohort into this age group in 2002 (Figure 12). The strong year classes produced from 1993-2000 supported the increased abundance of fish in the 9+ age group, but since the below average spawning and several years of spawning failure since 2001, the 9+ age group is also declining. The oldest fish seen recently in the population is 17 years old, indicating that fishing mortality has decreased significantly since the implementation of minimum size limits and a TAL. When the survey started in 1990 fish older than seven were rarely observed in the survey.

Taken together, all the independent surveys track A/R stock dynamics well, and indicate the stock is healthy and female spawning stock biomass is adequate to produce large year classes; the most recent occurred in 2011. The major factors currently contributing to annual spawning success, and hence stock abundance, are water quality and environmental conditions; the most important of these being river flow during the spring spawning season and for the following 3-5 weeks afterwards, as eggs and larval fish are transported the 137 river miles down the Roanoke River to their nursery areas in the western Albemarle Sound and lower Chowan River.

CSMA Stocks

A fishery independent gill net survey in the Central and Southern portion of the state was initiated by the NCDMF in May of 2001. Data from the Fishery-Independent Gill Net Survey (Program 915) on the Pamlico, Pungo, and Neuse Rivers demonstrated that the majority of all striped bass were captured in the upper and middle portions of the rivers. Annual striped bass CPUE ranged from 0.9 to 2.15 fish per sample during the reporting period (Table 17).

MANAGEMENT STRATEGY

A/R Stock

Estuarine striped bass in North Carolina are managed under Amendment 1 to the North Carolina Estuarine Striped Bass FMP and subsequent revisions. Striped bass fisheries in the Atlantic Ocean of North Carolina are managed under ASMFC's Amendment 6 to the Interstate FMP for Atlantic Striped Bass and subsequent addenda. The A/R stock is managed using biological reference points for spawning stock biomass and fishing mortality that are aimed at maintaining a sustainable harvest and adequate spawning stock biomass. Stock status is determined through a formal, peer reviewed stock assessment process that evaluates annual estimates of fishing mortality and biomass against their target and threshold values. An annual harvest quota for the A/R stock is calculated to keep these metrics below their targets.

CSMA Stocks

The need for continued conservation management efforts at this time are supported by the constrained size and age distributions, low abundance, and the absence of older fish in all stocks. Since the 2004 FMP there has been little change in the size and age distribution with few age 6 and older fish observed in any system. Management strategies in place to constrain harvest in an effort to allow for rebuilding of the stocks include a total harvest moratorium in the Cape Fear River, an annual commercial TAL of 25,000 pounds, and daily creel limits, a closed summertime harvest season, and a protective slot limit for the recreational fisheries. Annual stockings in all CSMA systems are designed to augment the populations during this period of low abundance until which time successful natural reproduction in these stocks occurs.

MANAGEMENT AND RESEARCH NEEDS

Several management issues were identified and explored in Amendment 1. Table 18 outlines the specific issue and implementation status. Several management and research needs were also identified. Table 19 outlines the progress on recommendations identified in Amendment 1 to the North Carolina Estuarine Striped Bass FMP.

FISHERY MANAGEMENT PLAN RECOMMENDATION

Updates to the ASMFC Atlantic striped bass stock assessment and the North Carolina A/R striped bass stock assessment are planned starting August 2015, with the next benchmark assessments scheduled for 2018. This coincides with the current NCMFC schedule for the North Carolina Estuarine Striped Bass FMP review. Should the TAL need to be adjusted in between FMP reviews based on an update to the stock assessment, a revision can serve as the mechanism to accomplish the change.

It is recommended that the review schedule for the North Carolina Estuarine Striped Bass FMP be maintained.

LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 2003. Amendment # 6 to the Interstate Fishery Management Plan for Atlantic Striped Bass. ASMFC, Washington, DC. Fisheries Management Report No. 41.

Laney, R. W., J. C. Benton, L. T. Henry, H. Johnson, J. W. Kornegay, K. L. Nelson, S. D. Taylor, and S. E. Winslow. 1993. North Carolina Estuarine Striped Bass Fishery Management Plan. North Carolina Division of Marine Fisheries and North Carolina Wildlife Resources Commission in cooperation with the U.S. Fish and Wildlife Service under Cooperative Agreement number 14-0004-87-904.

Mroch, R. and C. H. Godwin. 2014. Stock Status of Albemarle Sound-Roanoke River Striped Bass. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 236 pp.

NCDMF. 2004. North Carolina Estuarine Striped Bass Fishery Management Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 375 pp.

NCDMF. 2010. Application for an Individual Incidental Take Permit under the Endangered Species Act of 1973. North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries. 52 p.

NCDMF 2010. Catch Curve Exploitation Estimates for Neuse River and Tar/Pamlico River Striped Bass Stocks. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 79 pp.

NCDMF. 2013. Amendment 1 to the North Carolina Estuarine Striped Bass Fishery Management Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 826 pp.

NCDMF. 2014. November 2014 Revision to Amendment 1 to the North Carolina Estuarine Striped Bass Fishery Management Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 15 pp.

U.S. Fish and Wildlife Service. 1992. Report to Congress for the North Carolina Striped Bass Study Albemarle Sound Roanoke River Basin.

TABLES

Table 1. Albemarle/Roanoke striped bass spawning stock biomass and fishing mortality targets and thresholds. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

Reference Point	Fishing Mortality (F)	Spawning Stock Biomass (SSB pounds)	Total Allowable Landings pounds (TAL)
Target	0.33	969,496 lb	305,762 lb
Threshold	0.41	785,150 lb	325,905 lb
Estimate from 2014 A/R stock assessment	0.34	835,462 lb	N/A

Table 2. Striped bass commercial and recreational harvest and discards in pounds from the ASMA/RRMA, NC.

Year	Harvest (lb.)				Total Harvest	TAL	Discard (lb.)					Combined Harvest and Discards
	ASMA Comm.	ASMA Rec.	RRMA Comm.	RRMA Rec.			ASMA Comm.	ASMA Rec.	RRMA Comm.	RRMA Rec.	Total Discards	
1982	228,004	24,098	17,369	23,693	293,164		No estimates for shaded years					293,164
1983	228,742	27,320	8,861	26,861	291,784							291,784
1984	475,641	17,181	1,703	16,892	511,417							511,417
1985	269,671	6,603	6,200	6,492	288,966							288,966
1986	172,683	18,755	50	18,440	209,928							209,928
1987	228,861	37,621	0[#]	36,989	303,471							303,471
1988	108,791	52,434	0	74,639	235,864							235,864
1989	97,061	26,857	0	32,107	156,025							156,025
1990	103,757	36,976	0	42,204	182,937							182,937
1991	108,460	30,021	0	72,529	211,010	156,800				17,048	17,048	228,058
1992	100,544	51,167	0	36,016	187,727	156,800				4,370	4,370	192,097
1993	109,475	54,835	0	45,146	209,456	156,800				11,546	11,546	221,002
1994	102,201	39,704	0	28,084	169,989	156,800	151,810			12,613	164,423	334,412
1995	89,502	30,564	0	28,884	148,950	156,800	348,255			14,539	362,794	511,744
1996	89,624	29,185	0	28,173	146,982	156,800	200,429			36,634	237,063	384,045
1997	95,671	26,724	0	28,929	151,324	156,800	120,840			55,863	176,703	328,027
1998	122,454	64,885	0	73,527	260,866	250,860	135,855			21,149	157,004	417,870
1999	155,176	60,897	0	72,966	289,039	275,946	139,043			31,513	170,556	459,595
2000	218,888	116,163	0	119,584	454,635	450,000	137,996	11,951		33,810	183,757	638,392
2001	220,227	118,533	0	112,825	451,585	450,000	92,047	10,540		29,284	131,871	583,456
2002	222,834	92,649	0	112,698	428,181	450,000	128,664	7,710		10,897	147,271	575,452
2003	266,555	51,794	0	39,170	357,519	550,000	162,115	5,278		8,598	175,991	533,510
2004	273,666	98,403	0	120,697	492,766	550,000	89,832	9,244		62,523	161,599	654,365
2005	232,645	63,477	0	107,530	403,652	550,000	45,393	3,360		34,313	83,066	486,718
2006	156,314	35,985	0	84,523	276,822	550,000	54,529	1,453		13,799	69,781	346,603
2007	173,509	26,633	0	64,986	265,128	550,000	43,475	1,914		11,330	56,719	321,847
2008	74,926	31,628	0	32,725	139,279	550,000	108,176	4,969		37,624	150,769	290,048
2009	96,134	37,313	0	69,581	203,028	550,000	32,494	5,452		29,523	67,469	270,497
2010	199,829	11,460	0	72,037	283,326	550,000	44,838	3,318		25,263	73,419	356,745
2011	134,538	42,536	0	71,561	248,635	550,000	52,741	2,870		29,409	85,020	333,655
2012	115,605	71,456	0	88,271	275,332	550,000	34,253	3,995		10,251	48,499	323,831
2013	68,338	14,897	0	25,197	108,432	550,000						
2014	71,372	16,867	0	33,717	121,956	550,000						

Table 3. Recreational striped bass effort, harvest, and discards in the CSMA, NC.

	All Effort		Striped bass Effort		Striped bass Harvest		Striped bass Discards (numbers)				
Year	Trips	Hours	Trips	Hours	Number	Pounds	Over Creel	Under size	Legal size	In slot	Total
2005	64,018	302,159	13,205	44,313	3,833	14,966	152	15,611	1,000	78	16,841
2006	62,663	259,344	10,609	30,889	2,483	7,356	33	12,549	2,314	0	14,896
2007	65,764	296,031	10,974	37,088	3,600	10,795	147	21,673	1,707	0	23,527
2008	52,887	246,585	6,621	21,296	842	2,990	2,838	11,719	3,316	91	17,964
2009	45,907	201,319	5,642	20,695	896	3,062	7	4,472	1,768	719	6,966
2010	37,518	152,662	6,558	16,060	1,758	5,536	28	5,201	2,402	361	7,992
2011	45,246	160,610	12,608	33,353	2,727	9,475	9	16,661	5,397	2,128	24,195
2012	110,527	369,171	18,340	71,899	3,871	15,198	351	26,250	13,614	2,986	43,201
2013	113,830	408,696	20,053	85,674	5,425	20,003	438	19,304	10,361	2,305	32,408
2014	87,146	349,604	15,573	69,211	3,301	13,371	734	18,911	7,110	1,651	28,405

Table 4. Striped bass commercial landings at age in thousands of fish from the ASMA, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Age									
Year	1	2	3	4	5	6	7	8	9+	Sum N fish
1982	0.000	31.449	22.724	6.186	3.190	1.172	0.195	0.000	0.195	65.111
1983	0.000	23.841	27.694	11.921	4.070	2.253	1.672	0.800	0.436	72.687
1984	0.000	101.035	5.889	23.244	18.285	2.789	2.324	0.000	1.395	154.961
1985	11.562	80.428	30.113	2.287	1.271	0.762	0.508	0.127	0.000	127.058
1986	0.000	48.219	7.860	4.554	0.000	0.437	0.437	0.000	0.873	62.380
1987	0.000	31.392	13.525	12.160	4.157	0.248	0.000	0.434	0.124	62.040
1988	0.000	17.717	9.843	4.640	1.687	0.703	0.176	0.281	0.105	35.152
1989	0.000	13.577	9.073	7.947	1.383	0.129	0.064	0.000	0.000	32.173
1990	0.000	33.369	3.359	5.241	1.389	0.493	0.269	0.269	0.403	44.792
1991	0.000	6.820	19.875	4.157	0.877	0.292	0.292	0.000	0.162	32.475
1992	0.000	0.000	8.163	18.226	0.187	0.062	0.062	0.064	0.000	26.764
1993	0.000	0.000	1.076	15.794	10.965	0.756	0.262	0.116	0.116	29.085
1994	0.000	0.000	0.130	3.095	7.035	11.018	0.281	0.000	0.087	21.646
1995	0.000	0.000	0.240	4.829	11.161	3.647	0.160	0.000	0.000	20.037
1996	0.000	0.000	1.735	1.925	6.311	7.321	1.294	0.316	0.190	19.092
1997	0.000	0.000	0.997	3.846	3.647	9.107	3.462	0.274	0.040	21.373
1998	0.000	0.000	1.599	7.233	9.701	6.549	3.253	0.045	0.134	28.514
1999	0.000	0.000	0.000	3.344	20.972	9.513	1.134	0.230	0.430	35.623
2000	0.000	0.000	0.000	6.380	23.169	14.119	2.158	0.516	0.564	46.906
2001	0.000	0.000	2.818	16.908	25.018	3.361	0.445	0.643	0.246	49.439
2002	0.000	0.000	1.165	10.785	18.074	4.411	1.178	1.119	3.236	39.968
2003	0.000	0.000	4.779	15.036	15.270	5.584	1.505	0.515	2.141	44.830
2004	0.000	0.000	3.100	16.840	10.756	2.366	1.001	1.457	6.557	42.077
2005	0.000	0.000	0.707	9.151	19.515	7.864	1.854	0.764	3.244	43.099
2006	0.000	0.000	0.407	7.241	16.263	5.661	0.558	0.379	3.109	33.618
2007	0.000	0.000	0.168	3.953	13.225	5.473	1.217	0.583	2.958	27.577
2008	0.000	0.000	0.473	5.931	6.377	2.195	2.620	0.292	0.483	18.371
2009	0.000	0.000	1.264	11.497	6.713	2.665	0.906	0.354	0.602	24.001
2010	0.000	0.000	5.543	22.129	18.757	4.230	1.260	0.399	0.708	53.026
2011	0.000	0.000	1.698	12.237	12.170	2.645	1.128	0.447	0.373	30.698
2012	0.000	0.000	0.090	5.916	5.647	6.857	5.423	1.031	0.313	25.277

Table 5. Striped bass length data from commercial landings from the ASMA, NC.

Year	Mean Fork Length	Minimum Total Length	Maximum Total Length	Total Number Measured
2005	23	17	43	517
2006	23	18	44	938
2007	24	17	48	623
2008	22	18	47	553
2009	21	18	42	813
2010	21	17	48	940
2011	21	18	39	1,004
2012	22	18	39	643
2013	22	18	45	563
2014	23	18	43	483

Table 6. Striped bass sample counts for length, weight, sex, and age from commercial landings, ASMA, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Samples Collected			
Year	Length	Weight	Sexed	Aged
1982	1,089	1,089	1,089	612
1983	1,013	1,010	1,013	728
1984	919	919	919	679
1985	552	552	550	547
1986	422	422	422	375
1987	690	690	690	581
1988	566	566	564	421
1989	525	508	525	378
1990	520	520	520	398
1991	560	559	560	430
1992	335	335	334	141
1993	437	436	437	187
1994	455	454	454	353
1995	282	282	281	146
1996	603	602	605	297
1997	1,090	1,090	1,089	600
1998	633	633	633	440
1999	405	405	405	386
2000	835	832	834	562
2001	912	912	893	354
2002	920	920	917	505
2003	723	722	723	333
2004	455	454	451	386
2005	719	718	719	314
2006	926	926	924	437
2007	860	856	860	425
2008	547	545	545	391
2009	813	812	813	419
2010	940	940	939	563
2011	977	976	977	579
2012	649	642	649	451

Table 7. Striped bass recreational landings at age in thousands of fish from the ASMA, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Age									
Year	1	2	3	4	5	6	7	8	9+	Sum N fish
1982	0.000	3.598	2.600	0.708	0.365	0.134	0.022	0.000	0.022	7.449
1983	0.000	2.327	2.703	1.164	0.397	0.220	0.163	0.078	0.043	7.095
1984	0.000	3.662	0.213	0.843	0.663	0.101	0.084	0.000	0.051	5.617
1985	0.290	2.016	0.755	0.057	0.032	0.019	0.013	0.003	0.000	3.185
1986	0.000	5.239	0.854	0.495	0.000	0.047	0.047	0.000	0.095	6.777
1987	0.000	5.160	2.223	1.999	0.683	0.041	0.000	0.071	0.020	10.197
1988	0.000	1.711	2.762	4.185	3.473	2.152	1.677	0.610	0.373	16.943
1989	0.000	2.128	2.876	1.976	1.353	0.338	0.098	0.062	0.071	8.902
1990	0.000	9.896	3.703	1.245	0.683	0.208	0.176	0.032	0.016	15.959
1991	0.000	2.501	6.397	0.065	0.026	0.000	0.000	0.000	0.000	8.989
1992	0.000	0.092	9.912	3.342	0.137	0.092	0.023	0.023	0.000	13.621
1993	0.000	0.145	2.133	10.990	1.193	0.108	0.000	0.000	0.000	14.569
1994	0.000	0.017	0.749	2.485	5.090	0.085	0.000	0.000	0.000	8.426
1995	0.000	0.000	0.554	2.137	3.680	0.919	0.053	0.000	0.000	7.343
1996	0.000	0.000	0.561	2.163	3.725	0.930	0.054	0.000	0.000	7.433
1997	0.000	0.106	3.100	0.784	1.125	0.353	0.009	0.000	0.000	5.477
1998	0.000	0.000	0.092	11.431	6.114	1.316	0.627	0.024	0.000	19.604
1999	0.000	0.000	0.428	6.903	7.059	2.103	0.344	0.026	0.015	16.878
2000	0.000	0.000	0.003	19.792	14.359	3.311	0.439	0.097	0.038	38.039
2001	0.000	0.000	12.033	20.777	6.819	0.411	0.020	0.019	0.000	40.079
2002	0.000	0.000	4.564	13.910	8.491	0.695	0.171	0.059	0.008	27.898
2003	0.000	0.000	4.173	7.704	3.371	0.431	0.112	0.044	0.047	15.882
2004	0.000	0.000	0.252	11.258	12.630	3.248	0.420	0.168	0.028	28.004
2005	0.000	0.072	2.206	7.875	6.729	0.893	0.021	0.087	0.074	17.957
2006	0.000	0.048	0.903	3.414	5.135	1.094	0.019	0.060	0.037	10.710
2007	0.000	0.000	0.532	2.797	2.823	0.807	0.093	0.023	0.068	7.143
2008	0.000	0.000	3.858	2.943	2.140	0.936	0.076	0.055	0.039	10.047
2009	0.000	0.000	3.640	6.315	1.372	0.449	0.175	0.087	0.030	12.068
2010	0.000	0.000	0.444	1.131	1.330	0.458	0.132	0.008	0.000	3.503
2011	0.000	0.000	5.928	3.939	1.764	0.995	0.356	0.112	0.246	13.340
2012	0.000	0.000	1.955	10.997	4.413	3.442	1.227	0.197	0.113	22.344

Table 8. Striped bass recreational landings at age in thousands of fish from the RRMA, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Age									
Year	1	2	3	4	5	6	7	8	9+	Sum N fish
1982	0.000	2.307	1.670	1.311	0.798	0.850	0.220	0.139	0.029	7.324
1983	0.000	0.335	1.995	1.535	1.451	0.746	0.579	0.209	0.126	6.976
1984	0.000	2.789	0.237	0.950	0.828	0.359	0.122	0.177	0.061	5.523
1985	0.000	1.663	1.030	0.110	0.263	0.000	0.066	0.000	0.000	3.132
1986	0.000	3.072	2.052	1.539	0.000	0.000	0.000	0.000	0.000	6.663
1987	0.000	5.224	2.467	1.634	0.541	0.040	0.080	0.040	0.000	10.026
1988	0.000	1.680	2.721	4.109	8.146	0.000	0.000	0.000	0.000	16.656
1989	0.000	2.088	2.834	1.948	1.893	0.000	0.000	0.000	0.000	8.763
1990	0.000	9.714	3.643	1.245	1.093	0.000	0.000	0.000	0.000	15.695
1991	0.000	2.310	23.387	0.730	0.507	0.000	0.000	0.000	0.000	26.934
1992	0.000	0.168	10.458	2.731	0.034	0.000	0.000	0.000	0.000	13.391
1993	0.000	0.000	3.896	9.669	0.759	0.000	0.000	0.000	0.000	14.324
1994	0.000	0.000	1.549	4.134	2.469	0.132	0.000	0.000	0.000	8.284
1995	0.000	0.000	0.514	1.233	3.460	2.210	0.034	0.000	0.007	7.458
1996	0.000	0.000	1.899	2.736	2.201	1.364	0.167	0.000	0.000	8.367
1997	0.000	0.031	3.794	3.285	1.275	0.694	0.225	0.051	0.010	9.365
1998	0.000	0.024	3.190	13.344	4.724	1.339	0.244	0.146	0.097	23.108
1999	0.000	0.066	5.016	10.916	4.897	1.426	0.066	0.079	0.013	22.479
2000	0.000	0.103	13.334	18.653	4.265	1.515	0.128	0.128	0.077	38.203
2001	0.000	0.000	9.815	15.133	7.273	2.190	0.195	0.195	0.430	35.231
2002	0.000	0.019	3.347	18.107	11.094	3.253	0.282	0.112	0.208	36.422
2003	0.000	0.000	0.979	5.839	3.018	0.489	0.049	0.163	0.602	11.139
2004	0.000	0.000	7.607	9.595	5.619	3.128	0.106	0.080	0.374	26.509
2005	0.000	0.000	8.861	15.125	6.824	2.139	0.178	0.280	0.660	34.067
2006	0.000	0.000	2.682	16.304	4.788	1.245	0.072	0.024	0.219	25.334
2007	0.000	0.000	1.007	6.644	10.456	1.062	0.082	0.054	0.000	19.305
2008	0.000	0.158	4.741	3.856	1.138	0.569	0.048	0.000	0.032	10.542
2009	0.000	0.022	9.085	10.444	3.051	0.601	0.000	0.000	0.045	23.248
2010	0.000	0.000	6.029	11.634	4.145	0.542	0.000	0.048	0.047	22.445
2011	0.000	0.000	8.756	6.869	2.702	3.483	0.196	0.000	0.098	22.104
2012	0.000	0.000	5.482	19.189	3.374	0.337	0.421	0.042	0.000	28.845

Table 9. Striped bass length data from recreational landings from the ASMA, NC.

Year	Mean Fork Length	Minimum Total Length	Maximum Total Length	Total Number Measured
2005	20	18	29	1,631
2006	21	18	32	773
2007	21	15	39	415
2008	20	18	30	632
2009	20	18	42	549
2010	20	17	28	337
2011	20	18	34	979
2012	20	18	36	1,059
2013	20	18	32	527
2014	19	18	28	803

Table 10. Striped bass length data from recreational landings from the RRMA, NC.

Year	Mean Fork Length	Minimum Total Length	Maximum Total Length	Total Number Measured
2005	20	17	40	981
2006	20	17	39	1,058
2007	20	18	39	709
2008	19	17	35	667
2009	19	17	32	1,049
2010	20	18	28	954
2011	20	18	31	679
2012	20	17	28	688
2013	20	17	27	512
2014	19	17	30	559

Table 11. Striped bass sample counts for length, weight, sex, and age from recreational landings, ASMA, NC. ALK=age length key used. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Samples Collected			
Year	Length	Weight	Sexed	Aged
1994	1,179	1,179	0	ALK
1995	954	954	0	ALK
1996	1,062	1,062	0	ALK
1997	1,088	1,088	0	ALK
1998	3,276	3,276	0	ALK
1999	2,417	2,417	0	ALK
2000	3,153	3,153	0	ALK
2001	4,346	4,346	0	ALK
2002	3,173	3,173	0	ALK
2003	1,178	1,178	0	ALK
2004	2,854	2,854	0	ALK
2005	1,656	1,656	0	ALK
2006	769	769	0	ALK
2007	430	430	0	ALK
2008	633	633	0	ALK
2009	549	549	0	ALK
2010	269	269	0	ALK
2011	978	978	0	ALK
2012	1,059	1,059	0	ALK

Table 12. Striped bass sample counts for length, weight, sex, and age from recreational landings, RRMA, NC. ALK=age length key used. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Samples Collected			
Year	Length	Weight	Sexed	Aged
2005	359	353	357	ALK
2006	1,059	1,059	1,058	ALK
2007	709	709	709	ALK
2008	667	667	667	ALK
2009	1,049	1,049	1,049	ALK
2010	954	954	954	ALK
2011	679	679	679	ALK
2012	688	688	688	ALK
2013	512	512	512	ALK
2014	559	559	559	ALK

Table 13. Striped bass sample counts for length, weight, sex, and age from commercial landings, CSMA, NC. ALK=age length key used.

	Pamlico / Pungo R.				**Neuse / Bay R.**			
	Length (mm)				Length (mm)			
Year	Mean	Min	Max	N	Mean	Min	Max	N
2000	550.0	470	828	126	598.0	530	747	5
2001	556.8	498	614	116	589.3	546	750	12
2002	579.7	455	942	92	593.4	456	682	31
2003	541.9	420	889	163	579.1	454	890	19
2004	575.0	468	999	131	604.7	462	895	69
2005	551.0	465	888	127	582.3	480	870	70
2006	516.6	420	873	119	574.1	457	871	101
2007	527.9	462	778	112	527.8	449	632	56
2008	537.6	428	1020	54	553.4	440	1060	39
2009	519.1	440	741	99	538.7	449	737	70
2010	534.9	447	619	194	545.6	445	772	263
2011	545.7	428	647	281	555.1	456	1006	195
2012	576.8	363	712	234	583.2	443	702	96
2013	586.2	435	965	212	582.3	434	894	155
2014	508.2	431	587	24	557.3	482	716	26

Table 14. Striped bass GLM-standardized index of relative abundance and coefficient of variation (CV) from the Albemarle/Roanoke juvenile abundance survey, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

Year	GLM Index	CV[Index]
1982	3.01	0.354
1983	1.39	0.367
1984	0.36	0.270
1985	0.95	0.449
1986	0.10	0.328
1987	0.27	0.243
1988	4.81	0.226
1989	6.09	0.250
1990	1.32	0.271
1991	0.72	0.255
1992	2.22	0.220
1993	42.4	0.218
1994	56.0	0.224
1995	14.2	0.219
1996	31.1	0.232
1997	4.82	0.263
1998	5.60	0.283
1999	0.94	0.222
2000	56.2	0.245
2001	3.50	0.228
2002	6.32	0.381
2003	0.25	0.262
2004	1.75	0.221
2005	24.1	0.234
2006	2.87	0.224
2007	5.50	0.238
2008	5.52	0.314
2009	0.36	0.223
2010	6.88	0.220
2011	15.1	0.240
2012	5.11	1.23

Table 15. Striped bass catch proportion at age and GLM-standardized index of relative abundance and coefficient of variation (CV) from the fall/winter component of the Albemarle Sound IGNS (Program 135), NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Age										
Year	1	2	3	4	5	6	7	8	9+	GLM Index	CV[Index]
1991	0	0.76	0.22	0.022	0.0000	0	0	0	0	0.655	0.129
1992	0	0.17	0.74	0.083	0.0000	0	0	0	0	0.534	0.132
1993	0	0.12	0.13	0.70	0.026	0.0050	0	0.0011	0	0.769	0.128
1994	0	0.094	0.064	0.28	0.55	0.0057	0	0.0010	0	0.892	0.132
1995	0	0.51	0.10	0.11	0.24	0.036	0.00062	0	0.00062	0.289	0.144
1996	0	0.17	0.42	0.080	0.16	0.16	0.011	0	0	1.99	0.122
1997	0	0.20	0.36	0.23	0.127	0.064	0.016	0.0015	0.00023	0.612	0.131
1998	0	0.12	0.41	0.37	0.07	0.021	0.010	0.0016	0	1.38	0.122
1999	0	0.058	0.16	0.47	0.24	0.066	0.0034	0.00084	0.00045	0.641	0.129
2000	0	0.11	0.12	0.40	0.31	0.057	0.0040	0.00089	0.00089	0.626	0.128
2001	0	0.013	0.15	0.40	0.39	0.034	0.0047	0.0012	0.0012	0.993	0.157
2002	0	0.50	0.043	0.30	0.15	0.0038	0.00044	0	0	0.816	0.125
2003	0	0.038	0.48	0.25	0.19	0.042	0.0023	0	0	1.43	0.211
2004	0	0.097	0.22	0.54	0.12	0.017	0.00077	0.0020	0.0032	0.817	0.125
2005	0	0.072	0.14	0.40	0.33	0.053	0.0026	0.0027	0.00090	0.793	0.128
2006	0	0.39	0.063	0.14	0.25	0.13	0.019	0.0018	0.0045	0.373	0.141
2007	0	0.18	0.33	0.063	0.24	0.17	0.018	0	0	1.49	0.122
2008	0	0.16	0.67	0.13	0.019	0.013	0.0071	0.0015	0.00057	1.19	0.131
2009	0	0.16	0.24	0.55	0.039	0.0055	0.0019	0.00093	0	0.897	0.127
2010	0	0.61	0.14	0.083	0.148	0.012	0.0040	0.00088	0	0.406	0.135
2011	0	0.094	0.56	0.14	0.077	0.092	0.029	0.0062	0.0021	0.311	0.142
2012	0	0.36	0.16	0.31	0.099	0.021	0.048	0.0018	0		

Table 16. Striped bass catch proportion at age and GLM-standardized index of relative abundance and coefficient of variation (CV) from the spring component of the Albemarle Sound IGNS (Program 135), NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

	Age										
Year	1	2	3	4	5	6	7	8	9+	GLM Index	CV[Index]
1991	0.010	0.77	0.22	0.0023	0.0028	0.0010	0	0	0	1.47	0.104
1992	0	0.16	0.76	0.075	0.0056	0.00093	0	0.00093	0	0.845	0.0993
1993	0	0.20	0.25	0.51	0.045	0.0016	0	0.0016	0	0.292	0.118
1994	0	0.056	0.10	0.31	0.53	0.0048	0	0.0024	0	0.294	0.128
1995	0	0.61	0.05	0.11	0.18	0.054	0.0022	0.00050	0.00050	1.42	0.0970
1996	0	0.079	0.47	0.054	0.19	0.18	0.024	0.00082	0	0.993	0.0979
1997	0	0.091	0.41	0.31	0.067	0.10	0.025	0.00059	0	1.34	0.0959
1998	0	0.060	0.27	0.51	0.12	0.018	0.014	0.00051	0	1.96	0.0964
1999	0	0.031	0.13	0.44	0.33	0.068	0.0062	0.00087	0.00043	1.79	0.0937
2000	0	0.008	0.06	0.38	0.43	0.10	0.016	0.0029	0	1.67	0.0967
2001	0	0.005	0.21	0.56	0.21	0.0083	0.0028	0.0022	0.00056	2.17	0.0966
2002	0.00035	0.14	0.02	0.42	0.40	0.015	0.0012	0.0012	0.0025	1.06	0.0986
2003	0	0.030	0.39	0.32	0.20	0.035	0.0070	0.0087	0.0057	0.664	0.135
2004	0.0010	0.095	0.44	0.30	0.13	0.033	0.0045	0.0017	0.0030	1.44	0.126
2005	0.0028	0.051	0.15	0.67	0.10	0.023	0.0021	0.0069	0.0041	1.53	0.110
2006	0	0.41	0.052	0.33	0.17	0.024	0.0032	0.0026	0.0026	1.62	0.101
2007	0.0010	0.39	0.22	0.13	0.17	0.057	0.014	0.013	0.0100	0.502	0.110
2008	0.0016	0.20	0.72	0.028	0.027	0.020	0.0017	0.0012	0.0021	1.15	0.101
2009	0.0025	0.33	0.44	0.18	0.028	0.013	0.0039	0.0049	0.0042	0.463	0.148
2010	0.0030	0.76	0.13	0.049	0.048	0.0078	0.00070	0.0014	0.0032	1.46	0.121
2011	0.00058	0.30	0.48	0.11	0.054	0.034	0.017	0.0024	0.0012	1.07	0.132
2012	0	0.86	0.023	0.077	0.021	0.0073	0.0084	0.0017	0	2.48	0.149

Table 17. Annual weighted CPUE of striped bass (No. of individuals per sample), total numbers collected striped bass collected, and the number of gill net samples (N) in the Pamlico, Pungo, and Neuse River systems. The Percent Standard Error (PSE) represents a measure of precision. *Annually, 160 samples are collected from the Pamlico / Pungo Rivers, and 160 samples from the Neuse River, for a combined total of 320 samples. In 2005, only 304 stations were sampled due to high gasoline prices.

Year	CPUE	No. of Striped Bass	N*	PSE
2005	2.08	596	304	12
2006	2.09	639	320	12
2007	1.39	418	320	15
2008	1.45	442	320	16
2009	1.05	324	320	14
2010	2.07	640	320	14
2011	2.15	653	320	13
2012	0.9	271	320	14
2013	1.22	365	320	15
2014	1.61	490	320	13

Table 18. Research recommendations and progress from Amendment 1 to the North Carolina Estuarine Striped Bass FMP.

Management Strategy	Objectives	Outcome
Continued support and development of SHAs in NC.	2,4,5	Ongoing
Continued protection of SHAs by the cooperating agencies once they have been designated.	2,4,5	Ongoing
Work with WRC, DWQ, and others to implement management measures that will enhance water quality in areas used by striped bass.	2,4,5	Ongoing
Work with American Rivers and other partners to accelerate dam removal in priority areas.	2,4,5	Ongoing
Continue to protect NC coastal wetlands through the permit review process.	2,4,5	Ongoing
Quantify the density and distribution of striped bass eggs, fry, and juveniles in coastal rivers to estimate potential losses to entrainment and impingement	1,2,3,4,5	Ongoing in the Roanoke River through ECU. Still needed in the CSMA
Determine if contaminants are present in striped bass habitats and identify those that are potentially detrimental to various life history stages.	2,4,5	Ongoing through Division of Water Quality but could be expanded
Evaluate the effects of existing and future water withdrawals on water quality and quantity and fisheries habitat in coastal watersheds.	2,4,5	No Action
Identify and designate anadromous fish nursery areas and how early juvenile striped bass move and are distributed in NC estuarine waters.	1,2,3,4,5	No Action
Identify minimum flow requirements in the Tar/Pamlico, Neuse, and Cape Fear rivers necessary for successful spawning, egg development, and larval transport to nursery grounds.	2,4,5	No Action
Evaluate the impacts/effects of reverse osmosis plants on receiving waters and aquatic resources.	2,3,4,5	Short term studies conducted but there is a need for long term studies
Verify condition of identified SHAs used by striped bass.	2,4,5	No Action
Investigate abundance and spawning contribution of striped bass in the North Carolina and Virginia portions of the Blackwater, Nottoway and Meherrin rivers.	1,2,3,4,5	Some sampling is by VADGIF and a CRFL grant is being completed that evaluated the potential spawning contribution on the Chowan and Meherrin rivers.
Investigate striped bass use in the North Carolina portions of the Waccamaw River during the appropriate season.	1,2,3,4,5	No Action
Continue to investigate the potential for passage of striped bass above Roanoke Rapids Dam.	2,4,5	Ongoing
Support fish passage at Buckhorn Dam and Lock and Dam No.2 and No.3 and investigate anadromous fish utilization of the rock ladder at Lock and Dam No. 1.	2,4,5	Ongoing
Investigate the feasibility of fish passage at and	2,4,5	Ongoing

Management Strategy	Objectives	Outcome
improved water flows from Rocky Mount Mill Dam and Tar River Reservoir Dam.		
Support the removal of Milburnie Dam in Raleigh.	2,4,5	Ongoing
Support fish passage above the Yadkin chain of dams in North Carolina.	2,4,5	Ongoing
Data on the density and distribution of striped bass eggs, fry, and juveniles in coastal rivers are needed so that potential losses to entrainment and impingement can be estimated.	2,3,4,5	CSMA No Action
Identify effective engineering solutions to prevent entrainment and impingement of striped bass eggs, fry, and juveniles.	2,3,4,5	Ongoing
NCDMF and NCWRC should work with DWQ and other agencies to determine and establish more stringent water quality standards in Anadromous Fish Spawning Areas.	2,4,5	No Action
Determine system of origin of fish on the spawning grounds.	1,3,4	Ongoing through NCWRC genetics study **(High)**
Acquire life history information: maturity, fecundity, size and weight at age, egg and larval survival.	1,3,4	Ongoing through CRFL funded projects **(High)**
Conduct a mark-recapture study utilizing conventional tags and telemetry approaches.	1,2,3,4	Ongoing through CRFL funded projects **(High)**
Determine if suitable striped bass spawning conditions exist in the Tar/Pamlico, Neuse, and Cape Fear rivers	1,2,3,4,5	No Action **(Medium)**
Conduct egg abundance and egg viability studies.	1,2,3,4,5	No Action **(Medium)**
Determine contribution of stocked fish to spawning stock.	1,2,3,4,5	Ongoing through NCWRC genetics study **(Medium)**
Determine extent of spawning grounds.	1,2,3,4,5	Ongoing through CRFL funded grant **(Low)**
Improve discard estimates and discard biological characteristics from commercial fisheries.	1,3,4,5,6,7	Ongoing through statewide observer coverage **(Medium)**
Obtain biological characteristics such as length, weight, age, and sex of recreational harvest.	1,3,4,5,6,7	Ongoing through creel surveys but could be expanded **(Medium)**
Obtain biological characteristics such as length, weight, age, and sex of commercial harvest.	1,3,4,5,6,7	Ongoing but sampling could be increased **(Medium)**
Improve discard estimates and discard biological characteristics from recreational fisheries.	3,4,5,6,7	Ongoing through creel survey **(Low)**
Conduct delayed mortality studies for recreational and commercial gear.	3,4,5,6,7	Ongoing for recreational fisheries **(Low)**
Conduct independent surveys that adequately capture all life stages of striped bass.	3,4,5,6,7	No Action **(High)**
Continue tagging striped bass in order to evaluate the possible contribution to the Atlantic Migratory stock and provide data to be used in stock assessment efforts. Develop means to better assess the tag recapture and reporting rate for use in tag-based stock assessments.	1,3,4,5	Ongoing through CRFL funded projects **(High)**
Conduct a short term study to determine vulnerability-	1,3,4,5	No Action **(Low)**

Management Strategy	Objectives	Outcome
at-length for survey gears		
Apply for ITP for impacted fisheries.	3,4,5,6,7	Ongoing
Continue gear development research to minimize species interactions.	3,4,5,6,7	Ongoing
Implementation of outreach programs to inform state agencies, the public, and the commercial and recreational fishing industries about issues relating to protected species and fishery management	3,4,5,6,7	Ongoing
Methodology tested to accurately capture Atlantic Ocean striped bass harvest during summer months.	1,3,4,5	Ongoing through catch card survey but compliance is uncertain.
Increase surveys of stocked systems to determine percent contribution of wild versus stocked fish.	1,3,4,5	Ongoing through NCWRC genetics survey.
Determine if fish produced from system-specific parentage will increase stocking contribution to spawning populations.	1,3,4,5	Ongoing through NCWRC genetics survey.
Determine factors impacting survivability of stocked fish in each system.	1,3,4,5	No Action
More at-sea observations made for the gill net fishery to more accurately assess the discards from this fishery.	1,3,4,5,6,7	No Action
Explore improvements to NCDMF programs (Trip Ticket, Fish House sampling, fisherman surveys or logbooks) in order to acquire spatially and temporally accurate gill net gear parameters.	1,4,5,6,7	No Action
Investigate the impacts of delayed mortality on striped bass captured in gill nets.	1,3,4,5,7	No Action
Clarify relationships between salinity, DO, temperature and catch and release mortality rates in the ASMA and CSMA.	1,2,3,4,5,6,7	No Action
Year round creel survey in the ASMA.	3,4,5,6,7	No Action
Expand tagging programs to include high reward tagging.	1,3,4,5,6,7	Ongoing through CRFL funded grant
Conduct new analysis of relationship between JAI in Albemarle Sound and flows in Roanoke River	1,2,3,4,5	No Action

Table 19. Management action taken as a result of Amendment 1 to the North Carolina Estuarine Striped Bass FMP.

ISSUE	NCMFC/NCWRC SELECTED MANAGEMENT STRATEGY	OBJECTIVES ADDRESSED	REGUALTORY ACTION TAKEN
1. Recreational Striped Bass Harvest Closure – Oregon Inlet Area/Atlantic Ocean	Status Quo – Allow the fishery to continue with catch card survey (May – Oct).	3,4,5	No additional regulatory action required
2. Striped Bass Stocking In Coastal Rivers	Status quo and research needs – Goal of 100,000 Phase II striped bass stocked annually per CSMA system (Tar-Pamlico, Neuse, and Cape Fear) with 3,000 stocked fish tagged annually in each system.	3,4,5,6	No additional regulatory action required
3. Use Of Single Barbless Hooks During The Striped Bass Closed Season	Status quo (don't require barbless hooks) and continue to educate anglers on ethical angling practices, with the additional recommendation to include mortality statistics associated with various handling techniques when possible.	5,6,7	Increase angler education about proper angling and handling techniques to reduce discard mortality
4. Striped Bass Management Area – Albemarle Sound Management Area Southern Boundary Line Adjustment	Support the necessary rule changes to create a new boundary point.	2,3,6	Rule change: 15A NCAC 03J .0209; 03R .0112; and 03R .0201
5. Cashie River – Change In Joint and Coastal Waters Boundary Line	Support the necessary rule changes to create a new boundary point.	3,6	Rule change 15A NCAC 03Q .0202
6. Discard Mortality Of Striped Bass From Commercial Set Gill Nets Central Southern Management Area	Status Quo – continue the gill net requirement for tie downs and restricting gill net from within 50 yards of shore proclamation.	6,7	No additional regulatory action required
7. Hook and Line as Commercial Gear in Estuarine Striped Bass Fisheries	Status Quo (don't allow hook and line as commercial gear) and support the necessary rule changes for adaptive management.	3,6,7	Rule change 15A NCAC 03M .0201 and 03M .0202[1]

[1] These rule changes will not initiate hook and line harvest of striped bass, only make it possible to do so in the future should unforeseen gill net regulations due to Endangered Species Interactions make adaptive management necessary.

ISSUE	**NCMFC/NCWRC SELECTED MANAGEMENT STRATEGY**	**OBJECTIVES ADDRESSED**	**REGUALTORY ACTION TAKEN**
8. Central Southern Management Area Striped Bass Management Measures	Status Quo with the addition of instituting a pound for pound payback provision for the commercial harvest TAC. Status Quo for CSMA management measures maintain the following: **CSMA Recreational Harvest (Coastal, Joint, and Inland waters)** • Unified season Oct 1 – Apr 30 • 2 fish daily creel limit • 18 inch TL minimum size limit • Protective slot (no harvest) 22 – 27 inches TL (joint and inland waters only) • Harvest moratorium for Cape Fear River and its tributaries **CSMA Commercial Harvest (Coastal and Joint waters)** • TAC of 25,000 lbs and commercial fishery, excluding Pamlico Sound, is not a bycatch fishery • 18 inch TL minimum size limit • 10 fish or less trip limit • Spring season only, anytime between Jan 1 – Apr 30 • Gill net mesh size restrictions and yardage limits • 18 inch TL minimum size limit • Discards – maintain existing gill net tie-down and distance from shoreline (DFS) measures implemented by proclamation. • Harvest moratorium for Cape Fear River and its tributaries	1,2,3,4,5,6,7	No additional regulatory action required

ISSUE	**NCMFC/NCWRC SELECTED MANAGEMENT STRATEGY**	**OBJECTIVES ADDRESSED**	**REGUALTORY ACTION TAKEN**
9. Albemarle Sound Management Area And Roanoke River Management Area Striped Bass Management Measures	Status Quo with the current management measures in the ASMA and RRMA. Status Quo for ASMA and RRMA management measures maintain the following: **Biological Reference Points** • $F_{Target} = 0.25$ • $F_{Threshold} = 0.29$ **A/R stock has been managed with a Total Allowable Catch (TAC) since 1990** • Maintain current TAC of 550,000 lbs • The TAC will continue to be split evenly between commercial and recreational sectors • ASMA commercial TAC = 275,000 lbs • ASMA recreational TAC = 137,500 lbs • RRMA recreational TAC = 137,500 lbs **ASMA Commercial Harvest (TAC = 275,000 lbs)** • 18 inch TL minimum size limit (ASMFC compliance requirement) • Continue to operate as a bycatch fishery • Spring season, anytime between Jan 1 – Apr 30 • Fall Season, anytime between Oct 1 – Dec 31 • Daily trip limits for striped bass • Maintain gill net mesh size and yardage restrictions • Maintain seasonal and area closures • Maintain attendance requirements for small mesh nets (mid – May through late November)	1,2,3,4,5,6,7	No additional regulatory action required

ISSUE	**NCMFC/NCWRC SELECTED MANAGEMENT STRATEGY**	**OBJECTIVES ADDRESSED**	**REGUALTORY ACTION TAKEN**
9. Albemarle Sound Management Area And Roanoke River Management Area Striped Bass Management Measures (cont.)	**ASMA Recreational Harvest (TAC = 137,500 lbs)** • 18 inch TL minimum size limit • Daily creel limit (can be adjusted as necessary to keep harvest below the TAC) • Open 7 days a week all season (can be adjusted as necessary to keep harvest below the TAC) • Spring season, anytime between Jan 1 – Apr 30 • Fall season, anytime between Oct 1 – Dec 31 **RRMA Recreational Harvest (TAC = 137,500 lbs)** • 18 inch TL minimum size limit • Protective slot (no harvest): 22-27 inches TL • 2 fish daily creel, only one of which can be greater than 27 inches TL • Harvest season in entire river opens on March 1 and closes on April 30 by rule since 2008 • Single barbless hook regulation from April 1 – June 30 in Inland waters above the US 258 Bridge **Management of TACs for ASMA and RRMA** • Short-term Overages: if the harvest point estimate exceeds the total TAC by 10% in a single year, overage is deducted from the next year and restrictive measures implemented in the responsible fishery (ies) • Long-term Overages: five-year running average of harvest point estimate exceeds the five-year running average of the total TAC harvest by 2%, the responsible fishery exceeding the harvest limit will be reduced by the amount of the overage for the next five years. Should the target F be exceeded, then restrictive measures will be imposed to reduce F to the target level	1,2,3,4,5,6,7	No additional regulatory action required

ISSUE	**NCMFC/NCWRC SELECTED MANAGEMENT STRATEGY**	**OBJECTIVES ADDRESSED**	**REGUALTORY ACTION TAKEN**
9. Albemarle Sound Management Area And Roanoke River Management Area Striped Bass Management Measures (cont.)	**Proclamation Authority for the ASMA, RRMA, and CSMA striped bass stocks:** It should also be noted that under the provisions of this FMP the NCDMF Director and the NCWRC Chief of Inland Fisheries will maintain the ability to establish seasons, authorize or restrict fishing methods and gear, limit quantities taken or possessed, and restrict fishing areas as deemed necessary to maintain a sustainable harvest.	1,2,3,4,5,6,7	No additional regulatory action required

FIGURES

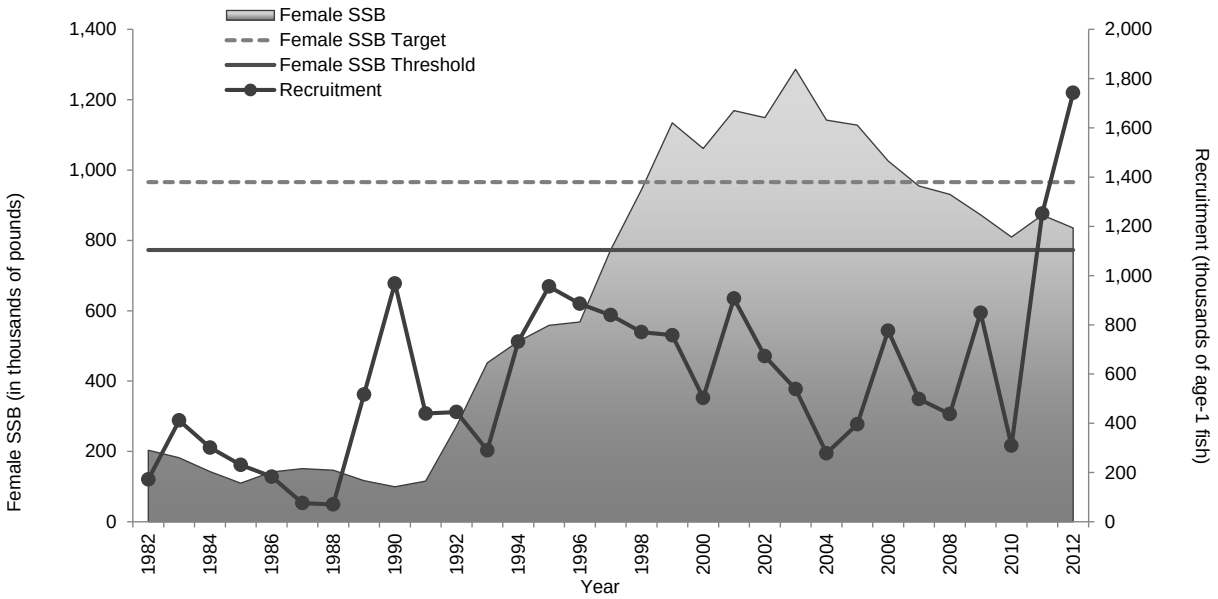


Figure 1. Albemarle/Roanoke striped bass female spawning stock biomass and recruitment (abundance of age-1). Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

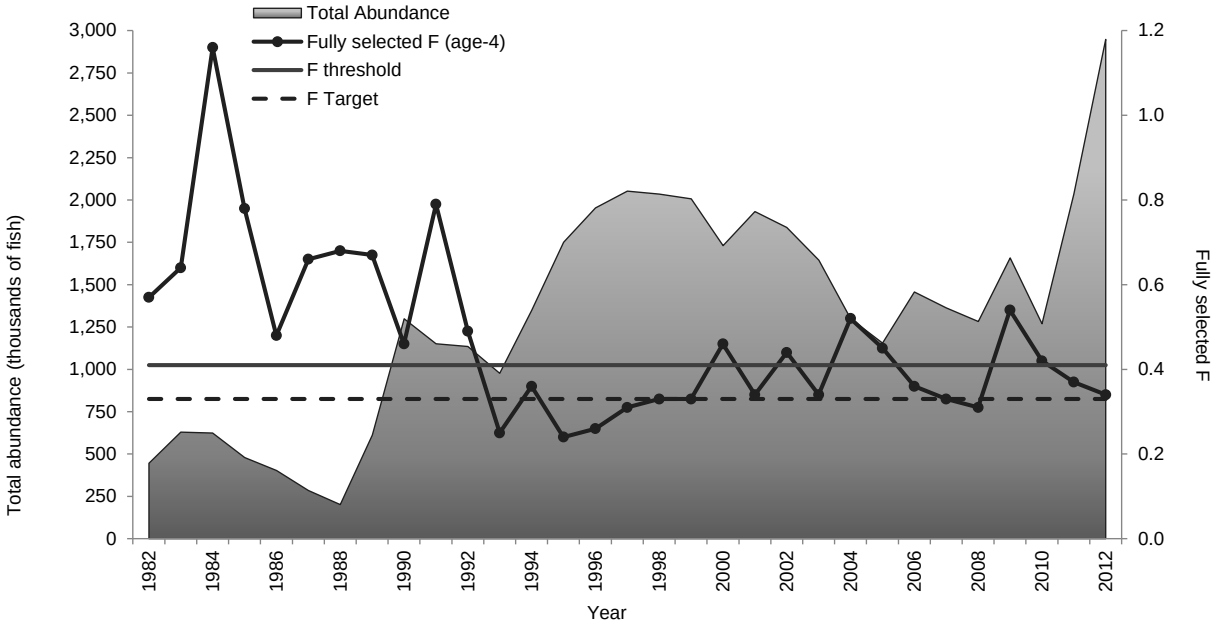


Figure 2. Albemarle/Roanoke striped bass total stock abundance and fishing mortality. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

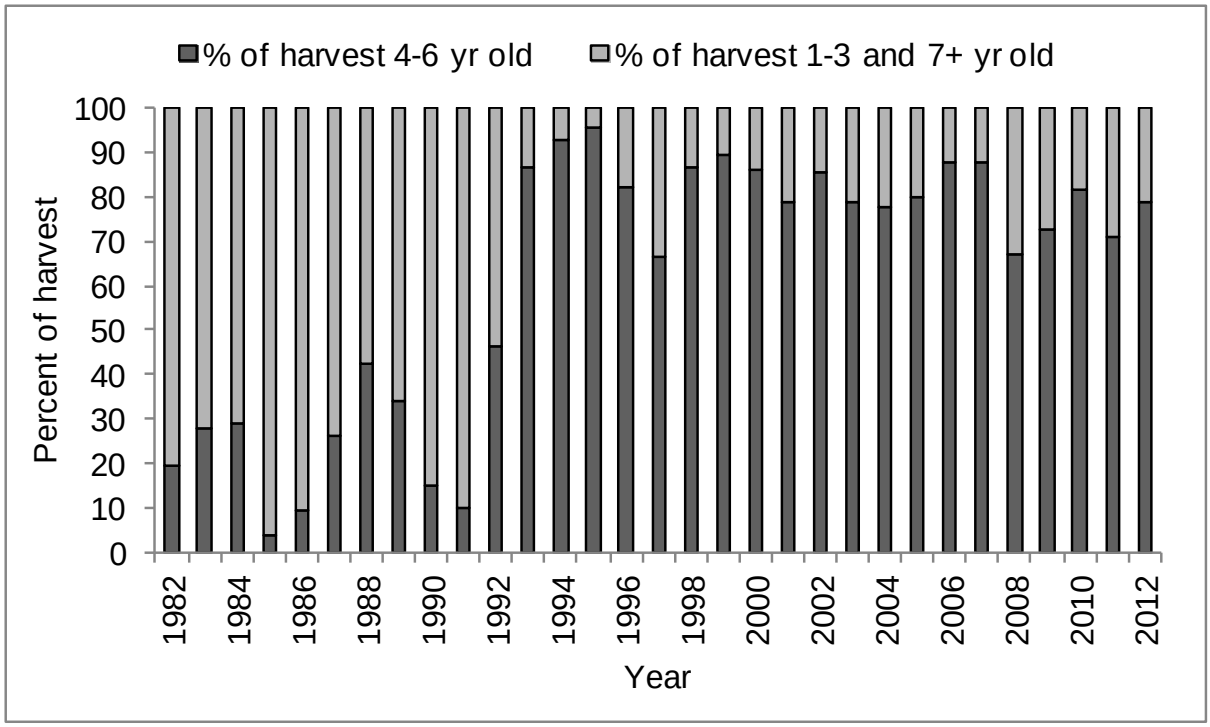


Figure 3. Percent of the total striped bass landings by 4-6 year old and 1-3 and 7+ year old age groups in the ASMA and RRMA, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

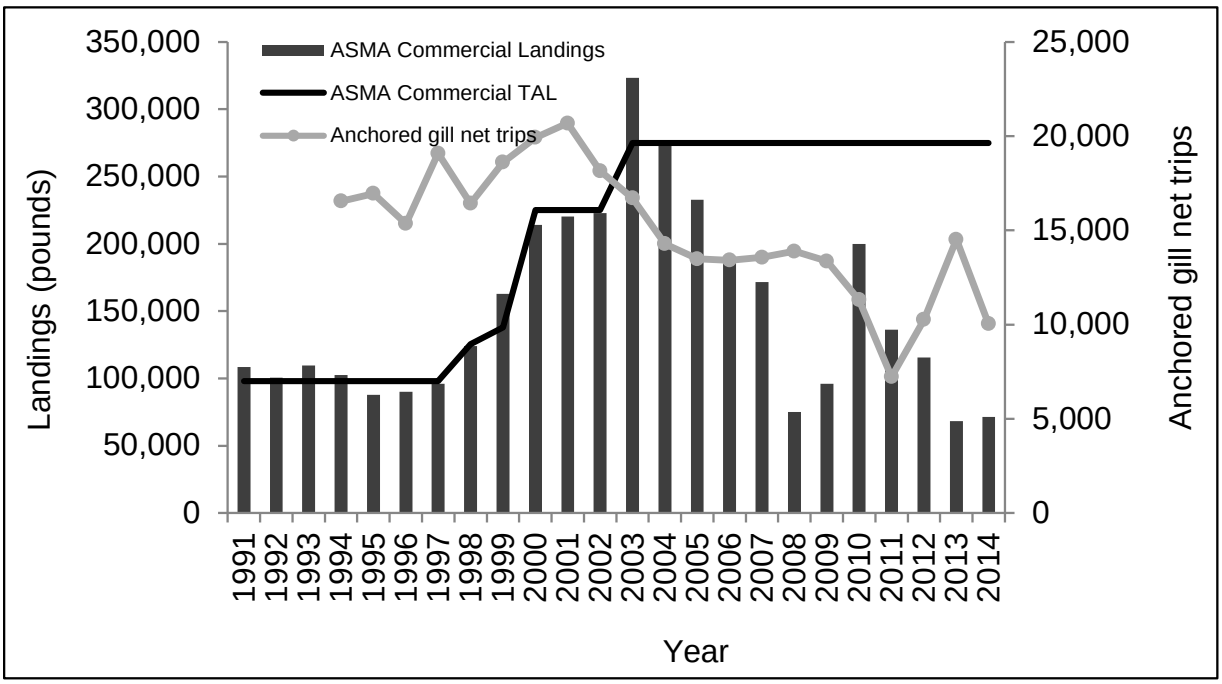


Figure 4. Commercial striped bass landings, TAL, and anchored gill net trips in the ASMA, NC.

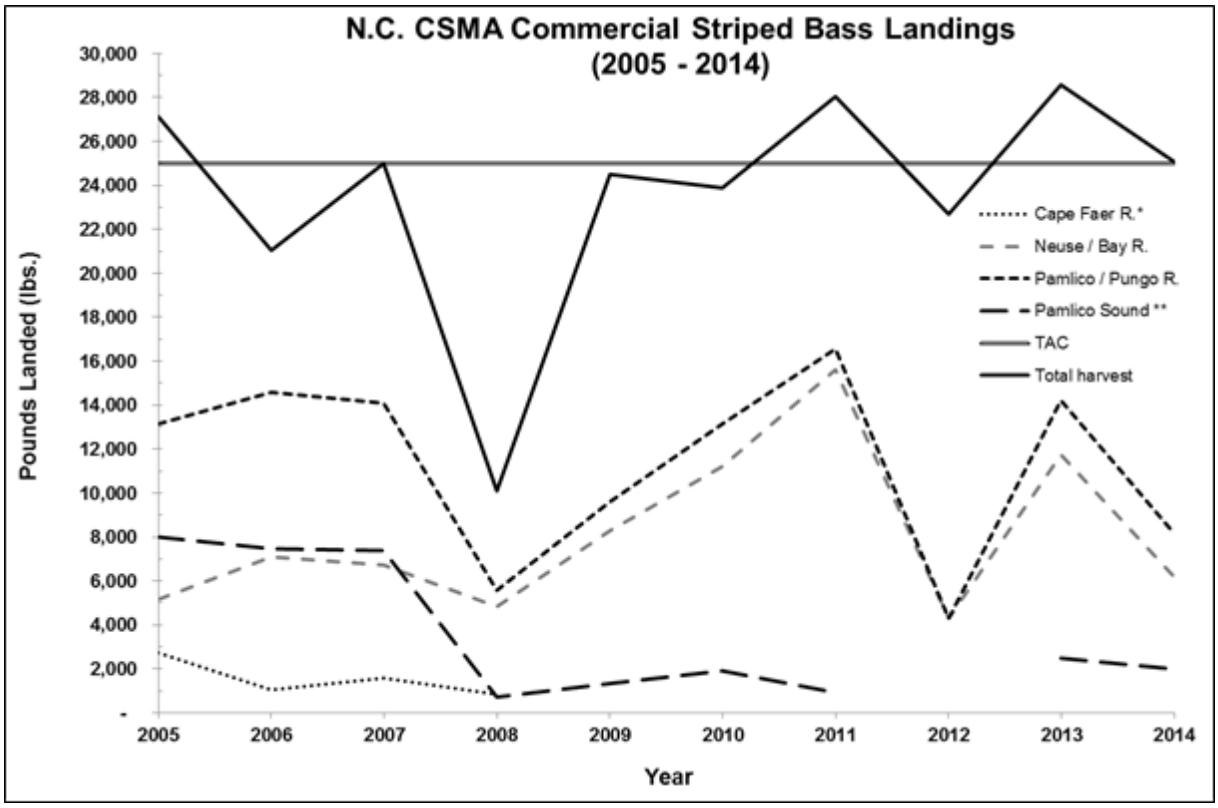


Figure 5. Commercial striped bass landings by river system, and the TAL in the CSMA, NC. There has been a moratorium on harvest in the Cape Fear River since 2009.

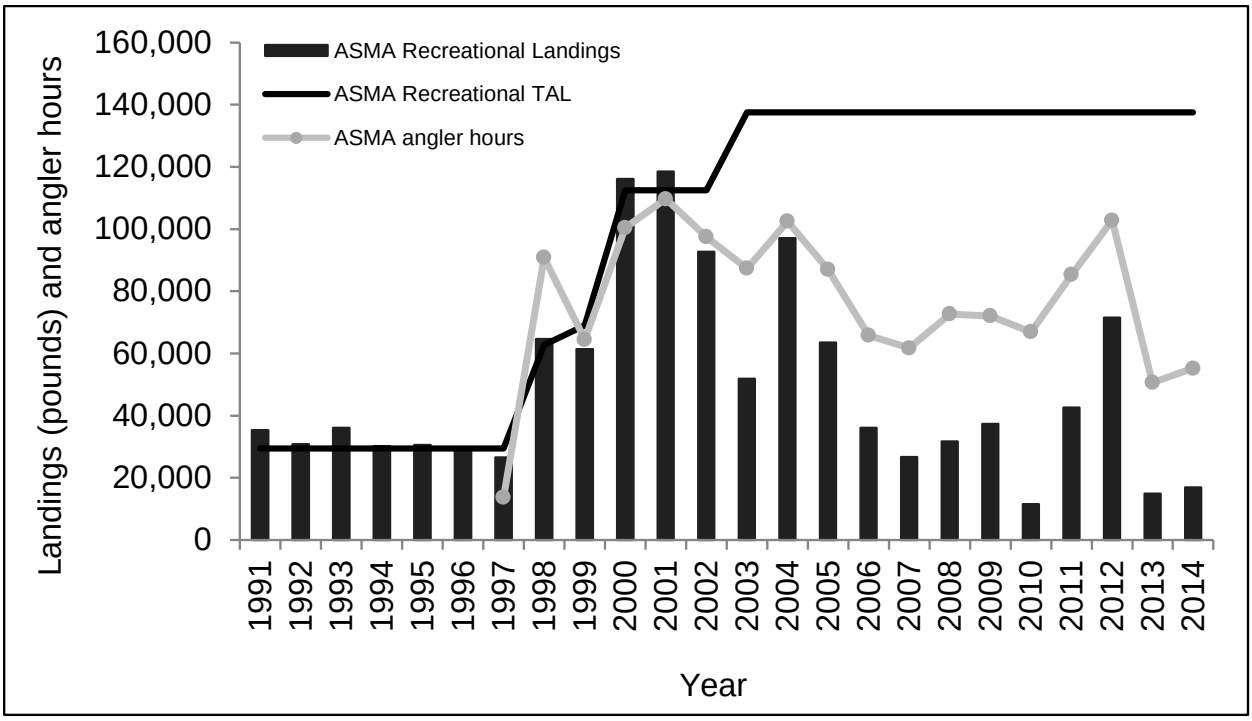


Figure 6. Recreational striped bass landings, TAL, and angler hours in the ASMA, NC.

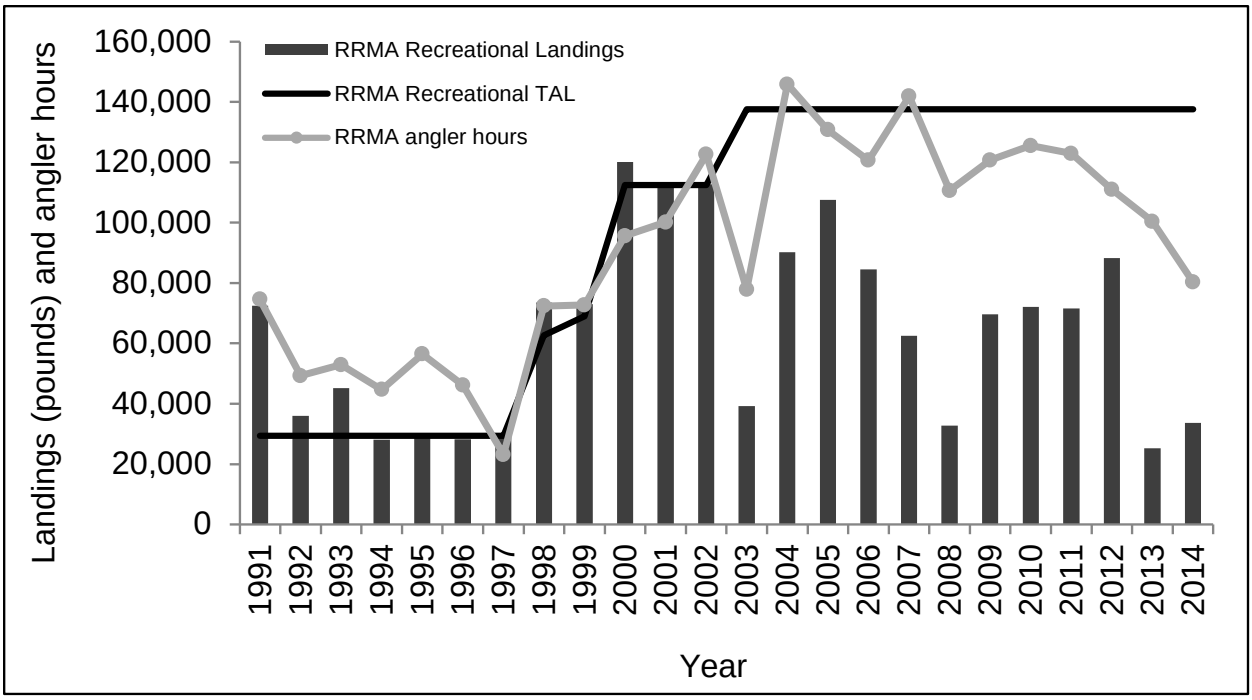


Figure 7. Recreational striped bass landings, TAL, and angler hours in the RRMA, NC.

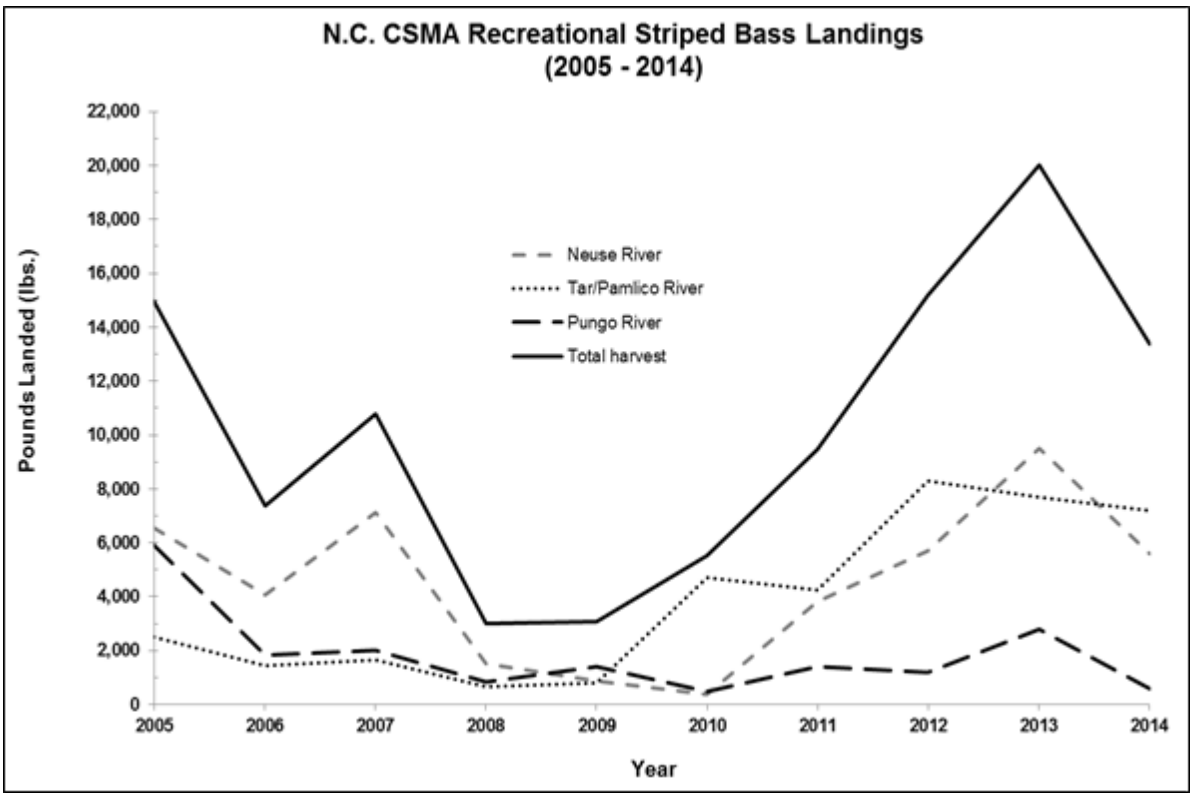


Figure 8. Recreational striped bass landings broken out by major river system in the CSMA, NC.

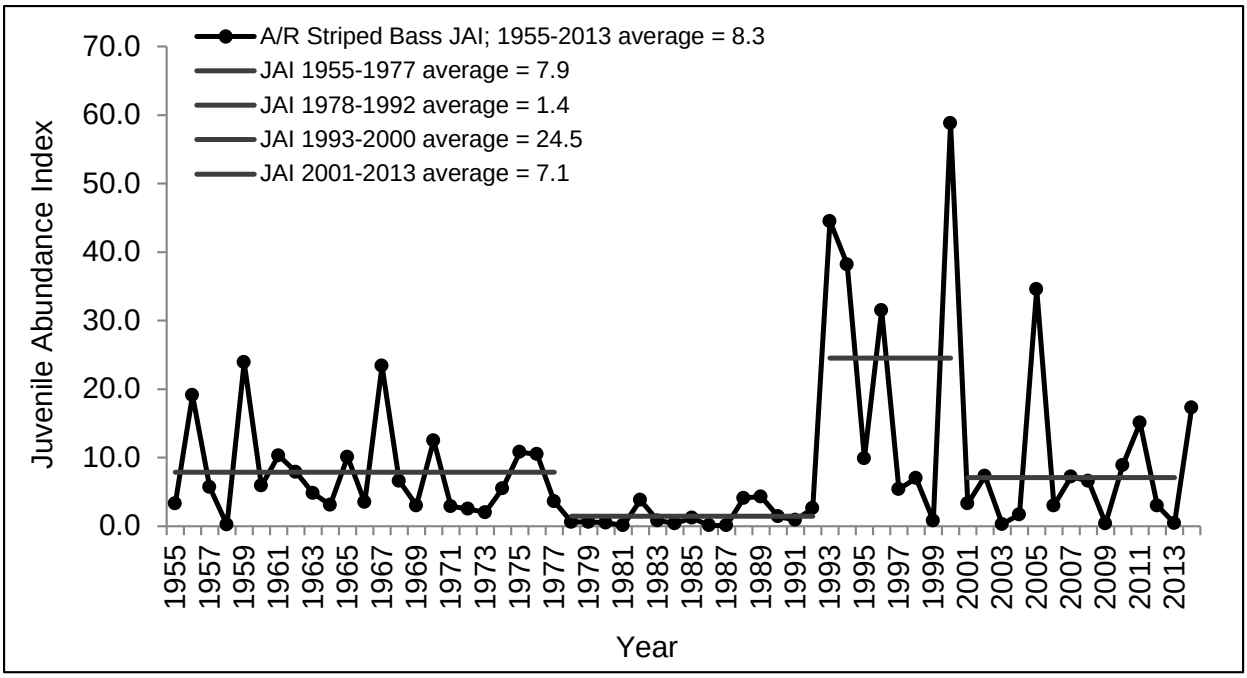


Figure 9. Juvenile abundance index (JAI) of Albemarle/Roanoke striped bass from the NCDMF juvenile trawl survey, western Albemarle Sound, NC.

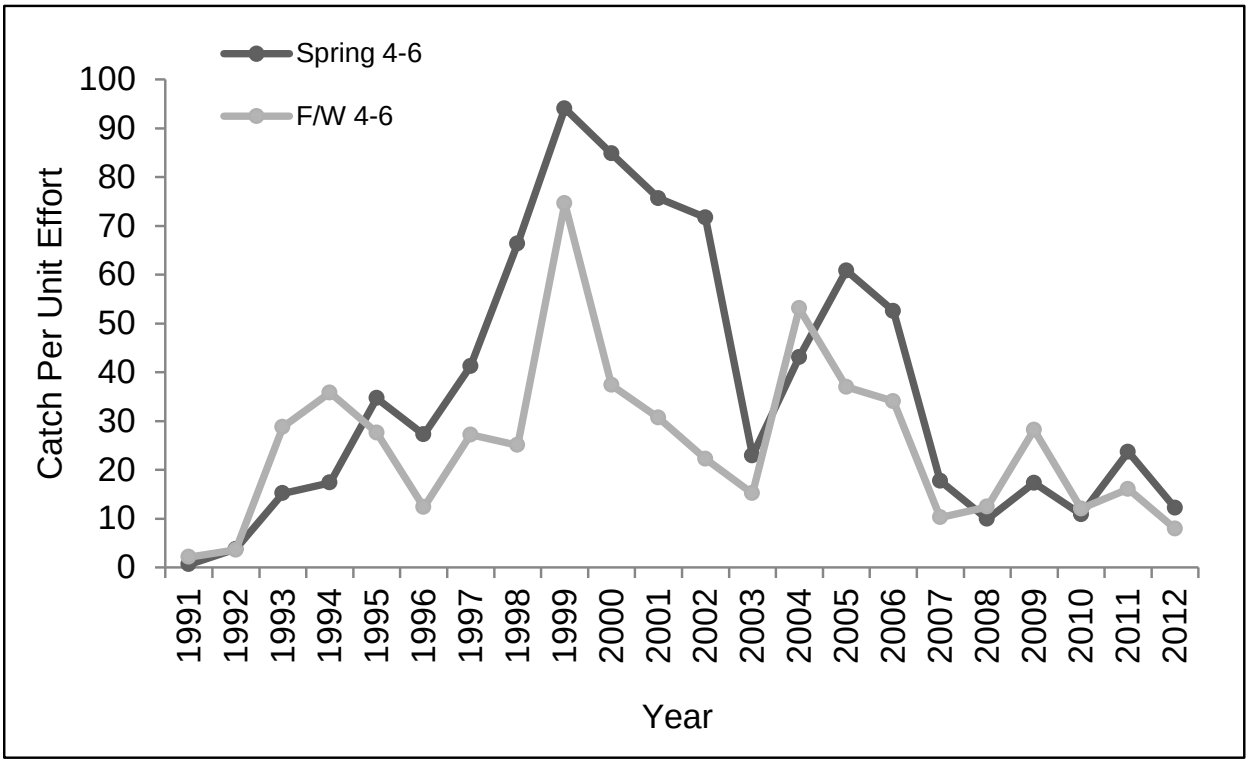


Figure 10. Relative abundance of age 4-6 Albemarle/Roanoke striped bass from the NCDMF fall/winter and spring independent gill net surveys, Albemarle Sound area, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

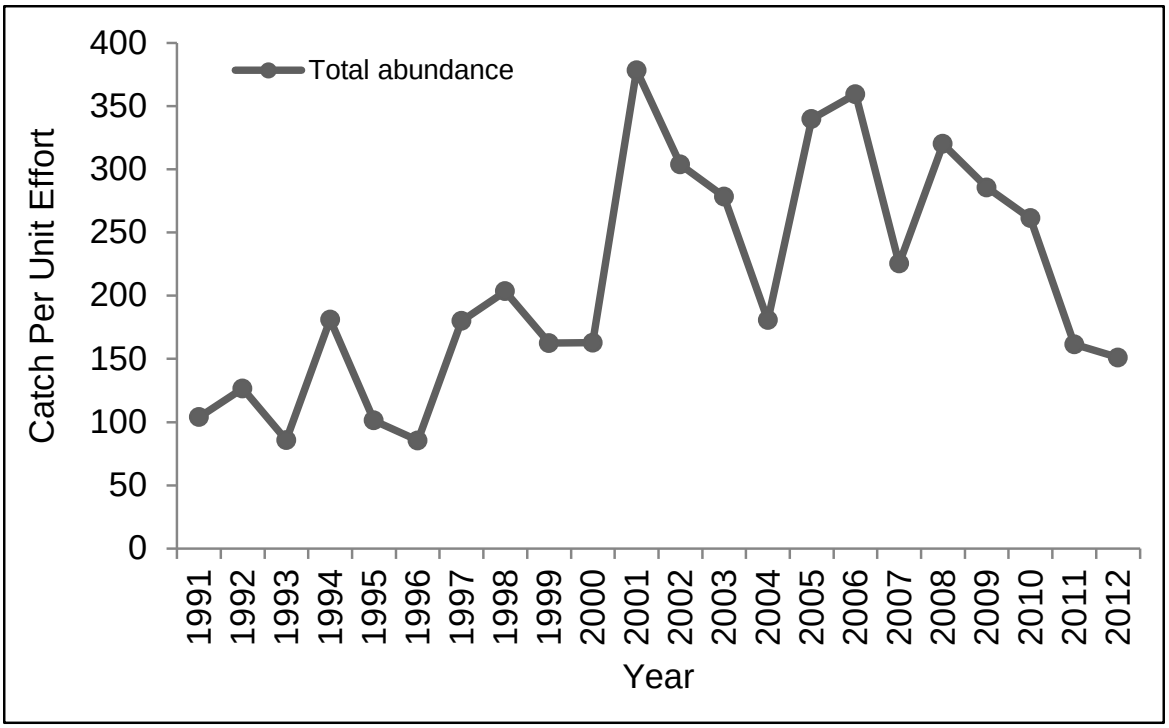


Figure 11. Relative abundance of Albemarle/Roanoke striped bass from the NCWRC spawning grounds electrofishing survey, Roanoke River at Weldon, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

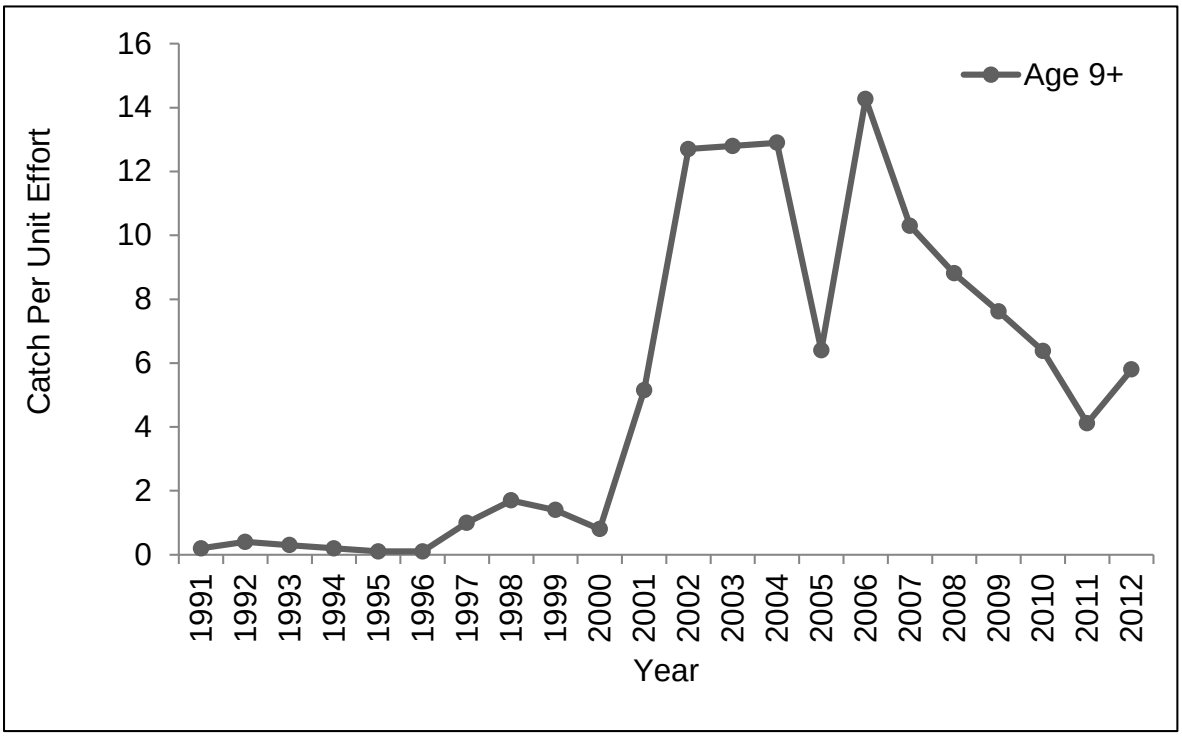


Figure 12. Relative abundance of age 9+ Albemarle/Roanoke striped bass from the NCWRC spawning grounds electrofishing survey, Roanoke River at Weldon, NC. Source: Stock Status of Albemarle Sound-Roanoke River Striped Bass, 2014.

FISHERY MANAGEMENT PLAN UPDATE
HARD CLAM
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	August 2001
Amendments:	Amendment 1 – June 2008
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	July 2013; Amendment 2 is currently in development and scheduled for final approval in November 2016.

The 2001 N.C. Hard Clam Fishery Management Plan (FMP) recommendations included: adding in a new mechanical clam harvest area in Pamlico Sound and rotate openings in this area with northern Core Sound, decrease the daily harvest limit for mechanical harvest in Core Sound, change some of the lease requirements, increase relay of clams, and increase funding for Shellfish Sanitation (NCDMF 2001).

The N.C. Hard Clam FMP Amendment 1 recommended from public bottom that the hard clam fishery continue harvest at current daily limits, eliminate the mechanical clam harvest rotation in Pamlico Sound, institute a resting period in the northern Core Sound mechanical clam harvest area, and develop sampling programs to collect information necessary for the completion of a hard clam stock assessment (NCDMF 2008). Amendment 1 also endorsed several changes to the shellfish lease program to increase the accountability of the leaseholders and improve public acceptance of the program

The N.C. Hard Clam FMP Amendment 2 along with the N.C. Oyster FMP Amendment 4 is in development and scheduled for final adoption in November 2016.

Management Unit

All hard clams (*Mercenaria mercenaria*) occurring within North Carolina coastal waters.

Goal and Objectives

From the draft Amendment 2, approved by the North Carolina Marine Fisheries Commission (NCMFC) in August 2014:

The goal of N.C. Hard Clam FMP is to manage hard clam stocks in a manner that achieves sustainable harvest and protects its ecological value. To achieve this goal, it is recommended that the following objectives be met:

1. Protect the hard clam stock from overfishing, while maintaining levels of harvest at sustained production, providing sufficient opportunity for both recreational and commercial hard clamming, and aquaculture.

2. Identify, develop, and promote research to improve the understanding of hard clam biology, ecology, population dynamics, and aquaculture practices.

3. Initiate, enhance, and continue studies to collect and analyze economic, social, and fisheries data needed to effectively monitor and manage the hard clam fishery.

4. Identify, develop and promote efficient hard clam harvesting practices while protecting habitat.

5. Promote the protection, restoration, and enhancement of habitats and water quality so that the production of hard clams is optimized.

6. Consider the socioeconomic concerns of all hard clam resource user groups, including market factors.

7. Promote public awareness regarding the status and management of the North Carolina hard clam stock.

STATUS OF THE STOCK

Stock Status

Since Amendment 2 to the NCDMF FMP for Hard Clams, the status of the hard clam stock in North Carolina has been considered unknown due to the paucity of data available to assess the population (NCDMF 2008). The NCDMF Hard Clam Plan Development Team recommends the status continue to be defined as unknown due to the continued lack of data needed to conduct a reliable assessment of the stock.

The statutory obligation to manage hard clams according to sustainable harvest cannot be met until the appropriate data are collected. While landings records reflect population abundance to some extent, the relationship is confounded by changes in harvest effort and efficiency.

Stock Assessment

Data limitations prevent NCDMF from conducting a hard clam stock assessment and calculating sustainable harvest. Currently, the only data available for the stock in most areas are the commercial landings and associated effort. For this reason, the current assessment focused on trends in catch rates in the commercial hard clam fishery from 1994 through 2013. These catch rates should not be considered an unbiased representation of trends in population size; fisheries-dependent data are often not proportional to population size due to a number of caveats and should be interpreted with caution if the interest is relative changes in the population.

The North Carolina commercial hard clam fishery is subject to trip limits, which could bias catch rates (Mike Wilberg, UMCES, personal communication; John Walter, NOAA Fisheries, personal communication); that is, the trip limits affect the amount of catch that is observed per unit effort—the true value of the variable cannot be observed. A censored regression approach was applied to calculate an unbiased index of relative abundance using data collected from a fishery with trip limits. Preliminary analysis found that for years in which greater than or equal to 50% of transactions equaled or exceeded the trip limit in a particular water body, the censored regression produced nonsensical results. For this reason, such years were removed from those water bodies where this occurred. Note that this was only an issue for mechanical harvest data.

Data were obtained from the North Carolina Trip Ticket Program for 1994 through 2013. The censored response variable (catch per unit effort—the number of clams per transaction) was fit within a Generalised Additive Models for Location Scale and Shape (GAMLSS) framework using the 'gamlss.cens' (Stasinopoulos et al. 2014) and 'survival' (Therneau 2014) packages in R (R Core Team 2014). Catch rates were estimated for both hand harvest and mechanical harvest in each of the major water bodies from which hard clams are harvested where sufficient data were available (see previous paragraph). Hand harvest occurs year-round and is summarized by calendar year. The majority of mechanical harvest occurs from December through March with some harvest occasionally allowed during other times of the year; therefore, mechanical harvest is summarized by fishing year (December through March). Only landings from public bottom were examined because planting of seed clams, grow-out availability, and market demand often artificially drives landings from private leases. Fisheries-dependent catch rates were expressed as numbers harvested per transaction. Catch rates were consistently higher for mechanical harvest than for hand harvest.

The Mann-Kendall test was performed to evaluate trends in the annual percentages. The Mann-Kendall test is a non-parametric test for monotonic trend in time-ordered data and allows for missing values (Gilbert 1987). The test was applied to the percentage of trip limits for hand harvest and mechanical harvest by area. Trends were considered statistically significant at □ = 0.05.

Based on the Mann-Kendall test there were significant increasing trends over time detected in eight areas for hand harvest—Bogue Sound, Core Sound, Inland Waterway, New River, Newport River, North River/Back Sound, Shallotte River, and White Oak River. A significant decreasing trend was found in the hand harvest catch rates in Pamlico Sound. The remaining water bodies showed no trend in hand harvest catch rates over time. The Inland Waterway, New River, Newport River, North River/Back Sound, and Stump Sound demonstrated significantly increasing trends in mechanical harvest catch rates over time. No trends were detected in Bogue Sound, Core Sound, or White Oak River catch rates for mechanical harvest.

Trends observed in fishery-dependent indices must be interpreted with strong caveats. In order for a fisheries-dependent index to be proportional to abundance, fishing effort must be random with respect to the distribution of the population and catchability must be constant over space and time. Other factors affecting the proportionality of fishery-dependent indices to stock size include changes in fishing power, gear selectivity, gear saturation and handling time, fishery regulations, gear configuration, fishermen skill, market prices, discarding, vulnerability and availability to the gear, distribution of fishing activity, seasonal and spatial patterns of stock distribution, change in stock abundance, and environmental variables. Many agencies, such as the NCDMF, do not require fishermen to report records of positive effort with zero catch; lack of these "zero catch" records in the calculation of indices can introduce further bias.

STATUS OF THE FISHERY

Current Regulations

Hard clams cannot be taken from any public or private bottom in areas designated as prohibited (polluted) by proclamation except for special instances for: Shellfish Management Areas (NCMFC Rule 15A NCAC 03K .0103), with a permit for planting shellfish from prohibited areas (NCMFC Rule 15A NCAC 03K .0104), and for the depuration of shellfish (NCMFC Rule 15A NCAC 03K .0107).

Public Bottom:

The minimum size limit for hard clams is 1-inch thickness (width). Daily commercial harvest limits on public bottom are no more than 6,250 hard clams (25 bags at 250 clams per bag) per fishing operation in any coastal fishing waters regardless of the harvest methods employed. Size, daily harvest limits, and season and area limitations do not apply in some situations on public bottom for: 1) temporary openings made on the recommendation of shellfish sanitation; and 2) maintenance dredging operations, where waste of the hard clam resource is apparent due to these activities and Shellfish Sanitation deem the area safe from public health risks.

The daily hand harvest limit on public bottom is 6,250 hard clams and the fishery is open year-round. Rakes no more than 12 inches in width or weighing no more than six pounds to take hard clams can be used in any live oyster bed, in any established bed submerged aquatic vegetation or in and established bed of salt water cordgrass.

The public mechanical hard clam harvest season can occur from December 1 through March 31, and is opened by proclamation. Internal waters that can open to public mechanical hard clam harvest can only be in areas in Core and Bogue Sounds, Newport, North, White Oak and New Rivers and the Intracoastal Waterway north of "BC" Marker at Topsail Beach which have been opened at any time from January, 1979, through September, 1988. Public hard clam mechanical daily harvest limits vary by waterbody. In some instances mechanical harvest areas are rotated (alternately open and close) with other areas (Table 1). The White Oak River, New River, and the Intracoastal Waterway (IWW) of Onslow and Pender counties (Marker 65 to the BC Marker at Banks Channel) are fished mainly with escalator dredges and are rotated on a yearly basis with maximum daily limits of 6,250 hard clams (25 bags at 250 hard clams per bag) per operation. The mechanical harvest area from Marker 72A to the New River Inlet is opened annually with a maximum daily harvest limit of 6,250 hard clams. The maximum daily harvest of 3,750 hard clams is allowed in North River, Newport River, and Bogue Sound (Table 1). Since 2008, upon adoption of Amendment 2 to the Hard Clam FMP, Core Sound has been divided into two areas and the northern area is open every other year while the southern portion is opened annually. Each area in Core Sound has a daily harvest limit of 5,000 hard clams per operation.

Recreational harvest limits from public bottom are 100 hard clams per person per day and no more than 200 hard clams per vessel. Hard clams can only be taken by hand for recreational purposes.

Private Bottom:

Leases and franchises in internal waters must adhere to the minimum 1-inch thick size limit for the sale of hard clams for consumption. There is no daily maximum harvest limit applied to the taking of hard clams from private bottom in internal waters.

Possession and sale of hard clams by a hatchery or aquaculture operation and purchase and possession of hard clams from a hatchery or aquaculture operation are exempt from the daily harvest limit and minimum size restrictions. The possession, sale, purchase and transport of such hard clams must be in compliance with the Aquaculture Operation Permit.

Commercial Landings

Hard clam harvest has fluctuated historically, often in response to changes in demand, improved harvesting, and increases in polluted shellfish area closures. Since 1994 it is known that about 88% (1994-2013 combined estimates) of the total commercial hard clam harvest come from public bottom in North Carolina. It is assumed that trends in hard clam landings from both sources (private and public bottom) combined can be attributed to changes in hard clam landings from public bottom since they make up the largest component to the overall harvest. Adverse weather conditions (i.e., hurricanes, heavy rain events) can impact the annual landings. Ten tropical cyclones (hurricanes and tropical storms) have made landfall in North Carolina since 1996 (http://www.nc-climate.ncsu.edu). Freshwater runoff after storm events often increase shellfish harvest area closures and therefore reduce effort in hard clam harvest for short term periods. Hard clams are a live product that have to go to market relatively quickly after harvest. Competition with hard clams grown in private culture from other states is also a known contributor to reduced market demand for hard clams in the wild since a more consistent product can be provided from private grow out facilities.
Annual average hard clam landings from 1994-2014 was 520,430 pounds of meats (Figure 1). Annual landings in 2011 were the lowest on record since 1975 at 295,467 pounds of meat. There has been a slight uptick in hard clam landings since the low in 2011 still are at one- fourth at their peak in the 1980s. Hard clams are a live-product and must to go to market and sold relatively quickly after harvest because of a short shelf life. Competition with hard clams grown in private culture from other states is also a known contributor to reduced market demand for hard clams in the wild since a more consistent product can be provided from private growers.

Recreational Landings

Unknown.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Currently, the only data available for the stock in all areas are the commercial landings and associated effort from the Trip Ticket Program. Sampling of commercial catches of hard clams has been ongoing in the Southern District, Morehead City Office since 1998. Additional sampling of other areas followed later as funding became available for expansion. Hard clam catches are sampled at the dealers year round when available. Trip ticket information is also obtained of the total catch in the trip. Information on the location(s) of the catch should be obtained in as much detail as possible (e.g. water body, nearest landmark, marker number,

etc.). Questions for the fisherman include: What gear or gears were used, gear parameters, (i.e. length of teeth, width of escalator, headrope length), how many minutes fished with each gear, location and depth of water fished. Additional questions include whether the catch came from public bottom or leased bottom, and if catch originated from a NCDMF Shellfish Rehabilitation area. Biological information on landed catch of hard clams is collected, including: shell length (mm) and shell width (depth) (mm) by market grade.

A total of 40,634 hard clams were measured from 2005 to 2014 (Table 2). Mean shell length (mm) has ranged from 60 mm to 69 mm in that timeframe with a minimum shell length of 25 mm to a maximum shell length of 120 mm seen in the measurements (Table 2).

Fishery-Independent Monitoring

A fisheries-independent monitoring program (Program 640) is currently underway in Core Sound to provide baseline data on hard clam abundance and gather quantitative environmental parameters. In the future it may be possible to expand this sampling into other areas to evaluate the entire population. Thirty randomly selected stations are sampled each year within three strata. The three designated strata were: Shellfish Mapping Strata (ST), Known Fishing Areas (FA), and Closed Shellfish Areas (CA). Sampling is performed at each station location within each stratum using a small patent tong on a 25-ft flat bottom boat. The patent tong has an opening of 0.51 square meters. Samples are quantified by station. Three replicates at each station location are taken.

All hard clams are measured for thickness and length to the nearest mm using calipers. Environmental data collected includes depth (m), surface and bottom salinity (ppt), surface and bottom temperature (°C), surface and bottom dissolved oxygen (mg/L), secchi depth (m), weather and wind elements, water level, distance from shore, and altered state. Sediment type is qualitatively described.

Very few hard clams are caught in this program due to the nature of the gear and random stratified sampling design. The Catch per Unit Effort (CPUE) or number of clams per station has ranged annually from 0.27 to 0.83 clams per station from 2007 to 2014 (Table 3). No trend is apparent from this sampling, but it is considered a short time series with only 8-years in development (Figure 2).

MANAGEMENT STRATEGY

There are no management triggers or methods to track stock abundance, fishing mortality, or recruitment between benchmark reviews from the current FMP. Landings and effort have decreased over time. There are no data to track the recreational fishery.

Amendment 1 to the N.C. hard Clam FMP recommended from public bottom that the hard clam fishery continue harvest at current daily limits, eliminate the mechanical clam harvest rotation in Pamlico Sound, institute a resting period in the northern Core Sound mechanical clam harvest area, and develop sampling programs to collect information necessary for the completion of a hard clam stock assessment (NCDMF 2008). Amendment 1 also endorsed several changes to the shellfish lease program to increase the accountability of the leaseholders and improve public acceptance of the program

See Table 4 for current management strategies under Amendment 1.

MANAGEMENT AND RESEARCH NEEDS

See Table 4 for current management strategies and implementation status of each under Amendment 1. The following research recommendations are part of Amendment 1 of the Hard Clam FMP (NCDMF 2008). Research recommendations with a '*' indicate an immediate need, and those with '**' indicate a less than immediate need.

- *Increase hard clam sampling programs to collect information necessary for the completion of a stock assessment. Programs will require long-term monitoring and a determination of the number of separate stocks in N.C. (needed)
- **Validation of ageing methods in North Carolina (needed)
- Investigate the role of adult dispersion patterns in spawning success (needed)
- **Determine fecundity of clams at each age (needed)
- Determine the importance of flushing rates and larval predation on larval survival (needed)
- Identify factors influencing settlement success (needed)
- Identify source and sink areas (needed)
- Describe spatial and temporal patterns of larvae and juveniles (needed)
- Investigate the role of lateral movement of juveniles in recruitment (needed)
- Determine the effects of harvest methods on juvenile settlement and survival (needed)
- **Develop an adult abundance index (needed)
- Note regional changes in abundance (needed)
- **Determine estimates of natural mortality (needed)
- **Identify factors influencing hard clam growth in North Carolina (needed)
- *Collect recreational landings data (needed)
- Survey recreational participants for demographic and spending data (needed)
- Determine the effect of shellfish filtering capacities on water quality parameters, such as bacteria, nutrients and sediments (needed)
- Support collaborative research to more efficiently track bacterial sources for land-based protection and restoration efforts (ongoing through the CHPP)
- **Quantify the impact of current fishing practices on clam habitat suitability in North Carolina (needed)
- Determine the impact of docks siting practices and bottom disturbing activities on nearby habitats and on the shifting boundaries of habitat itself so that protective buffer distances can be established (ongoing through the CHPP)
- **Quantify the relationship between water quality parameters and the cumulative effect of shoreline development units (i.e., docks, bulkhead sections)(ongoing through the CHPP)
- Utilize standardized monitoring metrics and methodologies with other researchers for clam restoration when possible (standard practice that is strived for all monitoring collaborations)
- Investigate clam larval dispersal and transport (needed)
- Determine the hydrodynamics of the areas for increasing clam production (needed)
- Investigate areas of sanctuary placement (shallow/deep), size, and impacts to the local fishing grounds (ongoing through NCDMF)
- Study the effects of transplanting spawners (needed)
- Determine methodologies to reduce predation (needed)
- Increase seed planting efficiencies (needed)
- Complete a cost analysis of various enhancement approaches (needed)
- Complete stock assessments of clams and oysters located within polluted areas

- Complete a review of current depuration programs in other states (researched through NCDMF)
- Complete a review of current DEH rules and possibly updating the rules may be necessary to fully reflect current technologies (needed)
- Explore new technologies for off-bottom culturing methods (needed)
- Further develop new types of biomarkers that can be used to select more effectively for disease-resistant genetic stock (needed)
- Develop disease-resistant or fast-growing strains of shellfish (needed)
- Establish a brood stock (hard clam and oyster) development program (ongoing through UNCW research hatchery)
- Develop methods to determine health of shellfish stocks to various diseases (needed)
- Assess survival and productivity of relayed oysters vs. natural recruitment on planted cultch (needed)
- Investigate timing of oyster spatfall, larval dispersal and transport (needed)
- **Determine the hydrodynamics of the areas for restoration and culture activities (needed)
- Collect population information on cownose rays (needed)
- Further research on the impacts of clam trawls and escalator dredges on sandy bottom environments (needed)
- Further studies on the effects of clam recruitment and clam mortality in the mechanical harvest areas (needed)
- Stock assessments are also needed in the waterbodies where mechanical harvest takes place (needed)
- Continue research on means and methods for reduction of non-point source pollution and mitigation of pollutant effects in the estuary (ongoing through the CHPP)

FISHERY MANAGEMENT PLAN RECOMMENDATION

Recommend maintain the current timing of the Benchmark Review. Amendment 2 of the N.C. Hard Clam FMP is currently in development and scheduled for NCMFC adoption in November 2016 with any recommended rules changes in effect by April 2017,

LITERATURE CITED

Gilbert, R.O. 1987. Statistical methods for environmental pollution monitoring. Van Nostrand Reinhold, New York. 320 p.

NCDMF. 2008. North Carolina Hard Clam Fishery Management Plan. Amendment 1. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 158 pp.

NCDMF. 2001. North Carolina Hard Clam Fishery Management Plan. Amendment 1. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 314 pp.

R Core Team. 2014. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Stasinopoulos, M., B. Rigby, and N. Mortan. 2014. gamlss.cens: fitting an interval response variable using gamlss.family distributions. R package version 4.2.7.

Therneau, T. 2014. A package for survival analysis in S. R package version 2.37-7.

TABLES

Table 1. Current daily mechanical hard clam harvest limits by water body. Season can only be opened from December 1 through March 31 by proclamation.

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 counties areas
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.

Table 2. Observed annual mean, minimum and maximum shell length (mm) of hard clams measured from commercial catches at the dealer, 2005 – 2014.

Year	Mean Shell Length	Minimum Shell Length	Maximum Shell Length	Total Number Measured
2005	66	46	96	304
2006	67	25	102	1,558
2007	66	41	111	1,406
2008	69	37	120	1,383
2009	64	39	112	1,862
2010	63	39	104	5,358
2011	64	38	111	10,670
2012	62	40	109	5,851
2013	63	40	108	4,750
2014	60	25	115	7,492

Table 3. Independent hard clam sampling (Program 640) annual estimates of catch per unit effort (CPUE=Number of clams per station) and their standard deviations, 2007 to 2014 for Core Sound.

Year	Total number of stations	Number of stations with zero catch	Number of clams	CPUE (Number of clams/station)	Standard deviation
2007	30	22	10	0.33	0.61
2008	31	24	12	0.39	0.80
2009	30	15	25	0.83	1.02
2010	30	19	15	0.50	0.78
2011	30	26	8	0.27	0.74
2012	30	17	17	0.57	0.77
2013	30	25	8	0.27	0.69
2014	30	24	13	0.43	0.94

Table 4. Summary of the management strategies and their implementation status from Amendment 2 of the N.C. Hard Clam Fishery Management Plan.

Management strategy	Implementation status
INSUFFICIENT DATA	
1. Recommend no change (status quo) to collect information on recreational harvest of shellfish	Accomplished
MANAGEMENT	
1. Rescind the proclamation but keep authority to open the designated area in the ocean for the mechanical harvest of clams if and when necessary	Accomplished; Proclamation SF-3-2009 dated May 1, 2009
2. Define recreational shellfish gear	Accomplished; Rule change to 15A NCAC 03I .0101
3. Allow no sale of weekend shellfish harvest except from leases	Accomplished; Rule change to 15A NCAC 03K .0106
4. Propose repeal of G.S. 113-169.2 license exemption.	Accomplished; Statute G.S. 113-169.2 change and Rule 15A NCAC 03K .0105 change
5. Set recreational limits in rule and proclamation	Accomplished; Rule change for 15A NCAC 03K .0105 and existing proclamation authority
6. Adopt a new rule limiting mechanical harvest of other shellfish to areas where and season when mechanical harvest gear for shellfish is allowed in existing fisheries	Accomplished; Rule change to 15A NCAC 03K .0108
7. Recommend no change to the open shellfish harvest license	Accomplished
8. Require all shellfish to be tagged at the dealer level	Accomplished; Rule change to 15A NCAC 03K .0101
9. Discontinue rotation of Pamlico Sound with northern Core Sound	Accomplished; Existing proclamation authority
10. Institute a resting period within the mechanical clam harvest area in the northern part of Core Sound	Accomplished; Existing proclamation authority
PRIVATE CULTURE	
1. Support the recommendation by the NCMFC that the Shellfish Hatchery Planning Advisory Team consider multiple uses of the demonstration shellfish hatchery facilities for different shellfish species	Accomplished
2. If clam seed grow out is initiated then the hatchery facility should work with the NCMFC Shellfish AC and DMF to determine management criteria for the uses of the clam seed stock	Accomplished
3. Propose an exemption from G.S. 113-168.4(b)(1) when the sale is to lease, UDOC permit, or Aquaculture Operations Permit holders for further rearing	Accomplished; Statute change to G.S. 113-168.4(b)(1)
4. Leave regulations in place as is for depuration facilities	Accomplished
5. Utilize user coordination plans for shellfish lease issuance coast wide	Funding required but was not sought due to budget limitations
6. Develop an independent education package in coordination with the Oyster Hatchery Program, N. C. Sea Grant, and other state agencies, and organizations to be presented at seminars with a mandatory attendance for all new leaseholders, and a mandatory completion of an examination with a passing score to meet education requirements for both new leaseholders and leaseholder transferees	Accomplished
7. Require an examination with a passing score based on pertinent information in the training package irrespective of whether the applicant has obtained instruction voluntarily or	Accomplished

Management strategy	Implementation status
is reviewing the information independently	
8. Request that appropriate agencies such as the Oyster Hatcheries and N.C. Sea Grant conduct shellfish lease training as part of their educational and outreach activities	Under development through the Resource Enhancement Section and NC Sea Grant
9. Modify G.S. 113–201 to include a requirement of an examination with a passing score for persons acquiring shellfish leases by lawful transfers unless they have a shellfish lease that is currently meeting production requirements	Accomplished
10. Support private oyster larvae monitoring programs	Accomplished
11. Support construction of an integrated system of shellfish hatcheries and remote-setting sites	Accomplished
12. Develop a subsidized, fee-for-service disease diagnosis program	Not under consideration at this time
13. Recommend status quo on the movement of seed shellfish from polluted waters	Accomplished
14. Change the current rule specifying a three year running production average to a five year production average and change the statutory provision for a ten year lease contract to a five year contract	Accomplished; Amended G.S. 113-202. Accomplished changes to rule 15A NCAC 03O .0201
15. Limit acreage per shellfish lease application to 5 acres	Accomplished; Rule change to 15A NCAC 03O .0201
16. A leaseholder holding at least 5 acres of shellfish bottom is required to meet shellfish lease production requirements before being approved for any additional lease acreage	Accomplished; Rule changes to 15A NCAC 03O .0201and 15A NCAC 03O .0210
17. Require Lat./Long. coordinates on lease corner locations as part of the requirement of a registered land survey	Accomplished; Rule changes to 15A NCAC 03O .0203
18. Develop regional lease acreage caps based on established use of water bodies	Accomplished; Amend G.S. 113-202
19. Rewrite the statutory provision limiting the amount of shellfish lease acreage that can be held by an individual to include acreage held by corporations where the individual is a member, or any combination of corporate or family holdings	Accomplished; Amend G.S. 113-202
20. Monitor seeded oyster sanctuaries for cownose ray predation	Not completed
21. Provide bilingual (English and Spanish) educational materials to consumers, leaseholders, UDOC permit holders, shellfish dealers, and other DENR state regulatory agencies	Under development by the ISSC and will come through Shellfish Sanitation. Funding limitations have slowed progress.
22. Encourage harvesters to take volunteer time and temperature control measures on their product	Accomplished through permit process.
HABITAT AND WATER QUALITY CONCERNS	
1. Identify and delineate Strategic Habitat Areas that will enhance protection of clam habitats; research physical factors influencing clam abundance predictably	Existing authority through the CHPP implementation plan
2. Coordinate SHAs with land-based conservation and restoration activities such as One North Carolina Naturally and DENR's green infrastructure planning	Existing authority through the CHPP implementation plan
3. Ensure oyster and SAV habitat definitions are consistent across regulating agencies	SAV definition in effect since April 2009. Existing authority through the CHPP implementation plan
4. Completely map all structured habitat (i.e., shell bottom, SAV) in North Carolina, including the deep, subtidal rocks on Pamlico Sound	Ongoing through Resource Enhancement Section Shellfish Mapping Program

Management strategy	Implementation status
5. Remap structured habitats to assess changes in distribution and abundance over time	Ongoing through Resource Enhancement Section Shellfish Mapping Program
6. Restore historical distribution and acreage of oysters and SAV where possible; coordinate with land-based protection and restoration efforts	Existing authority through the CHPP implementation plan
7. Balance protection of oyster beds and SAV (as habitat) with harvest provisions and expand oyster sanctuary planting and designation	Existing authority through the CHPP implementation plan; Accomplished expansion of oyster sanctuaries
8. Monitor biological/ecological condition and effectiveness of oyster sanctuaries and restored SAV beds	Accomplished in oyster sanctuaries. Not under investigation for SAV beds.
9. Cooperate with University researchers on oyster larvae distribution and oyster recruitment studies to aid in restoration planning	Accomplished
10. Develop and implement a comprehensive coastal marina and dock management plan and policy to minimize impacts to oyster and SAV habitat	Existing authority through the CHPP implementation plan
11. Develop permit application survey protocols for shellfish and SAV habitats for CAMA applicants	Accomplished through CHPP implementation plan
12. Evaluate and adjust as necessary dredging and trawling boundaries to protect and enhance oyster and SAV habitat	Existing proclamation authority and ongoing pilot study In Archer Creek to develop protocols
13. Seek additional resources to enhance enforcement of and compliance with expanded bottom disturbing fishing gear restrictions that protect oyster and SAV habitat	Existing authority through the CHPP implementation plan
14. Evaluate making conservation leasing available to non-government organizations for the purpose of oyster restoration and sanctuary development	Scheduled for consideration by CHPP Steering Committee
15. Work with NOAA and DWQ to determine appropriate levels of TSS, turbidity, chlorophyll a, and other water clarity parameters to achieve adequate water quality conditions for SAV growth and clam production	Existing authority through the CHPP implementation plan
16. Seek additional funds and process changes to allow local communities to more rapidly address repairs and upgrades to all aspects of the municipal waste systems, including collection and treatment systems	Existing authority through the CHPP implementation plan
17. Target productive shellfish resources in conditionally approved closed areas for land-based protection and restoration efforts. This could include designation as Strategic Habitat Are or Use-Restoration Water	Existing authority through the CHPP implementation plan
18. Modify mechanical harvest lines to exclude areas currently open to mechanical harvest where oyster habitat and SAV habitat exist based on all available information	Existing proclamation authority
19. Provide educational materials to harvesters in license offices and on DMF webpage, through other training opportunities, and through DMF Port Agent contact with harvesters and dealers and include other state and federal regulatory agencies to reach all coastal waters users	Accomplished
20. Support DWQ's efforts to improve stormwater rules through permit comments and CHPP implementation and co-ordinate with sister agencies	Accomplished. Rule change occurred in Oct. 2008
21. Recommend DWQ to designate Use-Restoration waters in conditionally closed waters where moderate contamination and healthy shellfish beds are present and develop strategies to restore and protect those waters	Accomplished; URW Coordinator hired by DWQ
22. Recommend DWQ designate Use-restoration waters in areas where moderate contamination and appropriate	Accomplished; URW Coordinator hired by DWQ

Management strategy	Implementation status
shellfish culture conditions are present and develop strategies to restore and protect those waters	
23. Recommend to the DWQ to accept a lower threshold of 10,000 square feet to coastal stormwater rules	Partially accomplished. Not as restrictive through DWQ rule changes as of Oct. 2008
24. Recommend a naturally vegetative riparian buffer width of 50 feet	Partially accomplished. Not as restrictive through DWQ rule changes as of Oct. 2008
25. Recommend the exclusion of all wetlands (coastal and non-coastal), from the built-upon area calculations	Partially accomplished. Not as restrictive through DWQ rule changes as of Oct. 2008
26. Recommend repeal of G.S. 113-207 (a) and (b) to end the requirement that all oyster rocks must be posted by the Department	Accomplished; Repeal G.S. 113-207 (a) and (b)
27. Recommend that conservation leasing for constructed oyster rock habitat be studied by DENR counsel for development of a proper mechanism and to develop siting criteria	Scheduled for consideration by CHPP Steering Committee
28. Leave current management practices in place for Ward Creek	Accomplished; Existing proclamation authority

FIGURES

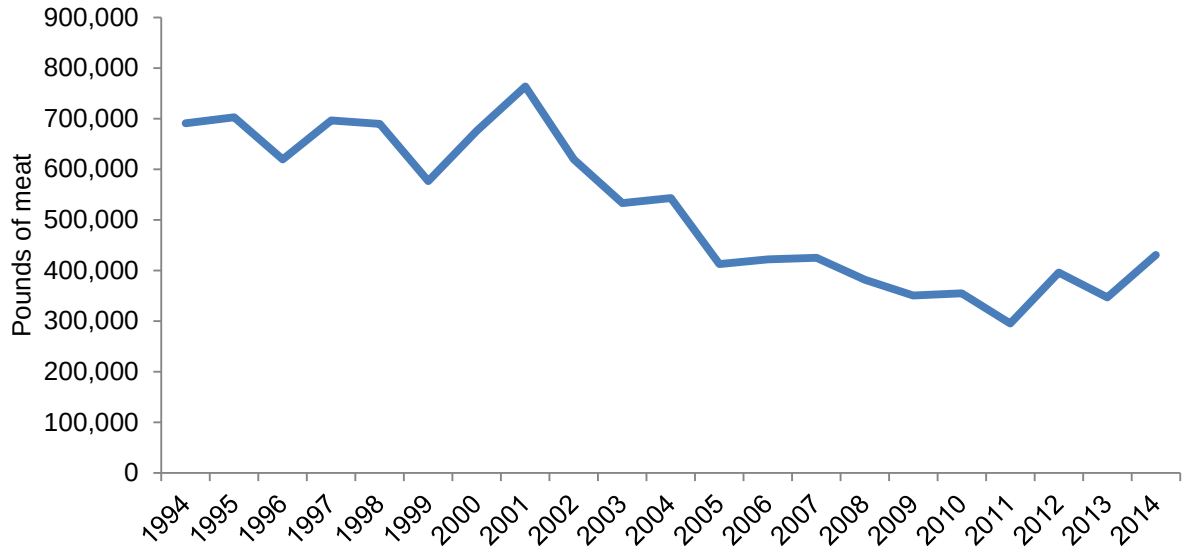


Figure 1. Annual hard clam landings (Pounds of meat) from private and public bottom in North Carolina, 1994-2014.

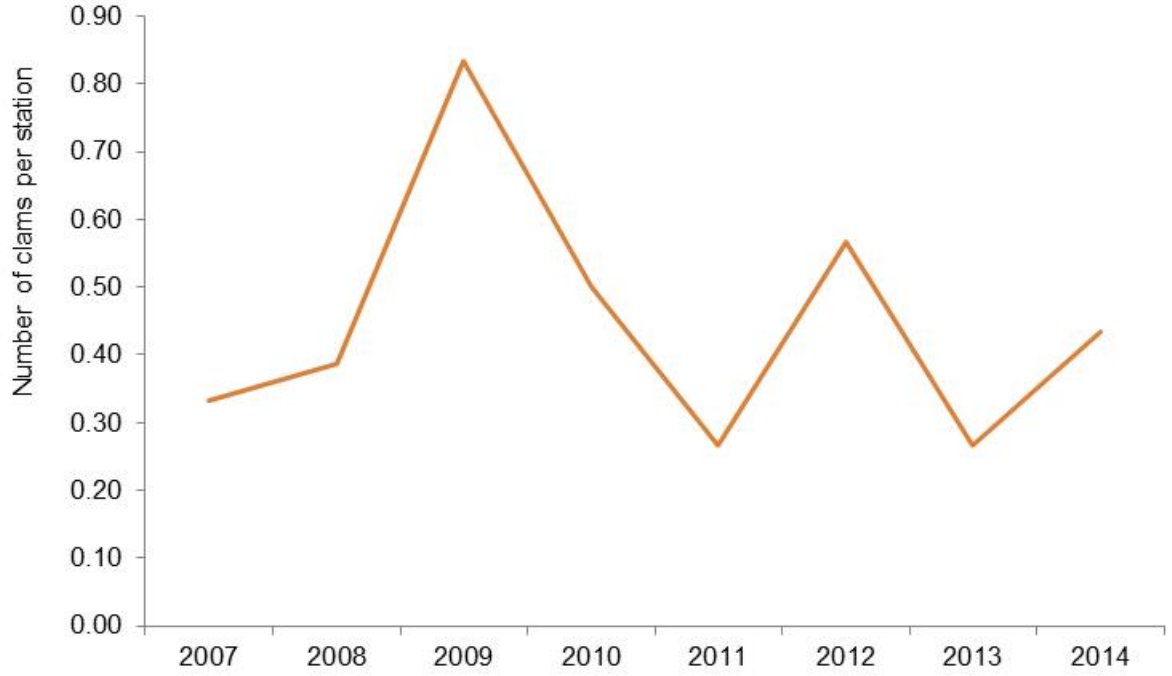


Figure 2. Annual catch per unit effort (Number of clams per stations) of hard clams in Core Sound from the independent sampling program 640, 2007 to 2014.

FISHERY MANAGEMENT PLAN UPDATE
KINGFISHES
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 2007
Amendments:	None
Revisions:	None
Supplements:	None
Information Updates:	Scheduled for completion December 2015
Schedule Changes:	None
Next Benchmark Review:	January 2020

The original 2007 Kingfish FMP developed management strategies that ensure a long-term sustainable harvest for recreational and commercial fisheries of North Carolina. The Marine Fisheries Commission approved the kingfish rules which included proclamation authority for the NCDMF director to impose restrictions on season, areas, quantity, gear, or size and a rewording of 15A NCAC 3J .0202. The Kingfish FMP is currently undergoing an Information Update scheduled for completion in December of 2015.

Management Unit

The North Carolina Kingfish FMP applies to all joint and coastal waters throughout North Carolina.

Goal and Objectives

The goal of the 2007 Kingfish Fishery Management Plan is to determine the status of the stock and ensure the long-term sustainability for the kingfishes stock in North Carolina (NCDMF 2007).

Objectives:

1. Develop an objective management program that provides conservation of the resource and sustainable harvest in the fishery.

2. Ensure that the spawning stock is of sufficient capacity to prevent recruitment overfishing.

3. Address socio-economic concerns of all user groups.

4. Restore, improve, and protect critical habitats that affect growth, survival, and reproduction of the North Carolina stock of kingfishes.

5. Evaluate, enhance, and initiate studies to increase our understanding of kingfishes' biology and population dynamics in North Carolina.

6. Promote public awareness regarding the status and management of the North Carolina kingfishes stock.

STATUS OF THE STOCK

Stock Status

The 2014 stock status for kingfish in North Carolina is “viable”. The stock status is based on an annual evaluation of trends in various fishery independent abundance indices and relative fishing mortality.

Stock Assessment

The 2007 Kingfish FMP selected the use of trend analysis and management triggers as the preferred management strategy to monitor the viability of the kingfish stock in North Carolina (NCDMF 2007). The trend analysis incorporates management triggers to alert NCDMF and NCMFC to the potential need for management action based on stock conditions. The activation of any two management triggers (regardless of trigger category) two years in a row warrants further data evaluation and potential management action. The analysis is updated each year and all trends relative to management triggers are provided as part of this annual update. Management triggers are based on fishery independent indices of abundance Young Of Year (YOY), adult fish, and proportion of catch greater than size at 50% maturity (L_{50}) and a relative fishing mortality index. YOY fish includes new young fish that enter the population that year. L_{50} is the length at which 50% of the adult population is sexually mature and ready to spawn. Based on updated analysis, no management triggers have been activated in either 2013 or 2014 and the stock is considered “viable.”

A formal quantitative stock assessment for kingfish is not available for kingfish in North Carolina; therefore no determination can be made relative to an overfishing or overfished status. Prior attempts at a stock assessment during the 2007 FMP development were not successful, primarily due to limited data. From these prior attempts, all reviewers noted a lack of migration (mixing) data to determine the movement patterns of kingfishes along North Carolina and the entire Atlantic coast. A regional (multi-state) stock assessment approach is likely needed to best determine the stock status for kingfish along the Atlantic coast including North Carolina.

STATUS OF THE FISHERY

Current Regulations

For shrimp or crab trawls, there is a three hundred pound trip limit for kingfishes south of Bogue Inlet from December 1 through March 31.

Commercial Landings

Commercial landings for kingfishes include southern, northern, and Gulf kingfishes. Landings have fluctuated historically, but have been on an increasing trend since 2011. The 2014 landings were the highest since 1995 for the entire time series (Figure 1). The vast majority of kingfishes landed are from the ocean gillnet fishery. The average landings from 1994-2014 was 657,666 pounds. Harvest of kingfishes is seasonal with peak landings in April and November. Peaks in landings coincide with seasonal movements of kingfishes along the Atlantic coast.

Recreational Landings

Recreational landings for kingfish include southern, northern, and Gulf kingfishes. Total recreational landings have been on an increasing trend since 1983 (Figure 2). Most kingfishes are landed from the ocean and the majority of the fish from man-made structures, such as piers, jetties, or bridges, or from beaches. A smaller portion of kingfishes are caught in estuarine waters of the state and the majority of those fish are harvested by anglers fishing from private vessels. Recreational harvest of kingfishes is also seasonal with the majority of fish harvested during the spring and the fall, and lowest during the summer.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Kingfishes are sampled from a variety of commercial fishery surveys, including the estuarine long haul, ocean trawl, pound net, ocean gillnet, estuarine gillnet and ocean beach seine fisheries in NC. A total of 38,995 kingfishes were measured from 2005 to 2014 [(32,713 southern, 3,327 northern and 2,955 Gulf)(Table 1)]. Mean length for southern kingfish ranged from 290 to 308 mm, with a minimum of 137 mm and a maximum of 558 mm. Mean length for northern kingfish ranged from 305 to 338 mm, with a minimum of 110 mm and a maximum of 445 mm. Mean length for Gulf kingfish ranged from 302 to 340 mm for with a minimum of 188 mm and a maximum of 448 mm.

Fishery-Independent Monitoring

The Pamlico Sound Survey catches the most kingfishes of any of NCDMF fishery independent sampling programs, and the majority of those are southern kingfishes. This survey has been running, uninterrupted for twenty-five years. From 1991 to present, the Pamlico Sound Survey has been conducted during the middle two weeks in June and September. The stations sampled are randomly selected from strata based upon depth and geographic location. The sample area covers all of Pamlico Sound and its bays, as well as Croatan Sound up to the Highway 64 Bridge, the Pamlico River up to Blounts Bay, the Pungo River up to Smith Creek, and the Neuse River up to Upper Broad Creek. However, most kingfish are caught in Pamlico Sound proper, and very few from the Neuse, Pamlico, and Pungo rivers.

Randomly selected stations (grids- one-minute by one-minute grid system equivalent to one square nautical mile) are sampled over a two week period, the second and third week of the month in both June and September. Tow duration is 20 minutes at 2.5 knots using the R/V Carolina Coast pulling double rigged demersal mongoose trawls. The R/V Carolina Coast is a 44-ft fiberglass hulled double rigged trawler owned and operated by the North Carolina Division of Marine Fisheries (NCDMF). Physical and environmental conditions such as temperature

(^{o}C), salinity (ppt), dissolved oxygen (mg/L), bottom composition, a qualitative assessment of sediment size, and water clarity (began 2008) are recorded at the end of each tow.

Table 2 summarizes the age data for kingfishes (southern, northern, and Gulf), collected from 2005 through 2014. The majority of age kingfish age samples came from Pamlico Sound independent gillnet survey, followed by the commercial ocean gillnet fishery. Southern kingfish ages ranged from 0 to 9 years old. Northern kingfish ages ranges from 0 to 5 years old. Gulf kingfish ages ranged from 0 to 7 year old. The modal ages ranged from 1 to 3 years for southern and Gulf kingfishes, and 0 to 2 for northern kingfish.

MANAGEMENT STRATEGY

The 2007 Kingfish FMP management strategy included three management triggers based on biological, dependent catch per unit effort (CPUE), and independent surveys indices. Management action through proclamation *would be considered* if one trigger was activated. Triggers were to be updated and evaluated annually.

The management triggers adopted in the 2007 Kingfish FMP were evaluated and recommendations were put forth to improve and refine those triggers. Based on the evaluation of the newly updated management triggers, the NCDMF recommended that consideration of management action should not be based on any one trigger alone but some combination of two or more triggers. This change accounts for normal inter-annual variation due to environmental factors.

The Pamlico Sound Trawl Survey and the Southeast Area Monitoring and Assessment Program (SEAMAP) survey data are currently used for management triggers for kingfishes in NC. The L_{50} management trigger is based on a conservative proportion of adults in the population. This is the length at which 50% of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in length. Data sources for this management trigger come from two fisheries independent surveys; the summer component of the SEAMAP survey, and the June component of the Pamlico Sound Trawl survey. If the proportion of adults $\geq L_{50}$ falls below 2/3 of the average proportion of adults $\geq L_{50}$ for the time series, then the trigger will be considered tripped.

The September portion of the Pamlico Sound Survey is also used to calculate a young of year index of relative abundance because there are more southern fish collected in the fall, and more young-of-year fish. The summer portion (June, July, and August) is used to calculate an adult index of abundance and the fall portion of SEAMAP is used as a young of year index of abundance.

The relative index derived from the Program 195 survey was calculated using a stratified generalized linear model (GLM) approach. The indices derived from the SEAMAP survey were computed using standard (non-stratified) GLMs.

Relative *F* is a simple method for estimating trends in *F* (Sinclair 1998). It is estimated as catch (commercial landings plus recreational harvest) divided by a fisheries-independent index of relative abundance. Here, catch (commercial landings plus recreational harvest) was divided by the SEAMAP spring index (Onslow, Raleigh, and Long bays, inner—shallow—strata) of relative abundance, given that the majority of catch occurs in the spring.

Biological Monitoring
Proportion of adults ≥ length at 50% maturity (L_{50}) for NCDMF Program 195 June (Figure 3)
Proportion of adults ≥ L_{50} for SEAMAP summer (Figure 4)
→ If the proportion of adults ≥ L_{50} falls below 2/3 of the average proportion of adults ≥ L_{50} for the time series, then the trigger will be considered tripped.

Fisheries-Independent Surveys—Juvenile and Adult
NCDMF Program 195 September index of YOY relative abundance (Figure 5)
SEAMAP summer index of adult relative abundance (Figure 6)
SEAMAP fall index of YOY relative abundance (Figure 7)
→ If a fisheries-independent survey falls below 2/3 of the average abundance for the time series (through 2014), then the trigger will be considered tripped.

Other
Relative fishing mortality rate (*F*) (Figure 8)
→ If relative *F* rises above the average relative *F* for the time series (through 2014) plus 1/3 of that average, the trigger will be considered tripped.

A summary of the various management triggers by year is provided in Table 3. Bold values indicate years when a particular management trigger was activated. None of the management triggers were activated in 2013 or 2014.

MANAGEMENT AND RESEARCH NEEDS

Table 4 provides a summary of management strategies for kingfishes and Table 5 provides a list of research needs.

FISHERY MANAGEMENT PLAN RECOMMENDATION

The NCDMF recommends maintaining the current timing for the information update. On May 21, 2015, the NC Marine Fisheries Commission (MFC) voted to proceed with an information update, with no management changes for kingfishes. The draft information update will be presented to the commission at its August 2015 business meeting for approval to post on the division web site for public review.

LITERATURE CITED

NCDMF 2007. North Carolina Fishery Management Plan, Kingfishes. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC., 235 pp.

Sinclair, A.F. 1998. Estimating trends in fishing mortality at age and length directly from research survey and commercial catch data. Canadian Journal of Fisheries and Aquatic Sciences 55(5):1248–1263.

TABLES

Table 1. Summary of length data sampled from the kingfish commercial fishery.

Southern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	299	160	415	2,871
2006	301	137	438	3,738
2007	290	146	498	5,135
2008	292	160	446	5,915
2009	293	176	418	3,845
2010	295	170	558	2,461
2011	297	206	461	2,074
2012	294	203	433	2,878
2013	308	164	409	1,357
2014	302	211	532	2,439

Northern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	302	173	407	132
2006	322	182	410	392
2007	317	180	439	633
2008	319	110	423	308
2009	315	174	401	271
2010	322	228	406	182
2011	318	219	431	203
2012	323	197	445	293
2013	336	218	406	754
2014	340	277	423	159

Gulf Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	312	205	448	252
2006	326	254	437	240
2007	305	188	447	481
2008	306	199	447	445
2009	313	251	406	292
2010	318	260	412	135
2011	338	219	455	309
2012	322	233	406	147
2013	328	235	443	469
2014	310	234	394	185

Table 2. Kingfish age data collected from all sources combined.

Southern Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	2	0	7	173
2006	2	0	6	438
2007	1	0	7	852
2008	2	0	9	324
2009	2	2	5	15
2010	2	1	5	163
2011	2	0	6	243
2012	1	1	6	228
2013	2	1	5	297
2014	3	0	5	269

Northern Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	-	1	2	2
2006	1	1	3	39
2007	0	0	2	20
2008	0	0	5	50
2009	1	1	3	14
2010	2	1	3	4
2011	2	0	4	115
2012	1	0	3	17
2013	2	1	3	26
2014	2	2	2	1

Gulf Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	1	1	6	15
2006	1	1	4	22
2007	1	0	4	118
2008	1	0	7	47
2009	-	-	-	0
2010	3	3	3	1
2011	2	1	6	28
2012	1	0	4	98
2013	1	1	4	44
2014	2	1	4	38

Table 3. Summary of management trigger organized by category. Bold indicate values that activate a trigger.

	BIOLOGICAL MONITORING		**FISHERIES-INDEPENDENT SURVEYS**			**OTHER**
	Proportion of Adults >= L50		**YOY Indices**		**Adult Index**	**Relative *F***
Year	Program 195 June	SEAMAP Summer	Program 195 September	SEAMAP Fall	SEAMAP Summer	Relative *F*
1987	0.602		**0.538**			
1988	0.450		**0.926**			
1989	**0.300**	0.585	**1.31**	10.5	**7.63**	17,627
1990	0.529	0.463	**2.35**	9.93	29.1	**92,209**
1991	0.667	0.894	**3.45**	9.92	41.7	31,107
1992	0.429	0.622	**1.37**	**5.20**	15.7	25,449
1993	0.542	0.456	**0.106**	**4.70**	14.2	**59,442**
1994	0.794	0.917	5.07	11.3	**3.10**	**137,621**
1995	0.440	0.486	8.60	**2.36**	**11.1**	**49,097**
1996	0.872	0.780	**0.208**	9.77	**5.44**	30,411
1997	0.576	**0.373**	**0.452**	**4.00**	**11.0**	20,276
1998	1.00	0.769	**0.207**	10.6	**5.65**	9,743
1999	0.920	0.608	**3.79**	22.6	28.0	24,813
2000	0.733	0.929	8.21	8.31	**11.6**	**83,334**
2001	0.660	**0.303**	4.42	**5.15**	25.6	20,962
2002	0.704	0.882	6.30	14.2	**11.9**	31,765
2003	0.860	0.645	5.81	**4.24**	18.5	5,706
2004	0.513	**0.284**	**2.98**	13.2	45.0	5,579
2005	0.594	0.643	**1.52**	11.0	18.1	5,530
2006	0.541	0.423	20.4	**5.55**	23.7	13,604
2007	**0.338**	0.521	8.97	**6.59**	**8.42**	**45,254**
2008	0.480	0.577	8.79	9.56	**3.99**	41,046
2009	0.591	0.398	24.9	**3.75**	16.2	33,941
2010	0.508	0.786	**1.47**	16.9	**11.9**	20,169
2011	0.447	0.507	16.8	31.3	21.1	31,533
2012	0.523	**0.368**	5.02	9.22	61.9	8,052
2013	0.659	0.558	16.9	10.7	39.5	4,048
2014	0.411	0.664	6.59	10.8	37.2	13,954
Threshold	<0.397	<0.396	<3.98	<6.7	<13.5	>44,219
Total Years	28	26	28	26	26	26
Years Trigger Activated	2	4	14	9	11	6

Table 4. Summary of management strategies and outcomes

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Fisheries Management		
The proposed management strategy for kingfishes in North Carolina is to 1) maintain a sustainable harvest of kingfishes over the long-term and 2) promote public education. The first strategy will be accomplished by developing management triggers based on the biology of kingfishes, landings of kingfishes, independent surveys, and requesting a stock assessment of kingfishes be conducted by Atlantic States Marine Fisheries Commission (ASMFC). The second strategy will be accomplished by the NCDMF working to enhance public information and education.	1, 2, 5, 6	• Management triggers are in place • DMF Director has proclamation authority should it be necessary to implement regulations to manage kingfish • Meetings and presentations have been utilized to educate and inform the public • NC FMP has been finalized and is the most comprehensive document available on the three kingfish species. • Next stock information update is scheduled for December 2015
Recommend ASMFC conduct a coastwide stock assessment on sea mullet.	5	ASMFC determined a stock assessment for the kingfishes was not necessary due to the positive trends in SEAMAP southern kingfish CPUE.
Endorse additional research to reduce bycatch in the shrimp trawl fishery, primarily shrimp trawl characterization studies involving at-sea observers and investigations into fish excluder devices with a higher success rate for reducing the harvest and retention of kingfish in shrimp trawls.	5	Bycatch characterization study of NC commercial shrimp trawl fishery was conducted in 2008.
Implement rule giving DMF director proclamation authority to manage kingfish.	3	Rule **15A NCAC 3M .0518** has been approved
Habitat and Water Quality		
The NCDCM should continue promoting the use of shoreline stabilization alternatives that maintain or enhance fish habitat. That includes using oyster cultch or limestone marl in constructing the sills (granite sills do not attract oyster larvae).	4	Refer to CHPP
To ensure protection of kingfish nursery areas, fish-friendly alternatives to vertical stabilization should be required around	4	Refer to CHPP

primary and secondary nursery areas.		
The location and designation of nursery habitats should be continued and expanded by the NCDMF.	4	Refer to CHPP
No trawl areas and mechanical harvest prohibited areas should be expanded to include recovery/restoration areas for subtidal oyster beds and SAV.	4	Refer to CHPP
Expansion and coordination of habitat monitoring efforts is needed to acquire data for modeling the location of potential recovery/restoration sites for oysters and SAV.	4	Refer to CHPP
Any proposed stabilization project threatening the passage of kingfish larvae through coastal inlets should be avoided.	4	Refer to CHPP
All coastal-draining river basins should be considered for NSW classification because they all deliver excess nutrients to coastal waters, regardless of flushing rate.	4	Refer to CHPP
Efforts to implement phase II stormwater rules must be continued.	4	Refer to CHPP
The EEP process should be extended to other development projects.	4	Refer to CHPP
Reduce sediment and nutrient loading by addressing multiple sources, including: • improvement and continuation of urban and agricultural BMPs, • more stringent sediment controls on construction projects, and • implementation of additional buffers along coastal waters.	4	Refer to CHPP

Table 5. Research needs and outcomes.

Management Related Research Needs	**Outcome**
Determine stock structure using genetics of kingfishes along North Carolina and the Atlantic Coast (LOW)	Grant approved for UNCW and DMF to use genetic markers to delineate the population structure
Conduct a coast-wide stock assessment of southern kingfish along the Atlantic Coast including estimation of biological reference points for sustainable harvest (HIGH)	No action
Validate YOY and adult indices used in trend analysis (HIGH)	UNCW has conducted seine surveys in the ocean to determine trends for all three species.
Develop a fisheries-independent survey in the ocean for juvenile and adult kingfishes (HIGH)	No action
Collect observer data from commercial fishing operations to estimate at-sea species composition of the catch, discard rates, and lengths (HIGH)	DMF has observers collecting data at sea for the flounder gill net fishery and other fisheries
Improve recreational data collection, particularly the species composition of discards, discard rates and associated biological data (HIGH)	Steps have been taken to improve sampling in recreational fisheries, including a carcass collection program
Improve dependent commercial data collection of more sample sizes for life history information (MEDIUM)	NCDMF ageing study collects kingfish from life history data
Evaluate and potentially expand the NCDMF fishery-independent gill-net survey to provide data on species composition, abundance trends, and population age structure by including additional areas of North Carolina's estuarine and near-shore ocean waters (MEDIUM)	No action
Continue bycatch reduction device studies in the shrimp trawl fishery to decrease bycatch (MEDIUM)	Ongoing research through DMF and various federal agencies.
Biological Research Needs	**Outcome**
Develop tagging study to estimate natural and fishing mortality, to investigate stock structure, and to understand movement patterns (HIGH)	No action
Collect histological data to develop maturity schedule with priority to southern kingfish (HIGH)	No action
Conduct study to estimate fecundity with priority to southern kingfish (MEDIUM)	No action
Conduct study to identify spawning areas with priority for southern kingfish (MEDIUM)	No action
Conduct an age validation study with priority to southern kingfish (HIGH)	No action
Sample inlets and river plumes to determine the importance of these areas for kingfishes and other estuarine-dependent species (LOW)	Sampling in the nearshore ocean through NC Adult Fishery Independent Survey was initiated in 2008 but discontinued in 2015. Gill net sampling in Cape Fear, New, Neuse, Pamlico, and Pungo rivers

	continues.
Determine the effects of beach re-nourishment on kingfishes and their prey (LOW).	Grant approved for UNCW to investigate effects of beach renourishment
Conduct a study to investigate how tidal stages and time of day influence feeding in kingfishes (LOW)	No action
Social and Economic Research Needs	**Outcome**
Increase the sample size of surveyed participants in the commercial kingfish fishery to better determine specific business characteristics and the economics of working in the fishery (LOW)	NCDMF conducted a study of CRFL holders in 2009/2010. But
Update information on the participants in the recreational kingfish fishery (LOW)	Socioeconomic study was conducted by NCDMF on piers.

FIGURES

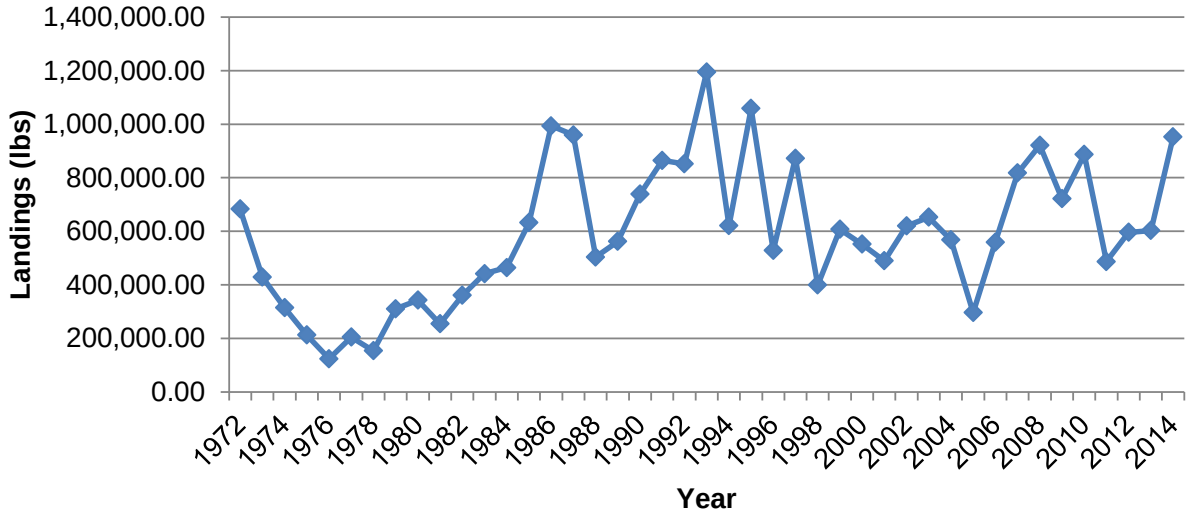


Figure 1. Commercial landings of kingfishes (southern, northern, and Gulf combined) from 1972 to 2014.

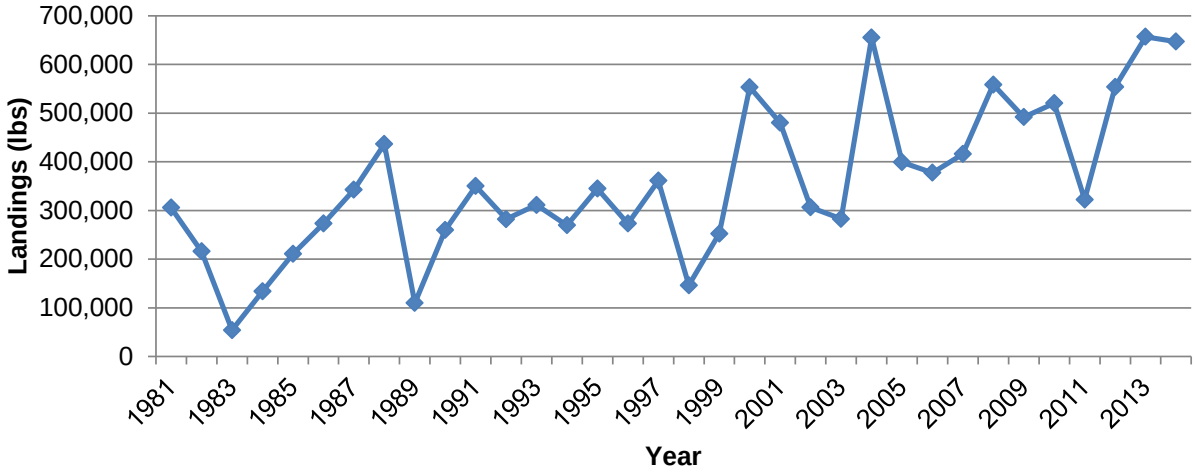


Figure 2. Recreational landings of kingfishes (southern, northern, and Gulf combined) from 1981 to 2014.

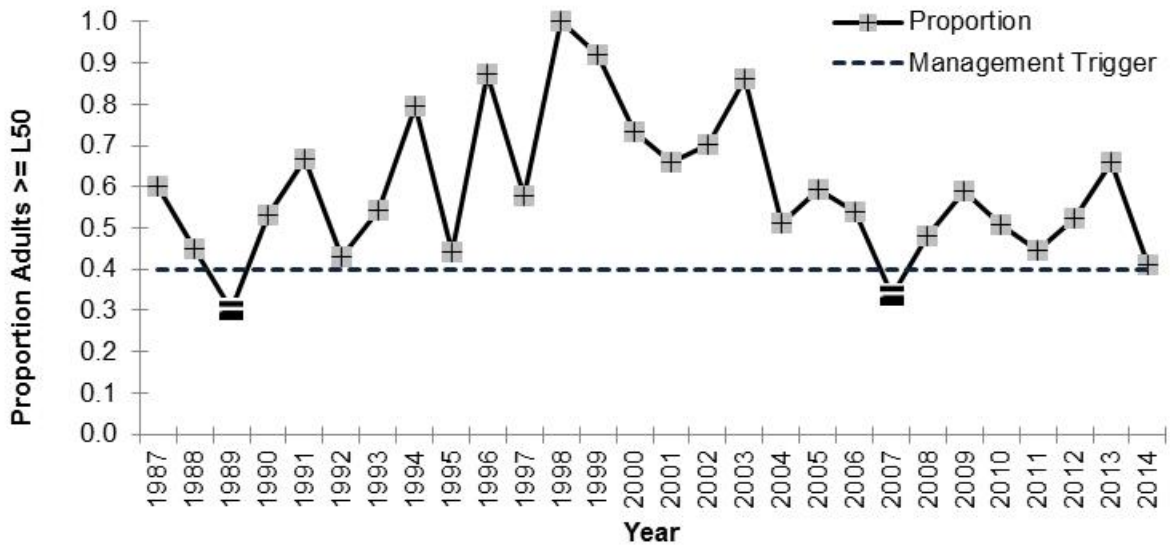


Figure 3. Annual proportions of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the June component of the NCDMF Program 195 survey (excluding strata NR, PR, and PUN), 1987–2013. Dotted line represents 2/3 of the average of the time series.

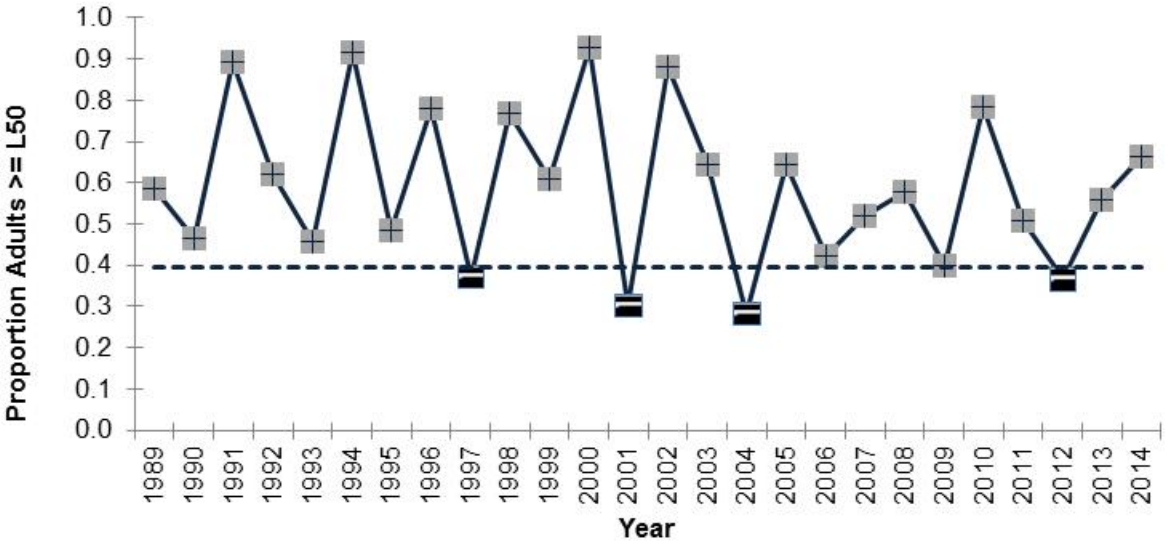


Figure 4. Annual proportions of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the summer component of the SEAMAP survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2013. Dotted line represents 2/3 of the average of the time series.

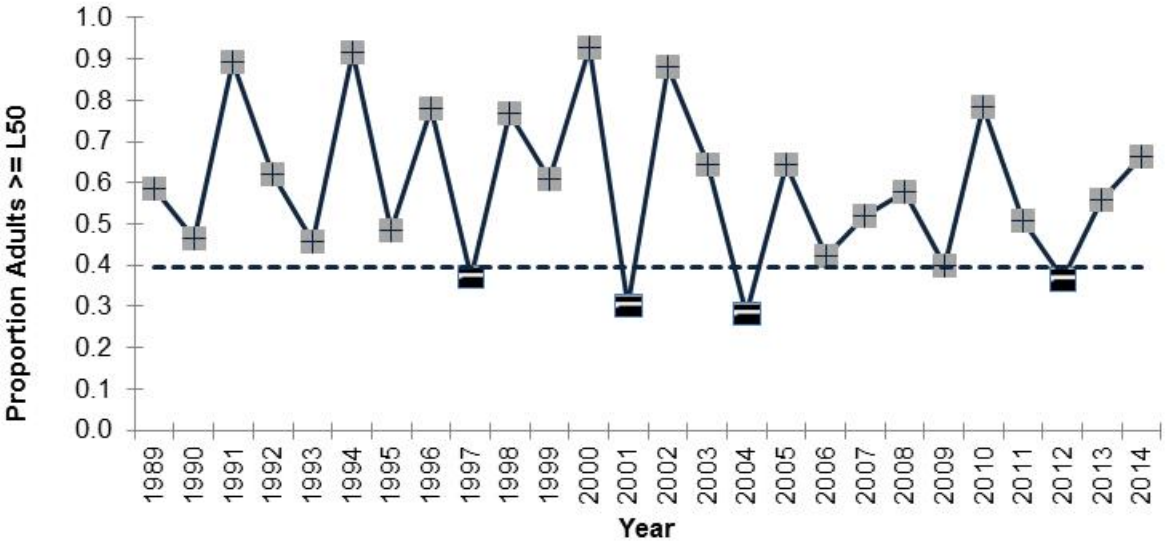


Figure 5. Annual index of relative YOY abundance for southern kingfish derived from the September component of the NCDMF Program 195 survey (excluding strata NR, PR, and PUN), 1987–2013. Dotted line represents 2/3 of the average of the time series.

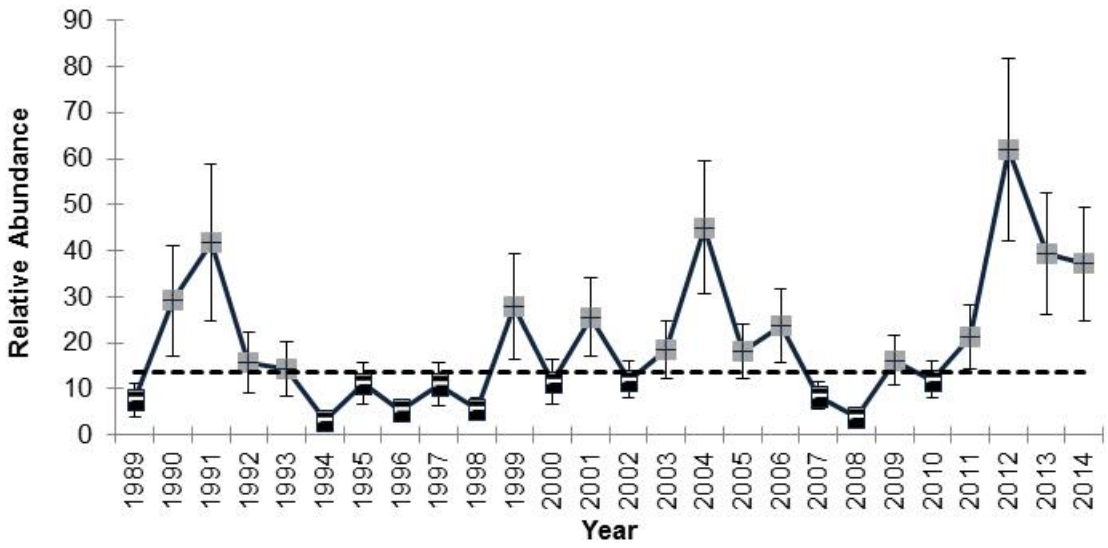


Figure 6. Annual index of relative adult abundance for southern kingfish derived from the summer component of the SEAMAP survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2013. Dotted line represents 2/3 of the average of the time series.

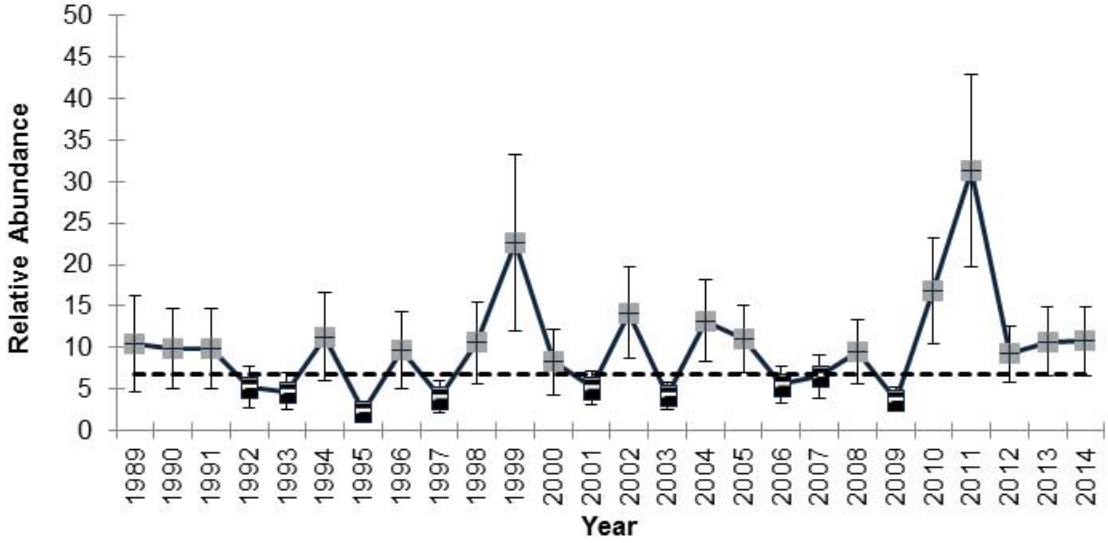


Figure 7. Annual index of relative YOY abundance for southern kingfish derived from the fall component of the SEAMAP survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2013. Dotted line represents 2/3 of the average of the time series.

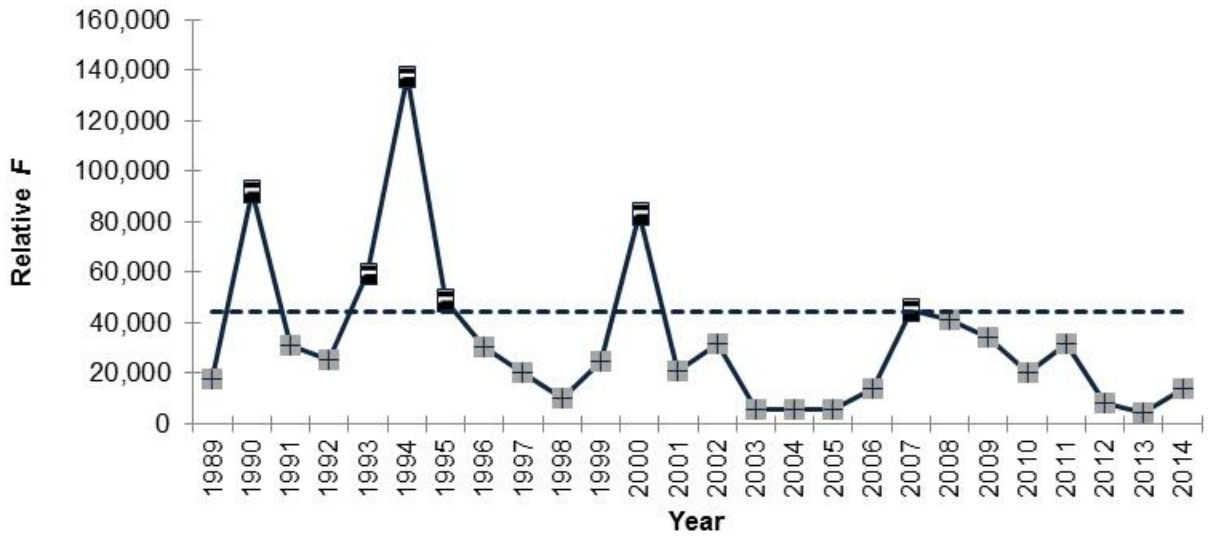


Figure 8. Annual index of relative YOY abundance for southern kingfish derived from the fall component of the SEAMAP survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2013. Dotted line represents 2/3 of the average of the time series.

FISHERY MANAGEMENT PLAN UPDATE
RED DRUM
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	March 2001
Amendments:	Amendment 1 – November 2008
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	July 2016

Red drum (*Sciaenops ocellatus*) in North Carolina are currently managed under Amendment 1 to the North Carolina Red Drum FMP. Harvest restrictions for the commercial and recreational fisheries were not required with the adoption of Amendment 1 in 2008. Overfishing was not occurring based on the 2007 North Carolina Division of Marine Fisheries (NCDMF) conducted red drum stock assessment (Takade and Paramore 2007). Amendment 1 did however, implement regulations to reduce the impact of mortality associated with regulatory discards. These included requiring circle hooks along with fixed weights and short leaders in the summer adult red drum recreational fishery in Pamlico Sound and further expanded the gill net attendance requirements that were originally implemented as part of the original 2001 North Carolina Red Drum FMP.

The 2001 North Carolina Red Drum FMP did implement restrictive harvest measures. Restrictions went in place in October of 1998 as “interim measures” to prevent overfishing on the stock. Harvest restrictions included: restricting all harvest of red drum to fish between 18 and 27 inches total length (previously allowed 1 over 27 inches), implemented a one fish recreational bag limit (previously 5 fish bag limit); implemented a daily trip limit for the commercial fishery that is set by the Director (previously no daily limit); and maintained the existing 250,000 pound annual commercial cap. The trip limit was designed to be low enough to reduce harvest and to deter targeting of red drum commercially. The original FMP also implemented seasonal small mesh gill net attendance requirements to reduce discard mortality of red drum. The North Carolina Red Drum FMP was approved in March of 2001 and maintained all the interim measures.

In addition to the state FMP, North Carolina also falls under the Atlantic States Marine Fisheries Commission (ASMFC) Red Drum FMP. This plan is currently managed under Amendment 2 to the interstate plan. Adopted in 2002, Amendment 2 required all states to implement management measures by January of 2003 that are projected to result in a 40% static Spawning Potential Ratio. Individual states are also required to maintain these management

strategies in order to ensure that overfishing is not occurring and that Optimum Yield (OY) in the red drum fishery can be obtained. Amendment 2 compliance requirements to the states include:

- Implementing bag and size limits projected by bag and size limit analysis to achieve the minimum 40% spawning potential ratio (SPR).
- Establishing a maximum size limit of 27 inches or less in all red drum fisheries.
- Maintaining current or more restrictive commercial fishery regulations.
- Requires any commercial cap overages from one fishing year to be subtracted from the subsequent year's commercial cap.

As a result of the management measures enacted through the 2001 North Carolina Red Drum FMP, no new management measures were required for North Carolina in order to comply with Amendment 2 to the ASMFC plan.

Management Unit

Red drum in North Carolina have both a state FMP and an interstate FMP through the framework of the ASMFC.

The North Carolina FMP applies to all joint and coastal waters throughout North Carolina.

The ASMFC plan applies to all states from Florida to Maine. The management unit for red drum along the Atlantic coast is divided into a northern and southern stock. North Carolina and all areas north along the Atlantic coast represent the northern stock.

Goal and Objectives

The goal of Amendment 1 to the North Carolina Red Drum FMP is to prevent overfishing in the red drum stocks by allowing the long-term sustainable harvest in the red drum fishery. To achieve these goals, it is recommended that the following objectives be met:

1. Achieve and maintain a minimum overfishing threshold where the rate of juvenile escapement to the adult stock is sufficient to maintain the long-term sustainable harvest in the fishery.

2. Establish a target SPR to provide the Optimum Yield from the fishery in order to maintain a state FMP that is in compliance with the requirements of the ASMFC Red Drum FMP.

3. Continue to develop an information program to educate the public and elevate their awareness of the causes and nature of problems in the red drum stock, its habitat and fisheries, and explain the rationale for management efforts to solve these problems.

4. Develop regulations that while maintaining sustainable harvest from the fishery, considers the needs of all user groups and provides adequate resource protection.

5. Promote harvest practices that minimize the mortality associated with regulatory discards of red drum.

6. In a manner consistent with Coastal Habitat Protection Plan, restore, improve and protect essential red drum habitat and environmental quality to increase growth, survival, and reproduction of red drum.

7. Improve our understanding of red drum population dynamics and ecology through the continuation of current studies and the development of better data collection methods, as well as, through the identification and encouragement of new research.

8. Initiate, enhance, and continue studies to collect and analyze the socio-economic data needed to properly monitor and manage the red drum fishery.

STATUS OF THE STOCK

Stock Status

The stock status of red drum is currently “recovering”. A stock assessment, conducted through the ASMFC in 2009 indicates that the red drum stock in North Carolina is not experiencing overfishing. A new stock assessment is scheduled for completion in 2015.

Stock Assessment

Red drum in North Carolina are currently listed as “Recovering”. Only the overfishing and not the overfished status can currently be determined for red drum. The threshold (below which the stock is experiencing overfishing) and the target fishing mortality rates correspond to those rates that achieve 30% and 40% static SPR. An assessment was last completed by the ASMFC in 2009. Based on the results of this assessment the spawning potential ratio was at or above target levels (Figure 1). Abundance of age 1 – 3 red drum increased during 1990 – 2000 after which it fluctuated widely (Figure 2). The increase in abundance of these age groups can be explained by the reduction in exploitation rates in the early part of the time series with relative stability since then (Figure 3).

Management measures in place have effectively controlled fishing mortality to a level sufficient to meet management targets. It is critical to note that reaching the target is only the first step in maintaining this fishery. In order for the red drum stock to be considered healthy and viable, the 40% static spawning potential ratio must be maintained continuously over time. Increases in the harvest rates (relaxation of current regulations) of red drum should only be allowed if those increases are not anticipated to lower the static SPR below the management goal (40%).

An updated stock assessment is currently underway through the ASMFC and is slated to be finalized later in 2015. The stock assessment results will be included as part of the upcoming formal review of the state red drum FMP.

STATUS OF THE FISHERY

Current Regulations

All harvest is limited to red drum between an 18 inch total length (TL) minimum size and 27 inch TL maximum size for both the recreational and commercial fishery. The recreational bag limit is one fish per day. A daily commercial bycatch allowance and an annual cap of 250,000 pounds,

with payback of any overage, constrain the commercial harvest. The commercial annual cap is monitored from September 1 to August 31. Within a fishing year, 150,000 pounds is allocated to the period between September 1 and April 30 and the remainder is allocated to the period of May 1 to August 31. Check with the NCDMF for the most recent proclamation on red drum harvest limits including trip limits and bycatch requirements.

Commercial Landings

North Carolina's commercial landings in 2014 were 90,954 pounds; a sharp decline from 2013 landings (371,949 pounds) and lower than the ten-year mean of 182,461 pounds (2005-2014; Table 1 and Figure 4). Gill nets dominated the catch in 2014 accounting for 88% of the commercial landings (Table 2).
Amendment 2 to the North Carolina Red Drum FMP maintained the 250,000 pound annual cap in the commercial fishery, but shifted the commercial fishing year to September 1 through August 31. Since that time, North Carolina's commercial landings during this fishing year have averaged 178,706 pounds. The 2009/2010 and 2013/2014 fishing years had overages (Table 3). All overages were deducted from the following year's cap allowance.

Recreational Landings

Recreational fishing activity is monitored through the Marine Recreational Information Program (MRIP). Recreational landings in 2014 were 598,166 pounds; well above the 2005-2014 ten-year average (333,289 pounds) but a decrease from 2013 landings (676,050 pounds; Table 1 and Figure 4). Releases totaled 383,421 fish in 2014; below the average 580,785 fish from 2005-2014.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery dependent sampling conducted by the NCDMF since 1982. Data collected in this program allow the size and age distribution of red drum to be characterized by gear/fishery. Predominant fisheries for red drum include estuarine gill nets, long haul seine/swipe nets, pound nets, and beach haul seines. Over the past decade gill nets have been the dominant gear used for red drum accounting for >90% of the overall harvest. In 2014, 88% of the red drum harvest was taken in gill nets, followed by pound nets with 11% (Table 2). In all, 444 red drum, primarily from set gill nets, were measured from the commercial fishery in 2014 (Table 4). The average size was 23 inches fork length. Average size has varied little over time ranging from 21 to 23 inches fork length since 2005. With the 18 to 27 inch slot limit on harvest, nearly all landings were from age one and two year old fish.
Similar to the commercial fishery, average size varies little from year to year in the recreational fishery (Table 5). In 2014, the average size recreational fish harvested was 23 inches fork length. From 2005 to 2014 this range varied little (21 to 23 inches fork length).

Fishery-Independent Monitoring

The NCDMF has conducted a juvenile red drum seine survey on an annual basis since 1991. The seine survey provides an index of abundance for juvenile (age-0) red drum with sampling occurring from September through November. The relative abundance of juvenile red drum is highly variable with both high and low abundance occurring in recent years. In 2014, 270 juvenile

red drum were taken in 120 seine samples for an overall state mean CPUE of 2.3. The 2014 overall mean CPUE was higher than 2013 (1.1) but was lower than the long term average of the survey of 5.5 (Table 6; Figure 5). Information gathered from this survey is currently used as an input parameter in the ASMFC Atlantic coast red drum stock assessment.

A fishery independent gill net survey was initiated by the NCDMF in May of 2001. The survey utilizes a stratified random sampling scheme designed to characterize the size and age distribution for key estuarine species in Pamlico Sound. By continuing a long-term database of age composition and developing an index of abundance for red drum this survey will help managers assess the red drum stocks without relying solely on commercial and recreational fishery dependent data. The overall red drum CPUE was 3.14 in 2014, the fourth highest in the time series (Table 7; Figure 6). The survey is currently used in the ASMFC Atlantic coast red drum stock assessment as an annual index of relative abundance for age-1 and age-2 red drum.

North Carolina initiated an adult red drum longline survey in 2007 that has continued through 2014. The primary objective of the survey is to provide a fisheries independent index of abundance for adult red drum occurring in North Carolina. From July through October, a standardized, stratified random sample design is employed. A standard sample consists of 1,500 meters of mainline set with 100 gangions placed at 15 meter intervals (100 hooks/set). Soak times are approximately 30 minutes. All random sampling takes place in Pamlico Sound. During the 2014 season, 322 red drum were captured out of 72 stratified random sets (4.5 red drum per set) which is near the time series average of 5.2 red drum per set (Table 8; Figure 7). Red drum ranged from 30 to 48 inches fork length with most being >40 inches in length. Sampling is scheduled to continue in 2015 and this survey is currently being considered as an input in the 2015 ASMFC red drum stock assessment.

In order to describe the age structure of harvest and indices, red drum age structures are collected from various fishery independent (scientific surveys) and dependent (fisheries) sources throughout the year. In 2014, 560 red drum were collected ranging in age from 0 to 41 years (Table 9). The majority of red drum collected from harvest (18 to 27 inches total length) are ages 1-3.

MANAGEMENT STRATEGY

Red drum in North Carolina are managed under Amendment 1 to the North Carolina Red Drum FMP and Amendment 2 to the ASMFC Red Drum FMP. Both plans have an identical management threshold (overfishing) and management target (30% and 40% static Spawning Potential Ratio). Stock status is determined by a formal, peer reviewed stock assessment. Amendment 2 to the ASMFC Red Drum FMP requires specific compliance criteria, including harvest restrictions designed to achieve the management target. Any changes to harvest that deviate from those options provided in this plan must be approved by the ASMFC South Atlantic Board. Amendment 1 to the North Carolina Red Drum FMP maintained measures for compliance and also implemented measures to reduce losses from discards in both the recreational and commercial fisheries (Table 10).

The current stock status is determined by the results of the 2009 assessment (SEDAR 18). Results of the 2009 assessment indicate that red drum in North Carolina are above the overfishing threshold and likely above the target static spawning potential ratio (Figure 1). A new stock assessment is currently underway and is slated for completion in November of 2015.

MANAGEMENT AND RESEARCH NEEDS

The following management and research needs are summarized from Amendment 1 to the North Carolina Red Drum FMP (status of need provided in parenthesis).

- Assess the size distribution of recreational discards (needed).
- Improved catch and effort data for the red drum recreational fishery, particularly for the fishery that occurs at night (needed).
- Development of independent surveys to monitor both the sub-adult and adult red drum populations. (ongoing through NCDMF gillnet and longline surveys).
- Continued life history studies for age and growth. Additional work needed to update maturity schedule and collect diet information specific to North Carolina (age and growth ongoing through NCDMF; ongoing diet work through NCSU, maturity work needed).
- Identification of spawning areas in North Carolina (studies conducted for Pamlico Sound, additional work needed).
- Characterize the adult recreational fishery with regard to tackle, geographic location, bait, water temperature, seasonality, hook types, etc. (needed).
- Obtain discard estimates from the commercial fisheries including information on size and disposition (ongoing through NCDMF observer program, recent expanded coverage).
- Collect data to determine the catch rates of red drum and targeted species with regard to distance from shore in the gill net fishery (needed, some data through Fishery Resource Grants and NCDMF Independent Gill Net Survey)
- Conduct a comprehensive study of gill net fishers including information on species targeted, gear characteristics and areas fished (needed, valuable ongoing data from fish house sampling and commercial observer program).
- Conduct studies to explore ways to reduce red drum regulatory discards with commercial gear while allowing the retention of targeted species (needed).
- Conduct additional research to determine the release mortality of red drum captured in gill nets (needed).
- Economic analysis of the adult red drum fishery (needed).
- Improved social and economic data collection on the recreational and commercial fishery, including information on current conflicts and potential for future conflicts in these fisheries (needed).
- Determine juvenile habitat preference and examine if recruitment is habitat limited (needed; study conducted by UNCW).
- Examine ecological use and importance of shell bottom to red drum (Needed; some work through CRFL by UNC).
- Identify coastal wetlands and other habitats utilized by juvenile red drum and assess relationship between changes in recruitment success and changes in habitat conditions (needed).
- Assess cumulative impact of large-scale beach nourishment and inlet dredging on red drum and other demersal fish that use the surf zone (needed).
- Determine location and significance of spawning aggregation sites throughout the coast (needed).
- Determine if navigational dredging between August and October significantly impacts spawning activity (needed).
- Determine if designation of spawning areas is needed, and if specific protective measures should be developed (needed).

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATIONS

The North Carolina Red Drum FMP was scheduled for review in 2014. However, a delay in this review was approved by the North Carolina Marine Fisheries Commission. This delay allows for consideration of an updated stock assessment for red drum. The stock assessment is being conducted by the ASMFC and is scheduled for completion in November of 2015. An important note is that there is a potential that the assessment results could prompt an initiation of a review of Amendment 2 to the ASMFC Red Drum FMP. Currently the North Carolina Red Drum FMP is scheduled to begin after completion of the ASMFC red drum stock assessment.

It is recommended that the review schedule for red drum be maintained.

LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 2002. Amendment 2 to the Interstate Fishery Management Plan for Red Drum. ASMFC, Washington, DC, Fishery Management Report No. 38, 141 p.

South Atlantic Fishery management Council (SAFMC). 2009. Southeast Data, Assessment and Review 18, Stock Assessment Report, Atlantic Red Drum. North Charleston, SC. 544 p.

Takade, H and L Paramore. 2007. Stock Status of the Northern Red Drum Stock. North Carolina Division of Marine Fisheries. In-House Report, 60 p.

TABLES

Table 1. Red drum recreational harvest and number released (MRIP) and commercial harvest (North Carolina Trip Ticket Program) for 2005-2014. All weights are in pounds.

	Recreational				
	Numbers		Weight (lb)		
Year	Landed	# Released	Landed	Commercial Weight (lb)	Total Weight (lb)
2005	51,807	378,541	239,393	128,770	368,163
2006	55,714	510,264	254,214	169,206	423,420
2007	66,789	416,352	310,715	243,658	554,373
2008	50,809	658,887	231,551	229,809	461,360
2009	57,543	429,776	288,958	200,296	489,254
2010	64,024	635,876	283,286	231,828	515,114
2011	45,143	207,697	212,245	91,980	304,225
2012	52,948	1,533,010	238,312	66,519	304,831
2013	164,218	654,030	676,050	371,949	1,047,999
2014	116,921	383,421	598,166	90,594	688,760

Table 2. North Carolina's 2014 red drum commercial harvest (pounds and percent by gear) by gear type.

Gear	Landings (lb)	%
Long Haul/Seine Net	322	<1
Pound Net	9,585	11
Gill Net	80,145	88
Other Gears	542	<1
Total	90,594	100

Table 3. North Carolina's annual commercial harvest based on a fishing year beginning September 1 and ending August 31.

Fishing Year	Landings (lb)	Annual Cap
2008/2009	134,161	250,000
2009/2010	275,924	250,000
2010/2011*	126,185	224,142
2011/2012	94,298	250,000
2012/2013	134,372	250,000
2013/2014**	262,753	250,000

*adjusted to pay back overage in 2009/2010 fishing year
**2013/2014 overage has been deducted from 2014/2015 allowance

Table 4. Red drum length (FL, inches) data from commercial fish house samples, 2005-2014.

Year	Mean Fork Length	Minimum Fork Length	Maximum Fork Length	Total Number Measured
2005	21	14	28	811
2006	22	14	29	1,289
2007	22	16	31	1,502
2008	23	13	29	1,214
2009	22	14	35	1,168
2010	22	14	31	1,134
2011	22	17	31	647
2012	21	16	28	359
2013	21	12	27	1,677
2014	23	18	28	444

Table 5. Red drum length (FL, inches) data from MRIP recreational samples, 2005-2014.

Year	Mean Fork Length	Minimum Fork Length	Maximum Fork Length	Total Number Measured
2005	22	18	26	48
2006	22	14	30	79
2007	22	17	27	71
2008	22	16	27	90
2009	23	18	28	136
2010	21	11	27	193
2011	22	17	29	147
2012	22	14	41	132
2013	21	17	28	333
2014	23	17	28	316

Table 6. The annual juvenile (age-0) abundance index from the North Carolina Red Drum Juvenile Seine Survey for the period of 1991-2014. N=number of samples; CPUE=Catch per unit effort; SE=Standard Error; PSE=Proportional Standard Error.

Year	N	CPUE	SE	PSE
1991	105	15.12	2.18	14
1992	116	3.71	1.13	31
1993	117	12.65	2.22	18
1994	93	8.29	2.41	29
1995	119	4.61	0.72	16
1996	104	2.63	0.47	18
1997	126	13.13	3.07	23
1998	124	8.23	1.12	14
1999	98	1.84	0.41	23
2000	123	3.14	0.58	18
2001	122	0.97	0.19	19
2002	120	2.23	0.53	24
2003	120	5.01	1.23	25
2004	120	8.32	1.13	14
2005	120	9.02	1.40	16
2006	120	3.44	0.73	21
2007	119	5.46	1.52	28
2008	120	1.58	0.30	19
2009	120	1.89	0.66	35
2010	120	4.69	0.97	21
2011	116	10.82	3.28	30
2012	120	2.69	0.71	26
2013	120	1.11	0.30	27
2014	120	2.25	0.62	27

Table 7. Annual weighted red drum CPUE (ages combined) from the North Carolina Pamlico Sound Independent Gill Net Survey. N=number of samples; CPUE=Catch per unit effort; SE=Standard Error; PSE=Proportional Standard Error.

Year	N	CPUE	SE	PSE
2001	237	1.56	0.31	20
2002	320	3.22	0.43	13
2003	320	1.25	0.22	18
2004	320	1.99	0.29	14
2005	304	2.76	0.41	15
2006	320	2.91	0.34	12
2007	320	3.19	1.02	32
2008	320	2.31	0.34	15
2009	320	4.17	1.27	31
2010	320	2.42	0.32	13
2011	300	0.45	0.07	17
2012	308	3.13	0.59	19
2013	308	6.59	1.12	17
2014	308	3.14	0.38	12

Table 8. Annual adult red drum CPUE (ages combined) from the North Carolina Longline Survey. N=number of samples; CPUE=Catch per unit effort; SE=Standard Error; PSE=Proportional Standard Error.

Year	N	CPUE	SE	PSE
2007	71	5.68	0.92	16.29
2008	72	3.79	0.68	17.86
2009	70	5.97	1.08	18.12
2010	72	5.56	1.14	20.55
2011	72	5.64	1.00	17.74
2012	72	5.22	0.93	17.80
2013	72	4.94	0.78	15.72
2014	72	4.47	0.63	14.18

Table 9. Summary of red drum age samples collected from both dependent (commercial and recreational fisheries) and independent (surveys) sources from 2005-2014.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	1	0	34	484
2006	1	0	32	641
2007	1	0	43	495
2008	1	0	36	574
2009	1	0	40	644
2010	1	0	37	516
2011	1	0	38	256
2012	1	0	39	605
2013	1	0	41	721
2014	1	0	41	560

Table 10. Management action taken as a result of Amendment 1 to the N.C. Red Drum FMP.

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Adult Harvest Limits	Status quo (no harvest over 27 inches TL)	1 & 2	No action required
Recreational Targeting of Adult Red Drum	It is unlawful to use any hook larger than 4/0 from July 1 through September 30 in the internal coastal fishing waters of Pamlico Sound and its tributaries south of the Albemarle Sound Management Area as defined in 15A NCAC 03R .0201 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 at 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: A circle hook defined as a hook with the point of the hook directed perpendicularly back toward the shank, and with the barb either compressed or removed. A fixed sinker not less than two ounces in weight, secured not more than six inches from the fixed weight to the circle hook. (also continued education on fishing methods that minimize risk to fish)During July through September, unlawful to use J-hooks larger than 4/0 while fishing natural bait in Pamlico Sound and its tributaries, excluding the ASMA and Core Sound, south (also continued education on fishing methods that minimize risk to fish)	1, 2 & 5	Rule change 3J .0306
Recreational Bag and Size Limits	Status quo (one fish per day between 18 and 27 inches TL)	1, 2 & 4	No action required
Commercial Limits	Trip Limit and Bycatch Provision Status quo (7 fish trip limit with 50% bycatch provision). Director retains authority to modify trip limit and bycatch provision as needed. Allow the possession of up to 3 fish while engaged in fishing without requiring that they be subject to the bycatch provision. Upon landing/sale all red drum possessed would be subject to bycatch provision. Commercial Cap Continue 250,000 lb annual cap monitored from September 1 to August 31.	1, 2, 4 & 5	 New proclamation

	Implement a split season on the annual commercial cap, capping the period of September 1 to April 30 at 150,000 lb and conserving the remaining portion of the cap for the period of May 1 to August 31. Unused cap in period one would be available for period two. 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.		Rule Change 3M .0501
Estuarine Gill Net Discarded Bycatch of Red Drum Estuarine Gill Net Discarded Bycatch of Red Drum	Small Mesh Attendance (<5" stretch mesh) Year-round Attendance Expand year-round attendance within 200 yards of shore to include the area of the lower Neuse out to the mouth of the river. Seasonal Attendance 1) Modify the seasonal attendance requirements for small mesh gill nets (currently May 1 to October 31) to include the period of May 1 through November 30 in the following locations: a) All primary and permanent secondary nursery areas and modified no-trawl areas b) Within 200 yards of any shoreline for the areas of Pamlico, Pungo, Neuse and Bay Rivers and bays c) Within 50 yards of any shoreline in the areas of Pamlico and Core Sound south to the NC/SC line d) Area Core Sound and south is excluded from 50 yard shoreline attendance requirement during October and November Modification to current small mesh seasonal attendance area along the Outer Banks (i.e. modified no-trawl area) Modify attendance area between Rodanthe and Gull Island to straighten out line and allow for non-attended nets in area of deeper water	1, 2, & 5	Rule change 3R .0112 Rule change 3J .0103 & 3R .0112 Rule change 3R .0112

	Modify the current attendance line in the area of Oliver Reef, near Hatteras to allow for non-attended nets in area of deeper water. Large Mesh (>5" stretch mesh) Require all unattended large mesh gill nets to be set a minimum of 10 feet from any shoreline from June through October	1, 2, & 5	Rule change 3J .0103
The use of gigs, gaffs or spears to take red drum.	Continue to prohibit and move Proclamation FF-40-2001 into rule	1 & 2	Rule change 3M .0501

FIGURES

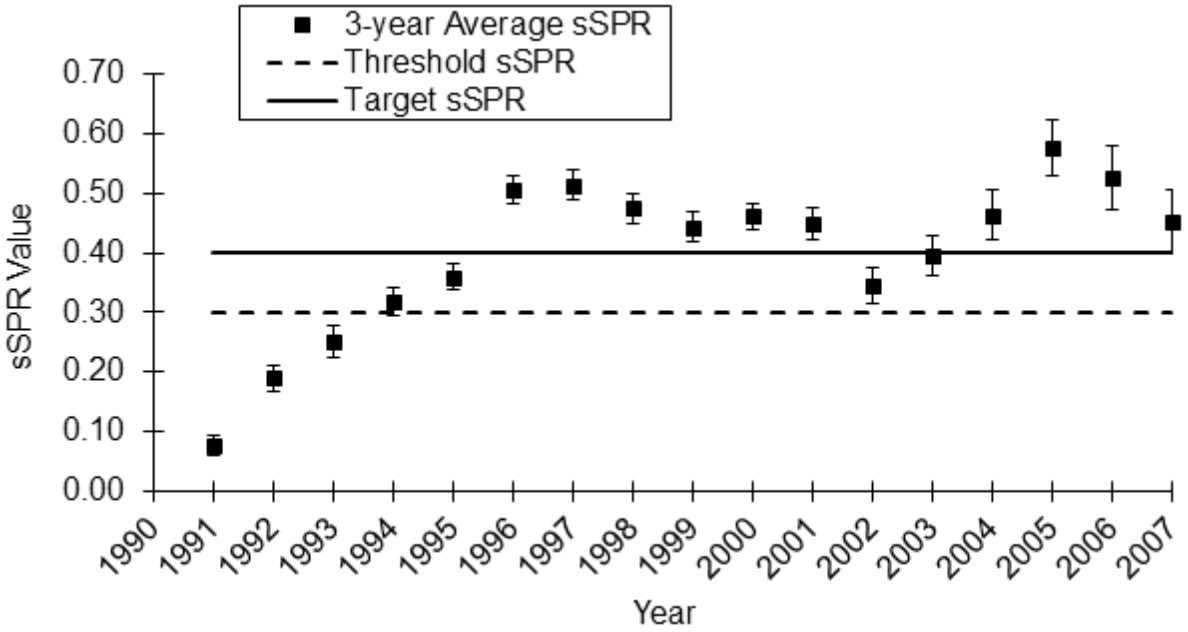


Figure 1. Northern region (North Carolina north) estimates of three-year average static spawning potential ratios. Three-year average include current and previous two year's sSPR estimates. The dashed line shows the 30% overfishing threshold and the solid line shows the 40% target sSPR.

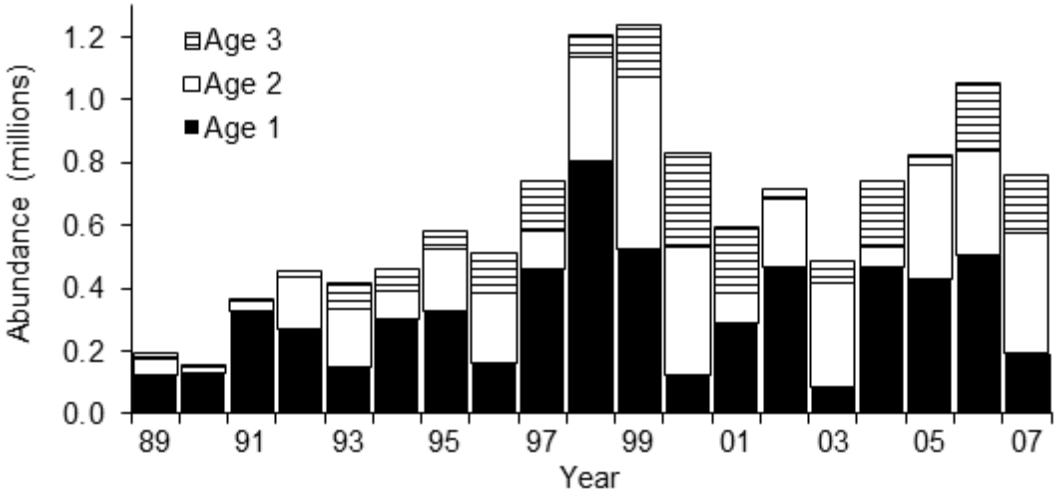


Figure 2. Estimates of abundance of red drum ages 1-3 in the northern region (North Carolina and north) during 1989-2007 (Source: SAFMC 2009).

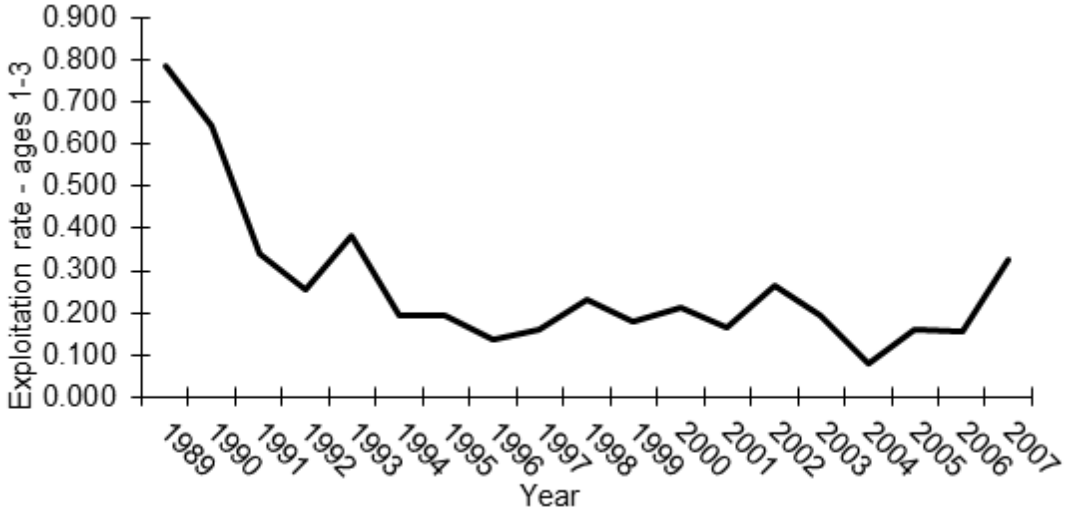


Figure 3. Estimated annual exploitation rate for red drum ages 1-3 in the northern region (North Carolina and north) during 1989-2007 (Source: SAFMC 2009).

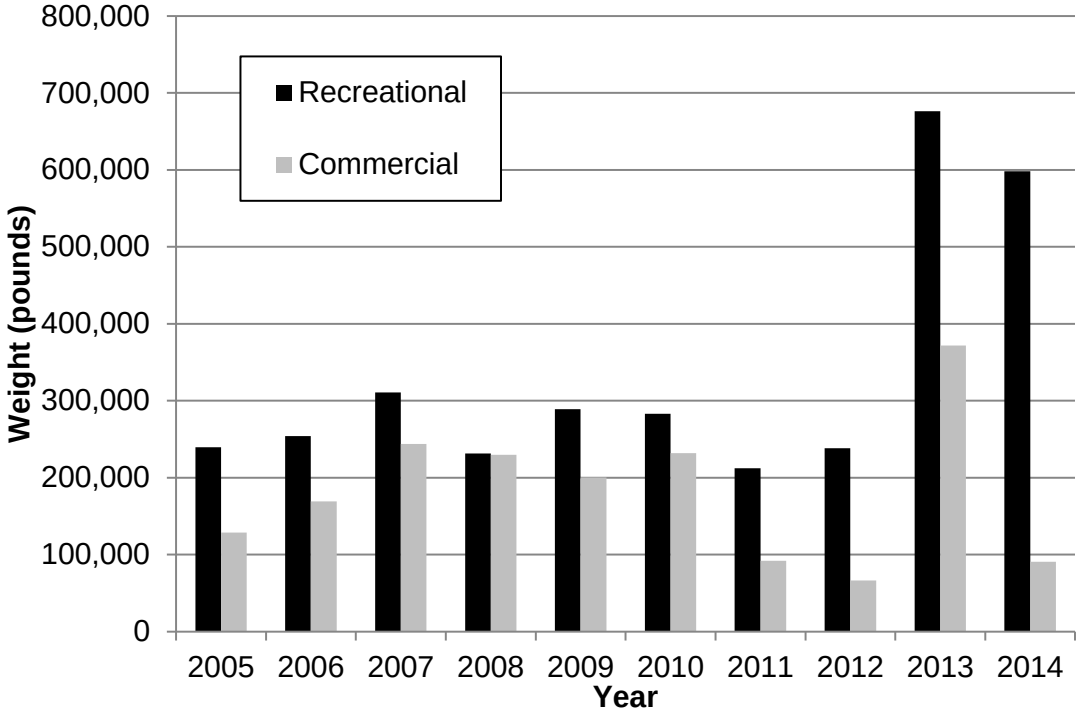


Figure 4. Annual commercial and recreational landings in pounds for red drum in North Carolina from 2005 to 2014.

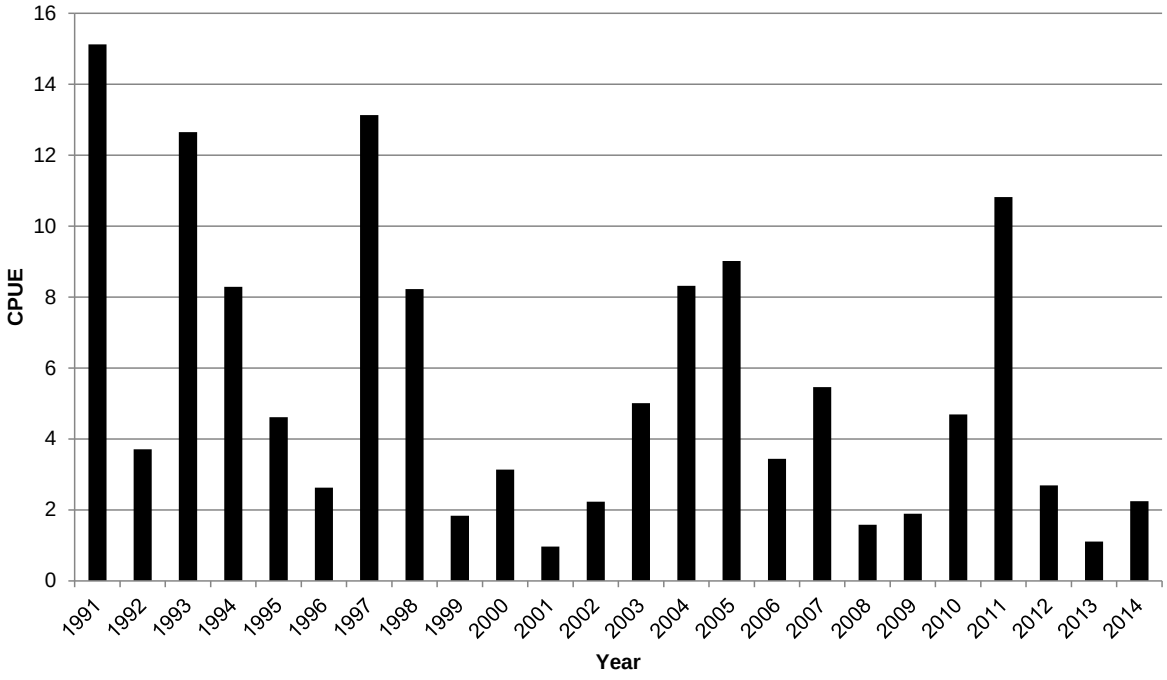


Figure 5. The annual juvenile (age-0) abundance index from the North Carolina Red Drum Juvenile Seine Survey for the period of 1991-2014.

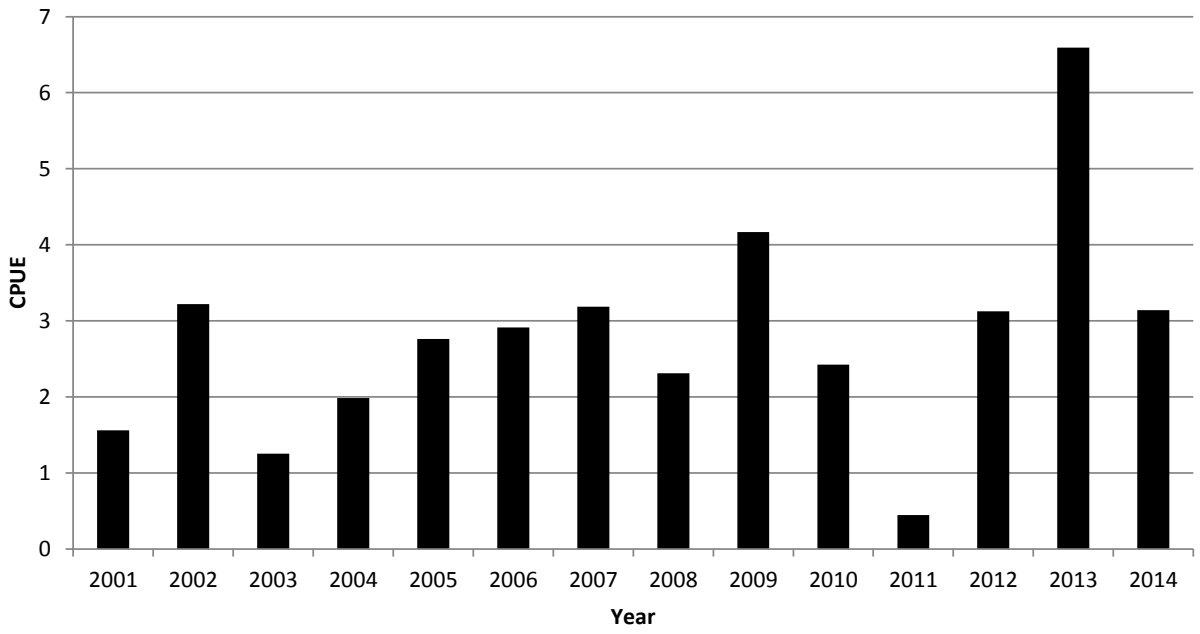


Figure 6. Annual weighted red drum CPUE (number captured ages combined) from the North Carolina Pamlico Sound Independent Gill Net Survey from 2001-2014.

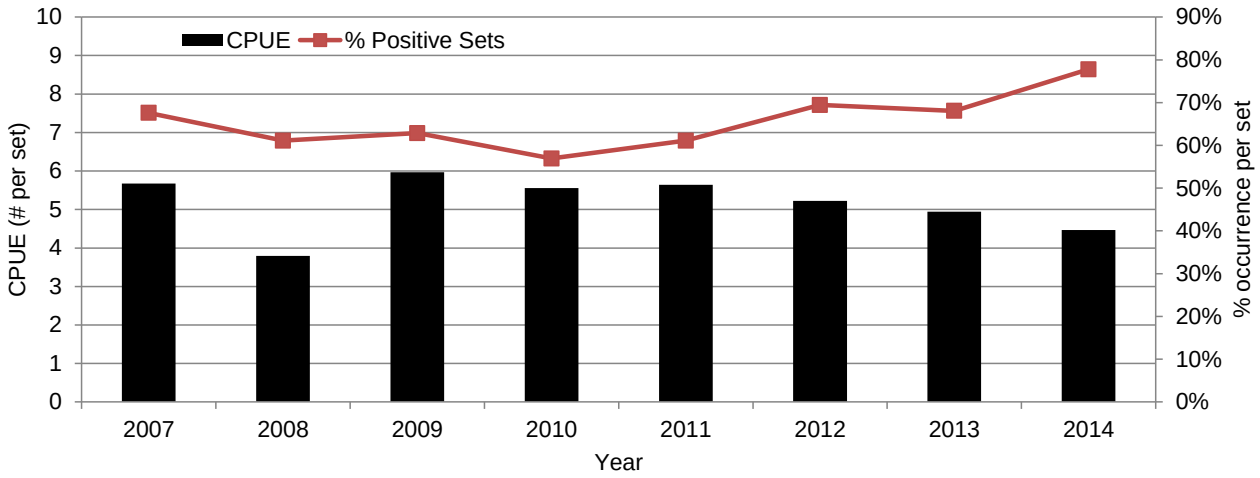


Figure 7. Annual adult red drum CPUE (number captured for ages combined) and percent positive sets from the North Carolina Red Drum Longline Survey from 2007-2014.

FISHERY MANAGEMENT PLAN UPDATE
RIVER HERRING
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	February 2000
Amendments:	Amendment 2 – May 2015 Amendment 1 – September 2007
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	May 2025

Amendment 2 to the North Carolina River Herring Fishery Management Plan (FMP) was finalized with three issues: 1) eliminating the discretionary river herring harvest season and permit since it was not serving the intended purposes of providing biological data for stock analysis and local product; 2) moving the Albemarle Sound/Chowan River Herring Management Areas to 15A NCAC 03R .0202, which corrected a reference and corrected the boundary of the Cashie River Anadromous Fish Spawning Area, and 3) removing alewife and blueback herring from exceptions in the Mutilated Finfish Rule 15A NCAC 03M .0101.

Due to the Rules Review Committee receiving at least 10 letters requesting legislative review (pursuant to G.S. 150B), a portion of the third issue to prohibit possession of river herring (alewife and blueback herring) greater than six inches aboard a vessel or while engaged in fishing from the shore or a pier is currently undergoing a legislative review (scheduled for May 2016).

Amendment 1 to the North Carolina River Herring FMP implemented a no-harvest provision for commercial and recreational fisheries of river herring in coastal waters of the state, effective in 2007. This was a result of the North Carolina Division of Marine Fisheries (NCDMF) 2005 stock assessment of river herring (data through 2003) that determined blueback herring and alewife were overfished and overfishing was occurring, there was minimal recruitment with continued declines for both species, and high fishing mortality rates. Additional management strategies included gear restrictions and stock recovery indicators. It also included a 7,500 pound limited research set-aside harvest to be used for data collection and to provide product to local herring festivals. The NCDMF Director allocated a maximum of 4,000 pounds to be used for this research season, which occurred in the Chowan River Herring Management Area around Easter week each year.

Additional outcomes of Amendment I included implementing monitoring programs, endorsing additional research on predation, restoration, impediments, bycatch and supporting spawning area habitat protection.

The original North Carolina River Herring FMP focused on issues pertaining to stock conditions (overfished and recruitment overfishing), habitat degradations, and research/monitoring expansion to provide assessment data and socioeconomic data.

Management Unit

Blueback herring and alewife management authority lies with the Atlantic Coastal states and is coordinated through the Atlantic States Marine Fisheries Commission (ASMFC). Responsibility for management action in the Economic Exclusive Zone (EEZ), located from 3-200 miles from shore, lies with the Secretary of Commerce through the Atlantic Coastal Fisheries Cooperative Management Act in the absence of a federal FMP. The NCDMF also has an FMP in place for statewide management of river herring.

Goal and Objectives

The goal of Amendment 2 to the North Carolina River Herring FMP is to restore the long-term viability of the river herring population. To achieve this goal, the plan adopts the following objectives:

1. Identify and describe population attributes necessary to sustain long-term stock viability.

2. Protect, restore, and enhance spawning and nursery area habitats.

3. Initiate, enhance, and/or continue programs to collect and analyze biological, social, economic, fishery, and environmental data needed to effectively monitor and manage the river herring fishery.

4. Promote education and public information to help the public understand the causes and nature of problems in the river herring stocks, its habitats and fisheries, and the rationale for management efforts to solve these problems.

The goal of Amendment 2 to the ASMFC Interstate Fishery Management Plan for Shad and River Herring (River Herring Management) is to protect, enhance, and restore East Coast migratory spawning stocks of alewife and blueback herring in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. To achieve this goal, the plan adopts the following objectives:

1. Prevent further declines in river herring (alewife and blueback herring) abundance.

2. Improve our understanding of bycatch mortality by collecting and analyzing bycatch data.

3. Increase our understanding of river herring fisheries, stock dynamics and population health through fishery-dependent and independent monitoring, in order to allow for evaluation of management performance.

4. Retain existing or more conservative regulations for American shad and hickory shad.

5. Promote improvements in degraded or historic alosine critical habitat throughout the species' range.

STATUS OF THE STOCK

Stock Status

The ASMFC completed a stock assessment on river herring in 2012 (ASMFC 2012), including data through 2009 (See Section 15, Appendix 15.3). The coast-wide assessment found river herring to be depleted throughout their range. The North Carolina portion of the stock assessment found that, although the stock was not experiencing overfishing, it remained overfished. The spawning stock biomass was less than five percent of the amount necessary for replacement and due to the biology of the species, significant improvements would not be likely within such a short time frame.

Stock Assessment

The North Carolina stock assessment (2005) used a forward-projecting, age-structured statistical catch-at-age model for the Chowan River blueback herring stock. This stock assessment was constructed for river herring and used to estimate the population sex-specific numbers-at-age, exploitation rates, and annual recruitment of age-3 fish during 1972-2009 using four data sources: total in-river catches, age and length compositions, a fisheries-independent young-of-year index, and assumed rates of age and sex-specific natural mortality. Biological samples for sex, age, and length data were collected from fishery landings, and natural mortality values were estimated using average weight at age and the Lorenzen (1996) method. Only ages 3 through 8+ were represented in the model because these are the only ages caught by the fishery and therefore the ages with the best data.

Three stock status indicators were adopted by the River Herring FMP plan development team, each based on a three-year moving average. The plan development team recommended using the first two stock status indicators (juvenile abundance and repeat spawners) as a trigger for doing a stock assessment earlier than ten years. If a three-year moving average of each of the indicators was above the threshold, it would trigger the need for a new stock assessment, which would determine the third stock status indicator.

1. Catch per unit effort (CPUE) of 60 young-of-the-year per haul in the Albemarle Sound juvenile abundance survey
2. Ten percent repeat spawners observed in fishery-dependent pound net samples
3. Spawning stock biomass (SSB) of 30% unfished SSB, estimated in stock assessment model.

STATUS OF THE FISHERY

Current Regulations

In 2007, Amendment 1 to the North Carolina River Herring FMP implemented a no-harvest provision for commercial and recreational fisheries of river herring in coastal waters. The North Carolina River Herring FMP Amendment 2, adopted by the North Carolina Marine Fisheries Commission (NCMFC) in May 2015, eliminated the discretionary river herring harvest season

and permit and removed alewife and blueback herring from exceptions in the Mutilated Finfish Rule.

Commercial Landings

Since Amendment 1 implemented a no-harvest provision the landings figure below (Figure 1) contains data only through 2006. Table 1 includes information on landings data from 2007 – 2014 when the discretionary harvest season was prosecuted.

Recreational Landings

There is currently no recreational fishery for river herring per the no harvest provision outlined in Amendment 1. Formerly, most river herring caught recreationally were likely used for personal consumption or for bait. For the years leading up to the 2007 harvest closure, the extent of river herring harvest for personal consumption in coastal North Carolina is unknown.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery dependent sampling conducted by the NCDMF since 1982. The dominant gears for river herring were gill nets and pound nets. In 2007, the no-harvest provision restricted commercial landings. However, the Chowan River Pound Net survey was implemented in 2008 to provide estimates of catch-per-unit effort (CPUE), percent of repeat spawners, and age and sex data for alewife and blueback herring. Tables 2 and 3 describe the mean, minimum and maximum length data for the last ten years and tables 4 and 5 describe the modal age, minimum and maximum age, and total number aged from this survey. Total pound net effort, total river herring catch, and CPUE for the Chowan River Pound Net Survey (Table 6) shows a downward trend through 2012 followed by an increasing trend through 2014.

According to the stock status indicators in order to restore the long-term viability of the river herring population, the stock status indicator objective is to see ten percent repeat spawners (blueback herring only) observed in the Chowan River Pound Net Survey. Figure 2 shows the current ten year average of repeat spawners to be 3.3%, with the last three years (2012-2014) falling below that average.

Fishery-Independent Monitoring

River herring are monitored regularly in several of the division's fishery independent monitoring programs, including Program 100 (Juvenile Anadromous Independent Fishery), Program 135 (Striped Bass Independent Gill Net Survey), Program 150 (Adult Anadromous Spawning Area Survey), and Program 160 (Anadromous Egg and Larval Survey). Tables 7 and 8 show the modal, minimum, and maximum age for alewife and blueback for the last ten years.

Data from Program 100 is used to annually calculate the juvenile abundance index (JAI) for blueback herring. The first of the stock status indices, it involves a CPUE of 60 young-of-the-year blueback herring for three consistent years in the Program 100 survey. The average JAI for the last ten years is 2.7, well below the needed stock status indicator requirements (Figure 3).

MANAGEMENT STRATEGY

River herring are currently monitored using the three stock status indicators based on blueback herring:

1. Catch per unit effort (CPUE) of 60 young-of-the-year in the Albemarle Sound juvenile abundance survey
2. Ten percent repeat spawners observed in the Chowan River Pound Net Survey
3. Spawning stock biomass (SSB) of 30 percent unfished SSB, estimated in stock assessment model.

Collectively, these indices represent *minimal* stock rebuilding goals for the recovery of river herring stocks in the Albemarle Sound and Chowan River. In the 2012 stock assessment ASMFC recommended a ten-year interval between stock assessments (ASMFC 2012). The plan development team recommended using the first two stock status indicators (juvenile abundance and repeat spawners) as a trigger for doing a stock assessment earlier than ten years. If a three-year moving average of each of the indicators was above the threshold, it would trigger the need for a new stock assessment, which would determine the third stock status indicator.

Currently the first two indicators are well below the threshold that would trigger a stock assessment which is needed to evaluate the third indicator. The spawning stock biomass was less than five percent of the amount necessary for replacement. Due to the biology of the species, significant improvements would not be likely within such a short time frame.

MANAGEMENT AND RESEARCH NEEDS

Included is a list of the management and research recommendations identified in the current FMP (Amendment 2) and the priority and status of each.

Life History

- Conduct studies of river herring egg and larval survival and development in North Carolina river systems. **High priority**
- Conduct research on predation of all life stages of river herring in the Albemarle Sound and other systems in North Carolina (including invasive species such as blue catfish and other predators). **Medium priority**
- Conduct studies on energetics of feeding and spawning migrations of river herring in North Carolina. **Medium priority**

Stock Status

- Estimate bycatch and discard mortality of river herring captured incidentally in Atlantic Ocean fisheries coastwide. **High priority**
- Estimate bycatch and discard mortality of river herring captured incidentally in inside fisheries. **Medium priority**

Environmental Factors

Water Quality Recommendations

- Evaluate effects of existing and future water withdrawals on water quality, quantity and fisheries habitat in coastal watersheds. NCDCM and NCWRC review and comment on water withdrawals and their effect on fisheries and habitat. **High priority**
- Determine if contaminants are present and identify those that are potentially detrimental to various life history stages of river herring. Long term water quality monitoring devices have been maintained and deployed to identify shifts or swings in water quality in multiple tributaries in the Albemarle Sound area. **High priority**
- Evaluate the impacts/effects of reverse osmosis (RO) plants on receiving waters and aquatic resources. NCDCM and NCWRC provide comments on permit applications for RO plants; some work by universities to evaluate effects of RO plants in local river systems. **Low priority**

Obstruction Recommendations

- Identify all man-made physical obstructions to river herring migrations (update Collier and Odom project) and prioritize impediments for removal /replacement after identification. The NCDMF has surveyed culverts in the Chowan River area and developed a priority list for replacement or repair. This information will be used by a paid graduate student to investigate fish friendly culverts. **High priority**
- Identify research needs regarding impediments to river herring migration**. High priority**

Impingement and Entrainment Recommendations

- Research is needed to determine the fate of river herring eggs, larvae and juveniles that are impinged, and then released through screen cleaning operations. **Low priority**

Climate change

- The specific effects of climate change, including warming water, increased drought severity, and loss of flood plain spawning habitat should be further investigated. **Low priority**

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATION

Pertaining to the current FMP schedule, the plan development team recommended using the first two stock status indicators (juvenile abundance and repeat spawners) as a trigger for doing a stock assessment earlier than ten years. If a three-year moving average of each of the indicators was above the threshold, it would trigger the need for a new stock assessment, which would determine the third stock status indicator.

It is recommended the review schedule for river herring remain the same.

LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 2009. Amendment 2 to the Interstate Fishery Management Plan. 173pp.

Atlantic States Marine Fisheries Commission (ASMFC). 2012. River herring benchmark stock assessment, Volume II. Stock Assessment Report No. 12-02. 707 pp.

Lorenzen, K. 1996. The relationship between body weight and natural mortality in juvenile and adult fish: a comparison of natural ecosystems and aquaculture. J. Fish. Biol. 49: 627-647.

North Carolina Division of Marine Fisheries (NCDMF). 2000. North Carolina fishery management plan for river herring, blueback herring (Alosa aestivalis) and alewife (Alosa pseudoharengus). North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Morehead City, NC.

North Carolina Division of Marine Fisheries. 2007. North Carolina fishery management plan for river herring, blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*): Amendment 1. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC

North Carolina Division of Marine Fisheries. 2009. Strategic Habitat Area Nominations for Region 1: Albemarle Sound to Northeastern Coastal Ocean of North Carolina. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC.

North Carolina Division of Marine Fisheries. 2014. North Carolina fishery management plan for river herring, blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*): Amendment 2. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC.

TABLES

Table 1. Harvest landings and value of discretionary river herring harvest season in North Carolina, 2007-2014.

Year	# of Permits Issued	Quota (lb/permit/period)	Harvest (lb)	Value ($)
2007	15	200	1,103	856
2008	13	250	1,292	775
2009	27	125	643	836
2010	30	125	1,765	1,765
2011	23	150	1,611	1,611
2012	18	150	678	678
2013	12	150	743	743
2014	27	150	989	1,319

Table 2. Blueback herring mean, minimum and maximum length data from 2005-2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	226	196	275	305
2006	225	196	257	156
2007	228	195	276	231
2008*	225	191	279	928
2009*	225	198	267	546
2010*	224	192	260	833
2011*	229	190	264	500
2012*	229	180	265	412
2013*	229	196	276	492
2014*	217	191	260	691

*2008 a no-harvest provision went into effect and the Chowan River Pound Net survey began

Table 3. Alewife mean, minimum and maximum length data from 2005-2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	244	200	286	539
2006	242	198	311	553
2007	229	196	278	45
2008*	227	190	287	1872
2009*	236	197	276	1000
2010*	241	203	282	822
2011*	247	201	283	806
2012*	248	190	286	641
2013*	234	196	330	854
2014*	234	202	295	1037

*2008 a no-harvest provision went into effect and the Chowan River Pound Net survey began

Table 4. Alewife ages from the dependent sampling surveys.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	5	3	7	253
2006	4	3	7	260
2007	3	3	6	30
2008*	5	4	8	588
2009*	5	3	7	342
2010*	6	3	7	277
2011*	6	3	8	211
2012*	4	3	8	259
2013*	3	2	7	308
2014*	3	2	6	328

*samples from the Chowan River pound net survey

Table 5. Blueback herring ages from the dependent sampling surveys.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	4	3	6	162
2006	4	3	5	86
2007	5	3	6	143
2008*	4	3	7	474
2009*	4	3	7	251
2010*	4	3	7	247
2011*	4	3	6	172
2012*	4	3	6	191
2013*	3	2	5	216
2014*	2	2	5	198

*samples from the Chowan River pound net survey

Table 6. Total pound net effort, catch and CPUE for the Chowan River Pound Net Survey 2009-2014.

Year	Total Effort (PN Weeks)	Total RH (lbs)	Total CPUE
2009	217	89,245	411.27
2010	260	71,532	275.12
2011	286	74,485	260.44
2012	315	18,415	58.46
2013	238	27,396	115.11
2014	271	45,619	168.34
Total	1,587	326,692	235.32

Table 7. Alewife ages from the independent sampling surveys.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	5	3	7	148
2006	5	3	7	284
2007	4	3	8	473
2008	5	3	7	428
2009	5	2	7	472
2010	6	3	8	490
2011	6	3	8	388
2012	5	3	7	181
2013	4	3	6	319
2014	4	3	7	361

Table 8. Blueback herring ages from the independent sampling surveys.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	4	2	7	174
2006	5	3	7	213
2007	5	3	7	379
2008	4	2	7	254
2009	5	3	7	330
2010	4	3	6	127
2011	4	3	6	112
2012	5	3	6	69
2013	3	2	6	211
2014	3	2	5	320

FIGURES

Figure 1. Statewide NC Commercial River Herring Landings, 1950 - 2006.

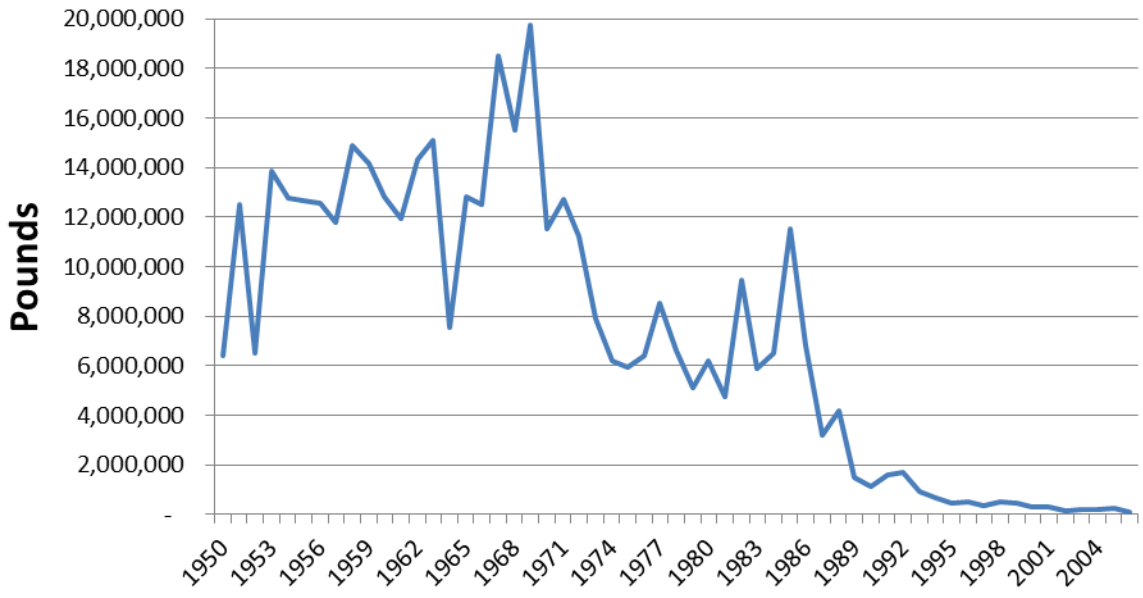


Figure 2. Percent of repeat spawners in the Chowan River Pound Net Survey, 2005-2014.

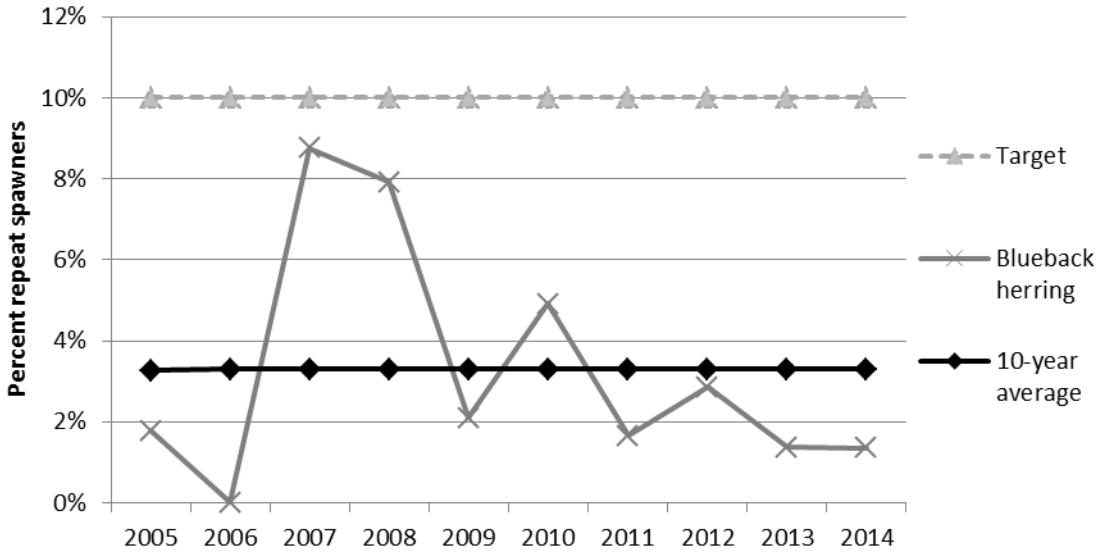
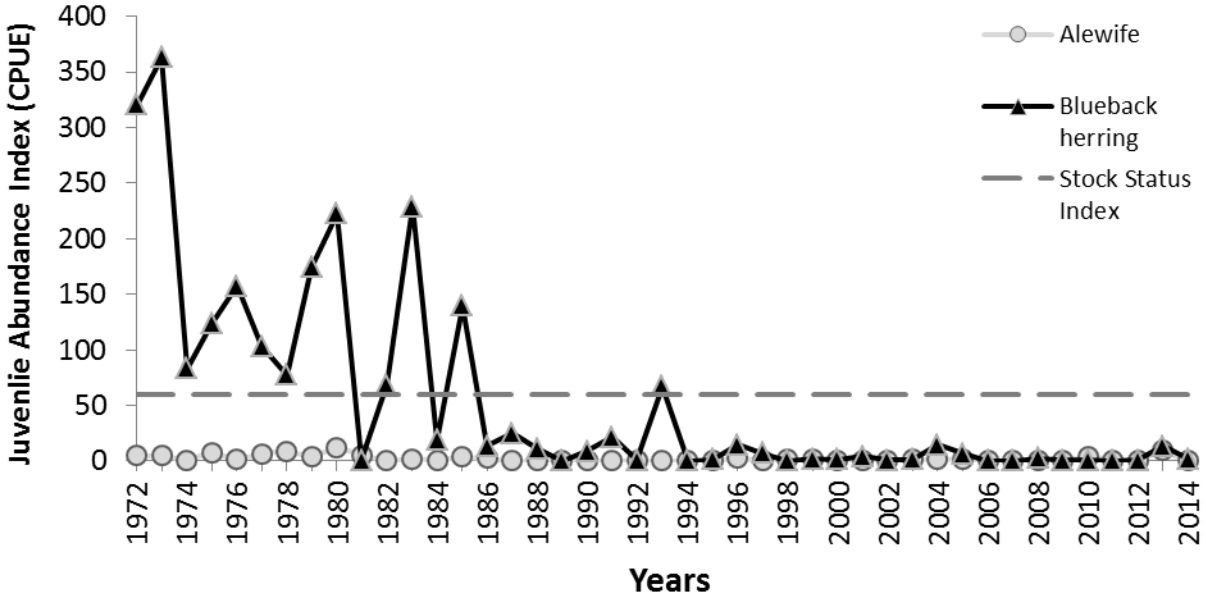


Figure 3. Blueback herring juvenile abundance index, North Carolina.



FISHERY MANAGEMENT PLAN UPDATE
SHRIMP
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	April, 2006
Amendments:	Amendment 1 – February 2015
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	July 2020

The N.C. Shrimp Fishery Management Plan (FMP) was approved in April 2006 by the N.C. Marine Fisheries Commission (NCMFC). The plan included a 90-foot headrope limit in some internal waters, allowed skimmer trawls as a Recreational Commercial Gear License (RCGL) gear and made recommendations on the minimum shrimp size at which some water bodies open to trawling. The plan also closed some areas in the state to protect habitats and juvenile finfish and established a 48-quart recreational limit. A restriction on the use of shrimp trawls above the Highway 172 Bridge over New River took effect in 2010 and this area above the bridge is now limited to skimmer trawls only. This strategy was codified into rule through Amendment 1.

Amendment 1 was adopted in February 2015 and was limited in scope to bycatch issues in the commercial and recreational fisheries. It recommended a wider range of certified bycatch reduction devices to choose from, the requirement of two bycatch reduction devices in shrimp trawls and skimmer trawls (beginning June 1, 2015), and increased the daily harvest limit for cast nets in closed areas. Amendment 1 also established a maximum combined headrope length of 220 feet in all internal coastal waters where there are no existing maximum combined headrope requirements, allowing for a phase-out period until January 1, 2017. Shrimp trawling was also prohibited, effective May 1, 2015 in the Intracoastal Waterway channel from the Sunset Beach Bridge to the South Carolina line, including the Shallotte River, Eastern Channel and lower Calabash River, to protect small shrimp. An industry workgroup, as a management strategy through Amendment 1, is currently working to test gear modifications to reduce bycatch to the extent practicable with a 40 percent target reduction in the shrimp trawl fishery.

Management Unit

The management unit includes the three major shrimp species of shrimp: brown (*Farfantepenaeus aztecus),* pink (*Farfantepenaeus duorarum*), and white (*Litopenaeus*

setiferus) and its fisheries in all coastal fishing waters of North Carolina, which includes the Atlantic Ocean offshore to three miles.

Goal and Objectives

The goal of the N.C. Shrimp Fishery Management Plan is to utilize a management strategy that provides adequate resource protection, optimizes the long-term commercial harvest, maximizes social and economic value, provides sufficient opportunity for recreational shrimpers, and considers the needs of all user groups. To achieve this goal, it is recommended that the following objectives be met:

1. Minimize waste and enhance economic value of the shrimp resource by promoting more effective harvesting practices.

2. Minimize harvest of non-target species of finfish and crustaceans and protected, threatened, and endangered species.

3. Promote the protection, restoration, and enhancement of habitats and environmental quality necessary for enhancing the shrimp resource.

4. Maintain a clear distinction between conservation goals and allocation issues.

5. Reduce conflicts among and within user groups, including non-shrimping user groups and activities.

6. Encourage research and education to improve the understanding and management of the shrimp resource.

STATUS OF THE STOCK

Stock Status

Shrimp stocks of all three species in North Carolina are still considered viable. Population size is regulated by environmental conditions, and while fishing reduces the population size over the season, fishing is not believed to have any impact on subsequent year class strength unless the spawning stock has been reduced below a minimum threshold level by environmental conditions. Because of high fecundity and migratory behavior, the three species are all capable of rebounding from a very low population size in one year to a large population size in the next, provided environmental conditions are favorable.

Stock Assessment

Estimates of population size are not available but since the fishery is considered to be an annual crop and fished at near maximum levels, annual landings are probably a good indication of relative abundance. Annual variations in catch are presumed to be due to a combination of prevailing environmental conditions, fishing effort, and the effects of changes in the economics of the fishery.

STATUS OF THE FISHERY

Current Regulations

General Rules

- Channel net is defined as a net used to take shrimp which is anchored or attached to the bottom at both ends or with one end anchored or attached to the bottom and the other end attached to a boat [15A NCAC 03I .0101 (3)(b)].
- Headrope is defined as a support structure for the mesh or webbing of a trawl that is nearest to the water surface when in use [15A NCAC 03I .0101 (3)(i)].
- Nursery areas are defined as areas in which for reasons such as food, cover, bottom type, salinity, temperature and other factors, young finfish and crustaceans spend the major portion of their initial growing season [15A NCAC 03I .0101 (4)(f)].
- Military danger zones and restricted areas are designated in 15A NCAC 3R .0102 and are enforced by the appropriate federal agency [15A NCAC 03I .0110 (a)].
- Maps or charts showing the boundaries of areas identified by rule or in proclamations are available for inspection [15A NCAC 03I .0121 (a)].
- The NCDMF shall mark boundaries with signs insofar as may be practical. No removal or relocation of signs shall have the effect of changing the classification or affect the applicability of any rule pertaining to that body of water [15A NCAC 03I .0121 (b)].

Rules Specific to Commercial Nets, Pots, Dredges, and Other Fishing Devices

- It is unlawful to use or set a fixed or stationary net in the Intracoastal Waterway where it may be a hazard to navigation, block more than two-thirds of any natural or manmade waterway, in the middle third of any marked navigation channel [15A NCAC 03J .0101 (1)(2)(3)].
- It is unlawful to possess aboard a vessel while using a trawl in internal waters more than 500 pounds of finfish from December 1 through February 28 and 1,000 pounds of finfish from March 1 through November 30 [15A NCAC 03J .0104 (a)].
- It is unlawful to use trawls nets in internal coastal waters from 9:00 p.m. on Friday through 5:00 p.m. on Sunday, except for the areas described in the next bullet [15A NCAC 03J .0104 (b) (1)].
- It is unlawful to use trawl nets from December 1 through February 28 from one hour after sunset to one hour before sunrise in portions of the Pungo, Pamlico, Bay, Neuse, and New rivers [15A NCAC 03J .0104 (b) (5)(A)(B)(C)(D)(E)].
- It is unlawful to use trawl nets in Albemarle Sound and its tributaries [15A NCAC 03J .0104 (b) (3)].
- The Director may by proclamation, require bycatch reduction devices or codend modifications in trawl nets to reduce the catch of finfish that do not meet size limits or are unmarketable as individual foodfish by reason of size [15A NCAC 03J .0104 (d)].
- It is unlawful to use trawl nets in designated pot areas opened to the use of pots by 15A NCAC 03J .0301(a)(2) within an area bound by the shoreline to the depth of six feet [15A NCAC 03J .0104 (6)].
- It is unlawful to use shrimp trawls for the taking of blue crabs in internal waters, except that it shall be permissible to take or possess blue crabs incidental to commercial shrimp trawling provided that the weight of the crabs shall not exceed 50 percent of the total weight of the combined crab and shrimp catch; or 300 pounds, whichever is greater [15A NCAC 03J .0104 (f)(2)].

- It is unlawful to use shrimp trawls for recreational purposes unless the trawl is marked with a pink buoy on the tailbag [15A NCAC 03J .0104 (e)].
- The Fisheries Director may, by proclamation, close any area to trawling for specific time periods in order to secure compliance with this rule [15A NCAC 03J .0104 (g)].
- It is unlawful to use a channel net until the Director specifies by proclamation when and where channel nets and other fixed nets for shrimping can be used [15A NCAC 03J .0106 (a)(1)].
- It is unlawful to set a channel net without yellow light reflective tape on the staffs, stakes and buoys [15A NCAC 03J .0106 (a)(2)].
- Channel nets cannot be set with any portion of the set within 50 feet of the center line of the Intracoastal Waterway (ICW) channel or in the middle third of any navigation channel marked by the Corps of Engineers or the Coast Guard. Fishermen must attend channel nets by being no more than 50 yards from the set at all times [15A NCAC 03J .0106 (a)(3)(4)(5)].
- The maximum corkline length of a channel net that can be used or possessed is 40 yards. No channel net, net buoys or stakes can be left in coastal waters from December 1 through March 1. From March 2 through November 30, cables and any attached buoy must be connected together with non-metal line when not attached to the net. Metallic floats or buoys to mark sets are unlawful [15A NCAC 03J .0106 (b)(c)(d)(e)].
- Channel nets must be properly marked with yellow light reflective tape and the owner's identification on each buoy. Identification includes one of the following: owner's NC motorboat registration number or the U.S. vessel documentation number or owner's last name and initials. Channel nets, anchor lines or buoys are not to be used in any way that constitutes a hazard to navigation [15A NCAC 03J .0106 (f) and (g)].
- It is unlawful to use channel nets to take blue crabs in internal waters, except that it shall be permissible to take or possess blue crabs incidental to channel net operations provided that the weight of the crabs do not exceed 50% of the total weight of crab and shrimp or 300 lb whichever is greater [15A NCAC 03J .0106 (h)(1)(A)(B)].
- The Director may, by proclamation, close any area to channel net use for specific time periods in order to secure compliance with the above bullet [15A NCAC 03J .0106 (h)(2)].
- It is unlawful to use nets from June 15 through August 15 in the waters of Masonboro Inlet or in the ocean within 300 yards of the beach between Masonboro Inlet and a line running 138° through the water tank on the northern end of Wrightsville Beach, a distance parallel with the beach of 4,400 yards. It is unlawful to use trawls within one-half mile of the beach between the Virginia line and Oregon Inlet [15A NCAC 03J. 0202 (1)(2)].
- It is unlawful to use a trawl with a mesh length less than four inches in the body and three inches in the extension and on and three-fourths inches in the cod end or tail bag from the west side of Beaufort Inlet Channel to the shore off Salter Path within a half mile of shore [15A NCAC 03J .0202 (3)].
- From December 1 through March 31 it is unlawful to possess finfish caught incidental to shrimp and crab trawling in the Atlantic Ocean unless the weight of the combined catch of shrimp and crabs exceeds the weight of finfish; except that crab trawlers working south of Bogue Inlet may keep up to 300 pounds of kingfish, regardless of their shrimp or crab catch weight [15A NCAC 03J .0202 (5)].
- It is unlawful to use shrimp trawls in all waters west of a line beginning at the southeastern tip of Baldhead Island at a point 33^0 50.4833'N – 77^0 57.4667 W; running southerly in the Atlantic Ocean to a point 33^0 46.2667'N – 77^0 56.4000 W from 9:00 PM through 5:00 AM [15A NCAC 03J .0202 (8)].
- It is unlawful to use trawl nets upstream of the Highway 172 Bridge in New River from 9:00 p.m. through 5:00 a.m. when opened by proclamation from August 15 through November

30 (15A NCAC 03J .0208).

- It is unlawful to use any commercial fishing gear in the Southport Boat Harbor, Brunswick County and to use any commercial fishing gear in the Progress Energy Intake Canal between the fish diversion screen and the Brunswick nuclear power plant (15A NCAC 3J .0206, 15A NCAC 03J .0207).
- It is unlawful to use shrimp pots with mesh lengths smaller than one and one-fourth inches stretch or five-eighths inch bar [15A NCAC 03J .0301(e)].
- It is unlawful to use pots with leads or leaders to take shrimp. Leads are defined as any fixed or stationary net or device used to direct fish into any gear [15A NCAC 03J .0301(l)].
- In Dare County commercial fishing gear may not be used within 750 feet of licensed fishing piers when opened to the public. Commercial fishing gear may not be used in the Atlantic Ocean off of portions of Onslow, Pender, and New Hanover counties during specified time frames [15A NCAC 03J .0402(a)(1)(A)(ii)(2)(A)(B)(i)(ii)(3)(A)(B)(i)(iii)(4)].
- Shrimp pound net set is defined as a pound net set constructed of stretch mesh equal to or greater than one and one-fourth inches and less than or equal to two inches [15A NCAC 03J .0501(a)(6)].
- A permit is required to deploy a pound net set and must be operational for a minimum of 30 consecutive days during the permit period. Each pound required the permittee's identification on a sign attached to a stake at the permitted ends of each set at all times. They must have yellow light reflective tape or yellow light reflective devices on each pound and have a marked navigational opening at least 25 feet wide at the end of every third pound and marked with yellow light reflective tape or yellow light reflective devices [15A NCAC 03J .0501 (b)(c)].
- It is unlawful to use a RCGL shrimp pound net unless it is marked by attaching to the offshore lead, one hot pink floating buoy. The owner shall be identified on the buoy by engraving the gear owner's current boat registration number or the owners US vessel documentation name. Each shrimp pound must be set a minimum of 100 yards from a RCGL pound net set or 300 yards from an operational permitted shrimp pound net set [15A NCAC 03J .0501(d)(1)(2)].
- It is unlawful within 30 days of abandonment of a permitted pound net set to fail to remove all stakes and associated gear from coastal fishing waters [15A NCAC 03J .0501(g)].
- Pound net permit applications, renewals and transfers are to comply with the permitting procedures and requirements for obtaining all NCDMF-issued permits. Application process, criteria for the granting of the permit, operational requirements and other elements of the shrimp pound net set permits are found in 15A NCAC 03J .0502, 15A NCAC 03J .0503, 15A NCAC 03J .0504 and 15A NCAC 03J .0505.

Rules Specific to Shrimp

- It is unlawful to take shrimp with nets until the Director opens the season in various waters by proclamation (15A NCAC 03L .0101).

Proclamations may specify any hours of day or night or both and any other conditions appropriate to manage the fishery. Some areas never open to shrimping, some areas are open year round, and some areas open and close throughout the year dependent upon shrimp movement and their size. Open areas to trawling are considered the shrimp open areas for all other gears including cast nets. All proclamations beginning with SH identify the open and closed areas and are found here throughout the year: http://portal.ncdenr.org/web/mf/2014-proclamation-archives.

- It is unlawful to take shrimp by any method from 9:00 PM on Friday through 5:00 p.m. on Sunday except in the Atlantic ocean or with the use of fixed and channel nets, hand seines, shrimp pots and cast nets [15A NCAC 03L .0102 (1)(2)].
- It is unlawful to take shrimp with mesh lengths less than one and one-half inches in trawls, one and one-fourth inches in fixed nets, channel nets, float nets, butterfly nets and hand seines [15A NCAC 03L .0103)(a)(1)(2].
- It is unlawful to take shrimp with a net constructed in a manner as to contain an inner our outer liner of any mesh size. Net material used as chafing gear shall be no less than four inches mesh length [15A NCAC 03L .0103) (b)].
- It is unlawful to take shrimp with trawls which have a combined headrope of greater than 90 feet in internal coastal waters except in Pamlico Sound, Pamlico River downstream of Pamlico Point/ Willow Point and Neuse River downstream of Winthrop Point/Windmill Point [15A NCAC 03L .0103)(c)(1)(2)(3)].
- It is unlawful to use a shrimp trawl in the Pungo River, upstream of Wades Point/Abel Bay, Pamlico River upstream of the entrance to Goose Creek/Wades Point and Neuse River upstream of Cherry Point/Wilkerson Point 15A [NCAC 03L .0103)(d)].
- It is unlawful to possess more than 48 quarts, heads-on or 30 quarts heads-off of shrimp per person per day or per vessel per day for recreational purposes [15A NCAC 03L .0105)(1)].
- It is unlawful to take or possess shrimp taken from any area closed to the taking of shrimp except for 2 quarts per person per day may be taken with a cast net in a closed area [15A NCAC 03L .0105(2)].
- It is unlawful to use trawls in the crab spawning sanctuaries from March 1 through August 31 [15A NCAC 03L .0205(a)].
- It is unlawful to use a trawl net in any primary or permanent secondary nursery area [15A NCAC 3N .0104, 3N .0105 (a)].
- Special secondary nursery areas may be opened to shrimp and crab trawling from August 16 through May 14 [15A NCAC 3N .0105(b)].

These areas open by proclamation and vary in their open time periods within the August 16th through May 14th window. They are opened once the finfish amount has declined to reduce bycatch. All proclamations beginning with SH identify the open and closed areas and are found here throughout the year: http://portal.ncdenr.org/web/mf/2014-proclamation-archives.

Recreational Licenses and Limits

- RCGL gear includes one shrimp trawl with a headrope not exceeding 26 feet in length per vessel, five shrimp pots, skimmer trawls, not exceeding 26 feet in total combined width and one shrimp pound net with each lead 10 feet or less in length and with a minimum lead net mesh of 1 ½ inches and enclosures constructed of net mesh of 1 ¼ inches or greater and with all dimensions being 36 inches or less. Attendance is required at all times for shrimp pounds [15A NCAC 03O .0302(a)(2)(3)(7)(8)].
- It is unlawful for a RCGL holder to use pots, including shrimp pots unless each pot is marked by attaching one hot pink floating buoy; the buoy should be engraved with the gear owners boat registration number or U.S. vessel documentation name [15A NCAC 03J .0302(a)(1)(2)].
- It is unlawful to possess more than 48 quarts, heads-on, or 30 quarts, heads-off, of shrimp per person per day or per vessel per day [15A NCAC 03L .0105].
- It is unlawful to possess more than 48 quarts, heads-on, or 030 quarts, heads-off, of shrimp when only one person aboard a vessel possesses a valid RCGL and recreational

commercial fishing equipment [15A NCAC 03O .0303(e)].

- It is unlawful to possess more than 96 quarts, heads on or 60 quarts, heads off of shrimp if more than one person aboard a vessel possesses a valid RCGL and recreational commercial fishing equipment [15A NCAC 03O .0303(f)].

Turtle Excluder Device Requirements

- It is unlawful to use a shrimp trawl that does not conform with the federal requirements for TEDs [15A NCAC 03L .0103)(g)].
- It is unlawful to trawl for shrimp in the Atlantic Ocean without TEDs within one nautical mile of shore from Browns Inlet to Rich's Inlet without a valid permit to waive the requirement to use TEDs in the Atlantic Ocean when allowed by proclamation from April 1 through November 30. It is unlawful to tow more than 55 minutes from April 1 through October 31 and 75 minutes from November 1 through November 30. It is unlawful to not fully empty the contents of each net after each tow. It is unlawful to refuse to take observers. It is unlawful to fail to report any sea turtle captured [15A NCAC 03O .0503 (d) (1)(2)(3)(4)(5)].

Federal Regulations

33 CFR 334.410 through 334.450

These rules designate prohibited and restricted military areas, including locations within North Carolina coastal fishing waters, and specify activities allowed in these areas.

50 CFR 223.206 - Exceptions to prohibitions relating to sea turtles.

The incidental taking of sea turtles in the shrimp trawl fishery is exempted from section 9 of the Endangered Species Act (ESA) if conservation regulations are followed and include the installation of NOAA Fisheries approved TEDs and alternative tow times for skimmer trawls, pusher-head trawls and butterfly trawls.

50 CFR 223.207 – Approved TEDs
This lists NOAA Fisheries approved TEDs such as the single-grid hard TEDs, hooped hard TEDs, special hard TEDs and soft TEDs, along with materials and gear specifications. Testing protocols for TEDs are also included in this rule.

50 CFR 229.7 – Monitoring of incidental mortalities
This requires that fishermen who participate in a Category I or II fishery are required to accommodate an observer onboard your vessel(s) up on request

50 CFR 622, Appendix D – Approved BRDs
This lists NOAA Fisheries approved BRDs and provides technical specifications for the construction and subsequent legal enforcement of these BRDs.

Rules implemented in Amendment 1 to the N.C. Shrimp Fishery Management Plan on May 1, 2015

- Modify the definition of mesh length to apply to diamond-mesh and square-mesh nets in support of a management strategy to require an additional bycatch reduction device in skimmer and otter trawls, which can include a square-mesh T-90 panel.

- Codify an existing management strategy prohibiting the use of trawl nets, except skimmer trawls, upstream of the N.C. 172 Bridge over the New River in Onslow County to continue reducing bycatch.
- Clarify the Division of Marine Fisheries director's proclamation authority for shrimp harvest restrictions;
- Establish a maximum combined headrope length of 220 feet in all internal coastal waters where there are no existing maximum combined headrope requirements, allowing for a phase-out period until Jan. 1, 2017.
- Allow cast-netting of shrimp in all areas otherwise closed to shrimping and increasing the harvest limit in these areas to 4 quarts, heads-on, or 2 ½ quarts, heads-off.
- Prohibit shrimp trawling in the Intracoastal Waterway channel from the Sunset Beach Bridge to the South Carolina line, including the Shallotte River, Eastern Channel and lower Calabash River, to protect small shrimp.

Commercial Landings

Landings in the North Carolina shrimp fishery vary from year to year and are dependent primarily on environmental conditions. Environmental factors, principally temperature especially severity of winter temperatures, and salinity can have a major influence on the yearly harvest. North Carolina's shrimp fishery is unusual in the southeast because all three species are taken here and the majority of the effort occurs in internal waters. While South Carolina, Georgia and Florida allow limited inside waters shrimping, the majority of their fisheries are conducted in the Atlantic Ocean and white shrimp comprise most of their harvest (NCDMF 2015).

The shrimp fishery in the northern portion of the state is conducted in Pamlico, Croatan, and Roanoke sounds and Pamlico, Pungo, Bay and Neuse rivers. The otter trawl is the predominant gear used in this portion of the state. Commercial activity occurs in all waters. The shrimp fishery in the central coastal area of the state occurs in Neuse River, Core Sound, North River, Newport River, Bogue Sound, and White Oak River. A variety of methods are used to catch shrimp including trawls, skimmer trawls, channel nets, shrimp pounds, and cast nets. Trawls are used on all three species in both the estuary and the ocean with two seam trawls used for brown and pink shrimp and four seam and tongue trawls for white shrimp, which tend to swim higher in the water column and have the ability to jump to the surface when disturbed. Most trawling in the central portion of the state is conducted at night. Channel nets are popular around Harkers Island in the Straits and North River while skimmer trawling is very popular in Newport River and New River.

In the southern portion of the state, the fishery is characterized by a large number of small boats fishing internal waters (primarily the Intracoastal Waterway, New and Cape Fear rivers) and larger vessels fishing the Atlantic Ocean primarily off New River, Carolina Beach, and Brunswick County. Many of the small boats are fished by individuals who shrimp part-time or for personal consumption. Use of gears other than trawls has increased primarily in the area from New River to Rich's Inlet. Channel, float, and butterfly nets make use of tidal currents to push shrimp into the nets and offer the advantages of less fuel consumption and less bycatch than traditional shrimp trawls. Channel nets are fished extensively in the areas around New River and Topsail inlets. To shrimp with a "float net", fishermen attach large floats to the doors and top lines of trawls to make the net fish up in the water column and are pulled slowly forward to harvest shrimp that are migrating to the inlets at night. Butterfly nets use this same harvest strategy but are attached to a metal frame and are held stationary in the water column to capture shrimp as the current carries them into the net. Skimmer trawls have become more popular around New River and Topsail Sound. These alternative gears are employed very little

in areas south of Rich's Inlet, however tidal conditions seem favorable for their use. Cast nets and seines are also used to harvest shrimp to provide live shrimp for the commercial bait fishery.

Landings provided by the trip ticket program are combined for all three shrimp species (Figure 1). Total landings from 1994 to 2014 have averaged 6,557,691 lb per year (Figure 1). The contribution to the landings continues to be 75% for inshore waters and 25% for the Atlantic Ocean (NCDMF 2015). Annual shrimping effort has fluctuated with shrimp abundance, but it appears to have gradually declined since 1994 (NCDMF 2015). This is due to a number of things including cheaper imported shrimp prices, increasing fuel prices, increased regulations, and fishermen retiring out of the industry. Landings in 2005 were lowest on record likely from several reasons; many large trawlers remained scalloping instead of shrimping because prices were high and the days at sea were extended (NCDMF 2015). Hurricanes Katrina (8/29/05) and Rita (9/4/05) hit the Gulf coast, negatively affecting the fishing industry. Shrimp breading operations in the Gulf shut down with only one operational in September and so some North Carolina shrimpers could not sell their product (NCDMF 2015).

Recreational Landings

Shrimp are harvested recreationally throughout the state by otter trawls, skimmer trawls, seines, cast nets, shrimp pots and shrimp pounds with specific gear limitations. Since July 1, 1999, anyone wishing to harvest shrimp recreationally with commercial gear is required to purchase a Recreational Commercial Gear License (RCGL). The RCGL is an annual license that allows recreational fishermen to use limited amounts of commercial gear to harvest seafood for their personal consumption. Seafood harvested under this license cannot be sold. Fishermen using this license are held to recreational size and possession limits, gear marking and gear limit and configuration requirements. Many of the species taken by recreational users of commercial gear are included in fisheries management plans. Until 2002, the influence that RCGL holders may have on these species was unknown. Two survey strategies were used to collect information from RCGL holders; a socioeconomic survey, conducted in 2001, 2004, and 2007, and catch and effort surveys conducted monthly from 2002 through 2008. Both of these surveys were terminated in 2008 due to budget constraints. RCGL holders harvested an average of 52,352 pound of shrimp a year from 2002 to 2008 (Table 1 from NCDMF 2015). The highest landings occurred in 2002 (101,766 lb), followed by 2008 (54,359 lb) and 2003 (50,961 lb) (NCDMF 2015).

Recreational landings of shrimp are unknown since this survey was discontinued in 2008.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Currently, the only data available for the stock in all areas are the commercial landings and associated effort from the Trip Ticket Program. No fishery dependent monitoring program exists for shrimp.

Fishery-Independent Monitoring

The Estuarine Trawl Survey (Program 120) is a fishery-independent multispecies monitoring program that has been ongoing since 1971 in the months of May and June. One of the key

objectives of this program is to provide a long-term data base of annual juvenile recruitment for economically important species. This survey samples fixed stations, a set of 104 core stations with additional stations as needed. The core stations are sampled from western Albemarle Sound south through the South Carolina border each year without deviation two times in the months of May and June. This survey targets juvenile finfish, blue crabs, and Penaeid shrimp. A two-seam 10.5 foot headrope trawl with a ¼ inch mesh in the body and 1/8 inch mesh in the tailbag is used. A one-minute tow is conducted covering a distance of 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 to 60 individuals is measured. Environmental data is collected, including salinity, dissolved oxygen, temperature, wind speed and direction.

Trends in the annual brown shrimp catch per unit effort (CPUE) as the number of brown shrimp per station in Program 120 sampling shows fluctuations from year to year (Figure 2). The proportional standard error was below 20 in all but 2 years from 1988 to 2014 (Table 2). A PSE of “20” and less was established by the Atlantic Coast Cooperative Statistics Program (ACCSP) as a standard when considering the precision of a given metric. The margin of error for the annual brown shrimp CPUE is low therefore providing greater confidence in the samples as an expression to the population (Table 2).

As indicated in the stock status section, annual landings are probably a good indication of relative abundance. When comparing the Program 120 brown shrimp CPUE to the landings from the months of June and July, that are predominantly brown shrimp in the harvest, you can see very similar trends (Figure 3).

MANAGEMENT STRATEGY

The management strategy for the shrimp fisheries in North Carolina is to continue to: 1) optimize resource use over the long-term, and 2) minimize waste. The first strategy is accomplished by protection of critical habitats, and gear and area restrictions to protect the stock. Minimization of waste is accomplished by gear modifications, bycatch reduction devices, area closures, and harvest restrictions.

There are no management triggers or methods to track stock abundance, fishing mortality, or recruitment between benchmark reviews from the current FMP. Landings and effort have decreased over time (NCDMF 2015). There are no data to track the recreational fishery.

Amendment 1 was adopted in February 2015 and was limited in scope to bycatch issues in the commercial and recreational fisheries. The management strategy for this amendment recommended a wider range of certified bycatch reduction devices to choose from, the requirement of two bycatch reduction devices in shrimp trawls and skimmer trawls (beginning June 1, 2015), and increased the daily harvest limit for cast nets in closed areas. Amendment 1 also established a maximum combined headrope length of 220 feet in all internal coastal waters where there are no existing maximum combined headrope requirements, allowing for a phase-out period until January 1, 2017. Shrimp trawling was also prohibited, effective May 1, 2015 in the Intracoastal Waterway channel from the Sunset Beach Bridge to the South Carolina line, including the Shallotte River, Eastern Channel and lower Calabash River, to protect small shrimp. An industry workgroup, is also currently working to test gear modifications to reduce bycatch to the extent practicable with a 40 percent target reduction in the shrimp trawl fishery. See Table 3 for the specific current management strategies.

MANAGEMENT AND RESEARCH NEEDS

The N.C. Marine Fisheries Commission selected management strategies and implementation status are provided in Table 3. Proposed research needs and status of need is provided in parenthesis from Amendment 1 include:

Management

High Priority

- Continue to conduct bycatch characterization work across all strata (for example: dominant species, season, areas, vessel type, number of nets/rigs, headrope length)(ongoing through NCDMF)
- Initiate/increase state monitoring and reporting on the extent of unutilized bycatch and fishing mortality on fish less than age-1 in the shrimp trawl fishery (needed)
- Continue to develop and test methods to reduce bycatch in the commercial and recreational shrimp trawl fisheries (ongoing in commercial shrimp trawl fishery through NCDMF)
- Obtain mortality (immediate and post-harvest) estimates of culled (active and passive) bycatch from gears used in the recreational and commercial shrimp fisheries (needed)
- Continue to develop standard protocol for bycatch estimations (ongoing at NCDMF with collaborative efforts with other agencies and researchers)

Medium Priority

- Conduct research to quantify the number of protected species interactions with the shrimp fishery (ongoing through current NCDMF grants)
- Continue to develop and test methods to reduce interactions with protected species in the commercial and recreational shrimp trawl fisheries (ongoing work being conducted by NOAA)
- Initiate sampling to investigate if additional areas currently open to shrimping need changes to their habitat designations (needed)
- Evaluate the effectiveness and efficiency of the current sampling protocol used to manage shrimp (needed)

Low Priority

- Continue to support research to determine the status of protected species along the N.C. coast to better anticipate and prevent interactions (for example: migration patterns and habitat utilization) (ongoing support continued to provide information as interactions with protected species occurs)

Biological

High Priority

- Continue to define and quantify the intensity, duration and spatial scale of trawling effort in N.C. estuaries (ongoing through NCDMF)
- Determine species interactions and predator/prey relationships for prominent shrimp trawl bycatch (needed)
- Determine how the resuspension of sediment, siltation, and non-point source pollution from adjacent land use practices impacts trends in shrimp abundance and habitat degradation (needed)

- Determine the spatial and biological characteristics of submerged aquatic vegetation that maximize their ecological value to shrimp for restoration and conservation purposes (ongoing through the CHPP)

Medium Priority
- Continue to map and quantify the habitat structure and sediment types in North Carolina estuaries (ongoing through NCDMF)
- Continue to measure the effects of trawling on sediment size distribution and organic carbon content (needed)

Low Priority
- Continue to investigate the impact of tiger shrimp in NC waters (research conducted through NOAA)
- Initiate research to determine the impacts of endocrine disrupting chemicals (EDCs) on the various life stages of shrimp (needed)

Social and Economic

Medium Priority
- Expand current social and economic surveys to specifically collect information on shrimp fishermen (needed)
- Continue to determine the extent of recreational shrimp harvest that is occurring. This group primarily use cast nets to take shrimp either for bait or personal consumption (needed)

Data Needs

High Priority
- Effort data needs to be collected to provide estimates based on actual time fished (or number of tows), rather than number of trips (needed)
- Improve accuracy of self-reported license gear survey data, or investigate other means of accurately obtaining shrimp fleet characteristic (needed)

Education

High Priority
- Encourage research and education to improve the understanding of new innovative BRDs and TEDs (ongoing through NCDMF; update proclamation in May 2015, outreach being conducted by staff and Marine Patrol to help the public understand the various BRDs available and proper placement within the trawls)
- Encourage research and education to improve the understanding and management of the shrimp resource as well as the fishery (needed)

FISHERY MANAGEMENT PLAN RECOMMENDATION

Recommend maintain the current timing of the Benchmark Review. Amendment 1 of the N.C. Shrimp FMP was just adopted in February 2015 with rule changes in effect May 1, 2015. Work in ongoing with a stakeholder group to test gear modifications to reduce bycatch to the extent practicable with a 40 percent target reduction in the shrimp trawl fishery.

LITERATURE CITED

North Carolina Division of Marine Fisheries. 2015. North Carolina Shrimp Fishery Management Plan. Amendment 1. North Carolina department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, NC. 519 pp.

TABLES

Table 1. Harvest (pounds) and pounds per trip of shrimp (three species combined) by RCGL gear from 2002 through 2008 (NCDMF 2015).

Year	Pounds	Pounds/trip
2002	101,766	19.1
2003	50,961	18.5
2004	43,698	9.3
2005	32,542	13.4
2006	49,362	20.3
2007	33,778	15.2
2008	54,359	22.3
Mean	52,352	16.8

Table 2. Program 120 annual sampling for brown shrimp from core stations in May and June combined. Number of samples (stations), brown shrimp arithmetic catch per unit effort (CPUE) as the number of shrimp per station, standard error, standard deviation, coefficient of variation (CV), minimum number caught at a station, maximum number caught at a stations, total number caught, proportional standard error (PSE), 1988-2014.

Year	Number of stations	CPUE (No. shrimp/tow)	Standard error	Standard deviation	CV	Minimum number per station	Maximum number per station	Total number of shrimp	PSE
1988	209	21.24	3.20	46.31	218.01	0	348	4,440	15
1989	207	29.23	5.40	77.68	265.78	0	775	6,050	18
1990	206	44.17	6.83	98.03	221.97	0	1,094	9,098	15
1991	207	48.57	5.36	77.18	158.88	0	520	10,055	11
1992	210	25.85	5.03	72.93	282.16	0	664	5,428	19
1993	205	23.79	4.35	62.31	261.95	0	348	4,876	18
1994	205	29.92	4.29	61.41	205.23	0	459	6,134	14
1995	208	38.62	5.72	82.53	213.72	0	615	8,032	15
1996	207	34.78	6.39	91.87	264.16	0	696	7,199	18
1997	207	25.62	6.24	89.80	350.45	0	856	5,304	24
1998	208	13.04	2.77	39.99	306.74	0	369	2,712	21
1999	206	49.67	7.55	108.34	218.09	0	675	10,233	15
2000	209	56.77	7.06	102.08	179.82	0	759	11,865	12
2001	209	42.81	6.30	91.03	212.64	0	717	8,947	15
2002	208	59.68	6.89	99.38	166.52	0	793	12,414	12
2003	208	31.17	4.32	62.32	199.91	0	563	6,484	14
2004	208	24.93	3.99	57.61	231.12	0	334	5,185	16
2005	208	23.17	4.35	62.75	270.81	0	551	4,820	19
2006	208	25.88	3.44	49.67	191.93	0	308	5,383	13
2007	208	18.49	1.89	27.20	147.16	0	170	3,845	10
2008	208	95.71	13.45	193.92	202.61	0	1,718	19,908	14
2009	208	60.29	8.16	117.73	195.27	0	1,001	12,540	14
2010	208	15.25	13.17	189.97	252.47	0	1,622	15,651	18
2011	208	52.17	7.41	106.82	204.74	0	930	10,852	14
2012	208	40.13	4.26	61.47	153.17	0	343	8,347	11
2013	208	27.53	4.39	63.25	229.77	0	459	5,726	16
2014	208	34.98	4.47	64.46	184.28	0	409	7,276	13

Table 3. The N.C. Marine Fisheries Commission selected management strategies, and implementation status to reduce bycatch.

Management Strategy	Implementation Status
Status quo (continue to prohibit otter trawls in the New River special secondary nursery area above the Highway 172 Bridge).	Rule change required in 15A NCAC 03J .0208; Rule change in effect on May 1, 2015.
Allow hand cast netting of shrimp in all closed areas and increase the limit to four quarts, with heads on per person.	Rule change required in 15A NCAC 03L .0105; Rule change in effect on May 1, 2015.
Status quo on a license requirement to fish a cast net for shrimp.	No action required
Upon federal adoption of TEDs in skimmer trawls, the division will support the federal requirement.	No action required
Establish a permitted live shrimp bait fishery and for DMF to craft the guidelines and permit fees after reviewing permitted operations in other states, and to allow live bait fishermen with a permit to fish until 12 p.m. (noon) on Saturday.	Based on review of other state operations, future rule changes will be required and include 15A NCAC 03J .0104, 03L .0102, 03O .0105, 03O .0503; Rule change in effect on May 1, 2015.
Allow any federally certified BRD in all internal and offshore waters of NC.	Existing proclamation authority; Proclamation issued with complete list of BRDs, SH-2-2015
Update the scientific testing protocol for the state's BRD certification program.	Plans to update the testing protocols to use the federal standards.
Convene a stakeholder group to initiate industry testing of minimum tail bag mesh size, T-90 panels, skylight panels, and reduced bar spacing in TEDs 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 TED 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 commission for consideration for mandatory use. • The stakeholder group may be partnered with the division and Sea Grant. • Members should consist of fishermen, net/gear manufacturers and scientific/gear specialists.	Stakeholder group convened and industry testing underway in 2015.
Require either a T-90/square mesh tailbag or other applications of square mesh panels (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.	Existing proclamation authority Rule change required in 15A NCAC 03I .0101; Rule change in effect on May 1, 2015. Proclamation issued for second BRD requirement to begin on June 1, 2015, SH-2-2015, http://portal.ncdenr.org/web/mf/proclamation-sh-02-2015
Status quo on effort management (no change in season, weekend, or night time fishing).	No action required
In order to put a cap on fleet capacity as a management tool, establish a maximum combined	Rule change required in 15A NCAC 03L .0103; Rule change in effect on May 1, 2015.

Management Strategy	Implementation Status
headrope length of 220 feet in all internal coastal waters where there are no existing maximum combined headrope requirements with a two-year phase out period.	
Prohibit shrimp trawling in the IWW channel from Sunset Beach to the SC state line, including Eastern Channel, lower Calabash River and Shallotte River.	Rule change required in 15A NCAC 03R .0114; Rule change in effect May 1, 2015.
Recommend the MFC Habitat and Water Quality Advisory Committee to consider changing designation of special secondary nursery areas that have not been opened to trawling since 1991 to permanent secondary nursery areas.	Rule changes required in 15A NCAC 03R .0104 and 03R .0105; Rule change in effect May 1, 2015.

FIGURES

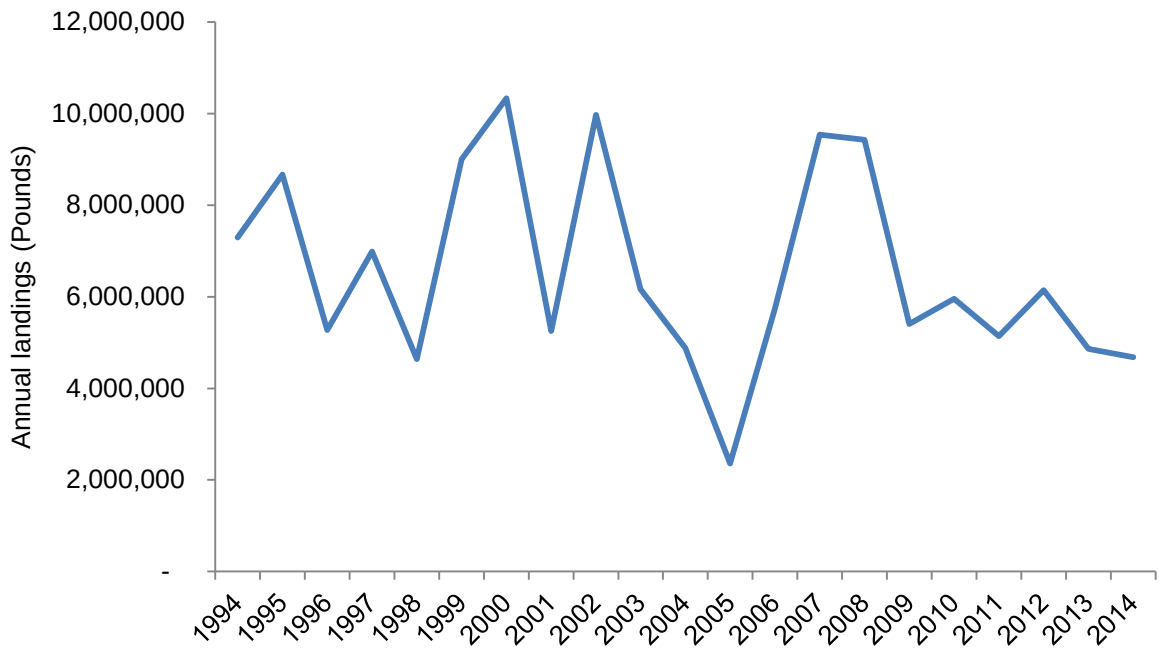


Figure 1. Annual shrimp landings (pounds) from all three species combined in North Carolina, 1994-2014. Data from the NCDMF Trip Ticket Program.

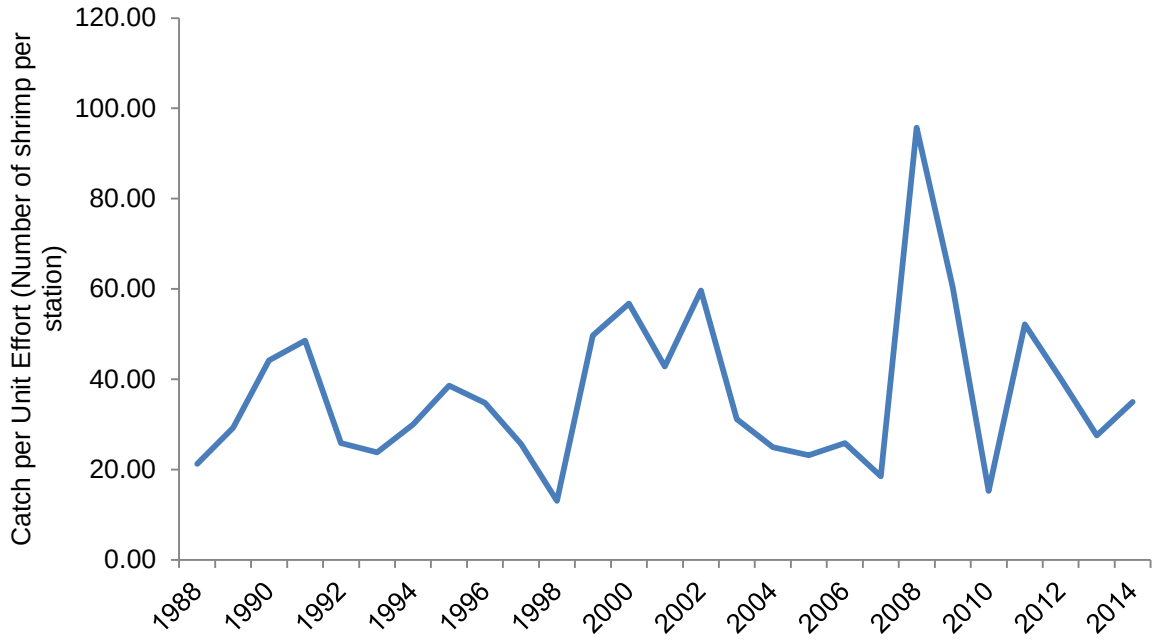


Figure 2. Annual catch per unit effort (number of shrimp per station) of brown shrimp from Program 120 estuarine trawl survey, 1988-2014.

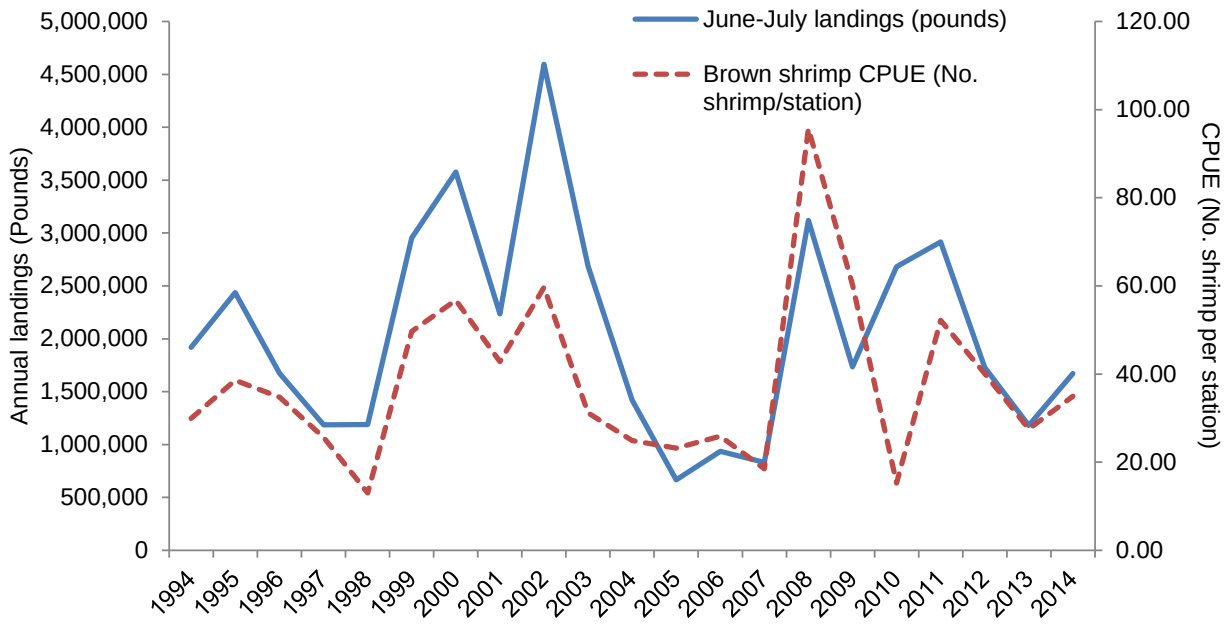


Figure 3. Comparison of shrimp commercial landings in the months of June and July to the brown shrimp Program 120 index of abundance or catch per unit effort (Number of shrimp per station), 1994-2014.

FISHERY MANAGEMENT PLAN UPDATE
SOUTHERN FLOUNDER
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	February 2005
Amendments:	Amendment 1 – February 2013
Revisions:	None
Supplements:	Supplement A to the 2005 FMP – February 2011 Draft Supplement A to Amendment 1 Currently in Development with Scheduled Approval in August 2015
Information Updates:	None
Schedule Changes:	None

Next Benchmark Review: Next 5-year review of the N.C. Southern Flounder Fishery Management Plan (FMP) is scheduled to begin July 2018. In May 2015 the N.C. Marine Fisheries Commission (NCMFC) requested a change to the FMP schedule to begin a new amendment and this request is currently under review by the Department of Environment and Natural Resources Secretary.

Actions to achieve sustainable harvest in Amendment 1 include: 1) accept management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery; 2) increase the recreational minimum size limit to 15 inches and decrease the creel limit to 6 fish. Amendment 1 also set new sustainability benchmarks at 25% SPR (threshold) and 35% SPR (target).

Draft Supplement A to Amendment 1 is in development and will be considered for final approval in August 2015.

Management Unit

North Carolina coastal and joint waters.

Goal and Objectives

The goal of Amendment 1 to the North Carolina Southern Flounder Fishery Management Plan (FMP) is to end overfishing and rebuild the spawning stock for long-term sustainable harvest and maintain the integrity of the stock. To achieve this goal, the following objectives must be met:

1. Ensure that the spawning stock biomass of southern flounder is adequate to produce recruitment levels necessary to increase spawning stock biomass and expand age distribution.

2. Implement management measures that will achieve sustainable harvest.

3. Promote harvesting practices that minimize bycatch.

4. Continue to develop an information program to educate the public and elevate their awareness of the causes and nature of problems in the southern flounder stock, its habitat and fisheries, and explain the rationale for management efforts to sustain the stock.

5. Address social and economic concerns of all user groups, including issues such as user conflicts.

6. Promote the protection, restoration, and enhancement of habitats and environmental quality for the conservation of the southern flounder population.

7. Initiate, enhance, and/or continue studies to improve the understanding of southern flounder population ecology and dynamics.

8. Initiate, enhance, and/or continue studies to collect and analyze the socio-economic data needed to properly monitor and manage the southern flounder fishery.

STATUS OF THE STOCK

Stock Status

The current status of the southern flounder stock is ‘concern.’ There are concerns about the sustainability of current harvest levels due to coastwide trends in juvenile and adult abundance and the high percentage of immature fish in the harvest. A regional stock assessment should be considered to determine stock status.

Stock Assessment

The 2009 stock assessment used a statistical catch-at-age model run using the Age Structured Assessment Program. Results showed the stock to be overfished with overfishing occurring throughout the time-series. These were the most recent assessment results included in Amendment 1. The 2014 Southern Flounder Stock Assessment used a statistical catch-at-age model run using Stock Synthesis. Upon review of the assessment, external peer reviewers and the NCDMF determined the model could not fully account for stock mixing during spawning and quantify migration of southern flounder to and from North Carolina waters. Consequently, the assessment was not accepted for determining stock status so it is currently unknown whether the stock is overfished or if overfishing is occurring.

STATUS OF THE FISHERY

Current Regulations

Commercial: 14–inches total length (TL) minimum size limit in internal and ocean waters, closed season in internal waters from December 1–31; no trip limits in internal waters and a 100-pound trip limit in ocean waters unless the individual has a License to Land Flounder from the Atlantic Ocean.

Recreational: 15–inches TL minimum size limit, 6-fish creel limit for all joint and coastal waters, and year-round season.

Commercial Landings

Any landings reported as caught in inshore waters are considered to be southern flounder by NCDMF Trip Ticket Program. Most southern flounder landings were from gill nets and pound nets, although gigs and other inshore gears (e.g. trawls) catch flounder in smaller numbers. Historically, pound nets were the dominant gear but landings from gill nets were higher in 1994-2013 (Figure 1). Peak commercial landings occurred in 1994. Since 1994, pound net landings decreased greatly while gill net landings remained relatively high until 2010. Decreases in gill net harvest in 2010-2012 were mainly due to lower landings in the Albemarle Sound. The Sea Turtle Settlement Agreement (2010) added regulations to gill nets in some areas of the state, resulting in lower effort in many areas, however the Albemarle Sound was mostly unaffected by these regulations. The Albemarle Sound is typically where the majority of southern flounder gill net harvest occurs. In 2013 gill net harvest increased greatly in the Albemarle Sound but decreased in Pamlico Sound and Core Sound; pound net landings also increased greatly in 2013. In 2014 gill net harvest decreased in all areas of the state but especially in the Albemarle Sound, due to widespread gill net closures to avoid catches of red drum. Pound net harvest remained relatively high and surpassed gill net harvest for the first time since 1994. Gig harvest of southern flounder has generally increased, especially since 2010, but remains less than 10% of total commercial harvest. Harvest by other commercial gears has generally decreased and currently makes up a small portion of commercial harvest. Commercial harvest is highest in fall months.

Trends in commercial trips have generally followed landings trends (Figure 2). Trips include the number of trip ticket records with landings reported. Some trips may represent more than one day of fishing. The majority of trips that harvest flounder are from gill nets. Gill net trips decreased greatly since 2010. Pound net trips decreased greatly until 2002 and were fairly consistent after that year. Gigging trips have increased greatly since 2010.

Recreational Landings

Recreational harvest of southern flounder is mainly by hook and line and gigs, with a small amount of harvest by spearfishing or RCGL gears. NCDMF does not have information on long-term trends of the gig fishery. This is because the Marine Recreational Information Program (MRIP) rarely encounters gig fishermen. A mail-based survey of gigging that began in 2010 indicates the gig harvest in 2010-2013 made up less than 25% of the recreational harvest (with hook and line harvest making up the remainder). Hook and line harvest can be split into ocean and inshore harvest, with most southern flounder harvested inshore (Figure 3). Hook and line harvest peaked in 2010 but by 2014 had declined to the lowest level since 1999. Harvest is highest during summer months.

Trends in recreational trips are somewhat difficult to interpret because they represent all paralichthid flounder species commonly caught in North Carolina (southern, summer and Gulf). This is because anglers simply report targeting 'flounder' rather than a particular species of flounder. Trips can be defined in several ways but in this document all trips that harvested or released any paralichthid flounder species were included. Trends in trips and harvest are roughly similar throughout most of the time-series but in 2012 to 2014 harvest declined while trips remained relatively high (Figure 4).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery-dependent sampling conducted by the division since 1982. Data collected in this program allow the size and age distribution of southern flounder to be characterized by gear/fishery. Several NCDMF sampling programs collect biological data on commercial and recreational fisheries that catch southern flounder. The primary programs that collect length and age data for harvested southern flounder include: 461 (gill net and seine), 476 (gig and spear), 432 (pound net) and 437 (long haul seine). Programs 466 and 570 collect length data on harvested and discarded flounder. Other commercial sampling programs focusing on fisheries that do not target southern flounder collect biological data rarely. NCDMF sampling of the recreational fishery through the MRIP collects length data on southern flounder. The NCDMF mail-based gigging survey collects harvest data for the recreational gig fishery but does not collect length or age data. Age data from the recreational fishery are collected mainly via voluntary angler donations.

There were no clear trends in commercial length and age data in 2005-2014 (Table 1). Annual mean lengths were fairly consistent and 2014 was similar to previous years. However, the number of fish measured in 2014 was the lowest of any year 2005-2014. The modal and maximum ages were also fairly consistent throughout the time-series. The annual number of age samples collected and aged was low from the commercial fisheries. 2014 age data were not complete.

There were no clear trends in recreational length and age data in 2005-2014 (Table 2). Annual mean lengths were fairly consistent and 2014 was similar to previous years. The modal and maximum ages were also fairly consistent throughout the time-series. The annual number of age samples collected and aged was generally low but increased in 2013 from the recreational fisheries. 2014 age data were not complete.

Fishery-Independent Monitoring

Several NCDMF independent sampling programs collect biological data on southern flounder. The primary surveys that collect length data for southern flounder and were included as indices of abundance in recent stock assessments were: 120 (Estuarine Trawl Survey), 195 (Pamlico Sound Survey), 135 (Striped Bass Independent Gill Net Survey) and 915 (Pamlico Sound Independent Gill Net Survey). Age data primarily come from program 915 although the other three surveys do collect age data also. Methodology for analyzing trends in CPUE for each survey changed with the 2014 stock assessment when generalized linear models (GLMs) were used to calculate relative yearly abundance index values. The indices were updated for this report through 2014 using the same methodology

There were no clear trends in fishery-independent length and age data in 2005-2014 (Table 3). Annual mean lengths were fairly consistent and 2014 was similar to previous years. However, the number of fish measured in 2014 was the lowest of any year 2005-2014. The modal age decreased slightly after 2006 but the maximum age increased slightly. The annual number of age samples collected and aged generally increased since 2005. 2014 age data were not complete.

Data collected by Program 915 were used for an index of general (juvenile and adult) abundance in recent stock assessments. The survey is designed to characterize the size and age distribution for key estuarine species in Pamlico Sound and its major river tributaries. Sampling began in Pamlico Sound in 2001 and was expanded to the current sampling area (including tributaries) in 2003. Each array of nets consists of floating gill nets in 30-yard segments of 3-, 3.5-, 4-, 4.5-, 5-, 5.5-, 6-, and 6.5-inch stretched mesh, for a total of 240 yards of nets. Catches from an array of gill nets comprise a single sample; two samples (one shallow, one deep) totaling 480 yards of gill net are completed each trip. Gill nets are typically deployed within an hour of sunset and fished the following morning. Efforts are made to keep all soak times within 12 hours. All gill nets are constructed with a hanging ratio of 2:1. Gill net sets are made using a random stratified survey design, based on area and water depth. Each region is overlaid with a one-minute by one-minute grid system (equivalent to one square nautical mile) and delineated into shallow (<6 feet) and deep (>6 feet) strata. Deep strata were not included in data analysis for this report. Sampling in Pamlico Sound is divided into two regions: Region 1, which includes areas of eastern Pamlico Sound adjacent to the Outer Banks from southern Roanoke Island to the northern end of Portsmouth Island; and Region 2, which includes Hyde County bays from Stumpy Point Bay to Abel's Bay and adjacent areas of western Pamlico Sound. Each of the two regions is further segregated into four similar sized areas, denoted by either Hyde or Dare and numbers 1 through 4. The rivers are divided into four areas in the Neuse River, three areas in the Pamlico River, and one area for the Pungo River. Although the survey is conducted in all months except January, only July-September data were used to analyze CPUE trends because these months had the peak catches of southern flounder. The survey was expanded to include areas in the southern portion of the state in 2008, but these data were not analyzed for the index due to the short time-series. The abundance index for Program 915 peaked in 2010 and the low point was in 2007 for the time-series analyzed (2003-2014) but has no clear trend overall (Table 4; Figure 5). In 2014 the abundance index declined relative to recent years.

Data collected by Program 135 were used for an index of general (juvenile and adult) abundance in recent stock assessments. Beginning in 1990, Program 135 has conducted gill net sets in waters of Albemarle Sound and Roanoke River. The survey was designed to monitor the striped bass population. The survey follows a random stratified design, stratified by geographic area. This survey divides the Albemarle region into six sample zones that are further subdivided into one-mile square quadrants with an average of 22 quadrants per zone. Four arrays of twelve meshes (2.5-, 3-, 3.5-, 4-, 4.5-, 5-, 5.5-, 6-, 6.5-, 7-, 8-, 10-inch stretch) of gill nets are set in each quadrant by the fishing crew, two arrays are sinking gill nets and two are floating. One unit of effort is defined as each 40-yard net fished for 24 hours. Only samples from November and December were included in analysis of CPUE trends (when the most extensive sampling coverage occurs). The abundance index for Program 135 peaked in 1992 and the low point was in 2011 for the time-series analyzed (1991-2014) and has been at a lower level since the mid-1990s (Table 4; Figure 5). In 2014 the abundance index was typical of recent years.

Data collected by Program 120 were used for a juvenile abundance index (JAI) in recent stock assessments. The Estuarine Trawl Survey (Program 120) is a fishery-independent multispecies

monitoring program that has been ongoing since 1971 in the months of May and June. One of the key objectives of this program is to provide a long-term data base of annual juvenile recruitment for economically important species. This survey samples fixed stations, a set of 104 core stations with additional stations as needed. The core stations are sampled from western Albemarle Sound south through the South Carolina border each year without deviation two times in the months of May and June. This survey targets juvenile finfish, blue crabs, and Penaeid shrimp. A two-seam 10.5 foot headrope trawl with a ¼ inch mesh in the body and 1/8 inch mesh in the tailbag is used. A one-minute tow is conducted covering a distance of 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 to 60 individuals is measured. Environmental data is collected, including salinity, dissolved oxygen, temperature, wind speed and direction. Data from this survey were used to produce juvenile abundance indices for southern flounder from 1991 to 2014. The abundance index for Program 120 peaked in 1996 and the low point was in 1998 for the time-series analyzed (1991-2014) but shows no clear trend (Table 4; Figure 6). In 2014 the abundance index declined slightly from 2013 but was typical of index values in recent years.

Data collected by Program 195 were used for a juvenile abundance index (JAI) in recent stock assessments. Program 195 conducts trawls using a random stratified survey design in waters of Pamlico Sound and major river tributaries in June and September. Only data from September were used for the JAI in the 2014 stock assessment. Stations are randomly selected from strata based upon depth and geographic location. Randomly selected stations are optimally allocated among the strata based upon all previous sampling in order to provide the most accurate abundance estimates (PSE <20). Tow duration is 20 minutes; using double rigged demersal mongoose trawls (9.1m headrope, 1.0m X 0.6m doors, 2.2-cm bar mesh body, 1.9-cm bar mesh cod end and a 100-mesh tailbag extension. Data from this survey were used to produce juvenile abundance indices for southern flounder from 1991 to 2014. The abundance index for Program 195 peaked in 1992 and the low point was in 1998 for the time-series analyzed (1991-2014) and has been at a lower level since the mid-1990s (Table 4; Figure 6). In 2014 the abundance index declined slightly from 2013 but was typical of index values in recent years (except 2012).

MANAGEMENT STRATEGY

Southern flounder are managed under Amendment 1 to the Southern Flounder FMP, adopted in February 2013. Amendment 1 established the threshold spawning potential ratio (SPR) of 25% and the target SPR of 35% and implemented management measures for the commercial and recreational fisheries (Table 5). Actions to achieve sustainable harvest in Amendment 1 include: 1) accept management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery; 2) increase the recreational minimum size limit to 15 inches and decrease the creel limit to 6 fish. Since the adoption of Amendment 1, the 2014 Southern Flounder Stock Assessment was completed. Upon review of the assessment, external peer reviewers and the NCDMF determined the model could not fully account for stock mixing during spawning and quantify migration of southern flounder to and from North Carolina waters. Consequently, the assessment was not accepted for determining stock status so it is currently unknown whether the stock is overfished or if overfishing is occurring. Due to concerns for the health of the stock based on abundance trends and the percentage of immature fish in the harvest, in February 2015 the NCMFC requested a supplement be developed for reducing harvest in the southern

flounder. The supplement process is currently underway and a final decision is expected in August 2015.

MANAGEMENT AND RESEARCH NEEDS

The management strategies and implementation status from Amendment 1 of the N.C. Southern Flounder FMP can be found in Table 5. The following research recommendations were included in Amendment 1; status of need is provided in parentheses:

- Investigate the feasibility of a quota as a management tool for the commercial southern flounder fishery (underway).
- Annual survey of the recreational gig fishery (mail-based survey underway, dockside survey still needed).
- Further research on southern flounder that remain in the ocean after the spawning season (tagging studies underway but other studies may be needed).
- Determine the exact locations of spawning aggregations of southern flounder in the ocean (tagging studies underway but other studies may be needed).
- Continued otolith microchemistry research to gain a better understanding of ocean residency of southern flounder (more research needed).
- Tagging study of southern flounder in the ocean to gain a better understanding of migration patterns into the estuaries (underway).
- Update the southern flounder maturity schedule (completed).
- Fishery dependent sampling of the commercial spear fishery for flounder in the ocean (some sampling done under NCDMF sampling but more may be needed).
- Harvest estimates and fishery dependent sampling of the recreational spear fishery for flounder in the ocean (not done except what MRIP encounters).
- Increased fish house sampling of the Currituck Sound flounder gill net and pound net fisheries (sampling has increased, more may be needed).
- Increased at-sea observer trips with gill netters and pound netters in Currituck Sound (underway for gill nets, pound net observing needed).
- Reestablish a RCGL survey to obtain harvest, discard, and effort information (not underway).
- Establish an at-sea observer program of the RCGL fishery (not underway).
- Formulate a bycatch estimate of southern flounder from crab pots (more research needed).
- Further research on degradable materials to determine which material works best in a given water body and how other parameters, such as microbial activities and the effects of light penetration impact degradation rates and performance of the crab pot (progress unknown).
- Further research on flatfish escapement devices that minimize undersized flounder bycatch and maximize the retention of marketable blue crabs (more research needed).
- Further research on factors that impact release mortality of southern flounder in the recreational hook and line fishery (more research needed).
- Research on deep hooking events of different hook types and sizes on southern flounder (more research needed)
- Population dynamics research for all Atlantic protected species (underway?).
- Continued gear research in the design of gill nets and pound nets to minimize protected species interactions (some research completed, more may be needed).

- Development of alternative gears to catch southern flounder (some research completed, more may be needed).
- Further research on the size distribution of southern flounder retained in pound nets with 5.75-inch and 6-inch escape panels (some research completed, more is needed).
- Research on the species composition and size distribution of fish and crustaceans that escape pound nets through 5.75-inch and 6-inch escape panels (some research completed, more is needed).
- Coast wide at-sea observations of the flounder pound net fishery (still needed).
- Discard mortality estimates of southern flounder from pound nets (still needed).
- Continue at-sea observations of the large mesh gill net fishery, especially outside of the PSGNRA, including acquiring biological data on harvest and discards (underway).
- Increase the number of large mesh gill catches sampled in areas such as Albemarle Sound and the Newport River (sampling has increased, more may be needed).

Research recommendations from 2014 stock assessment, included in Draft Supplement 1 to Amendment 1:

- Retain mail survey of recreational gig survey harvest and discards. Develop methodology to validate mail survey results, possibly using dockside survey (research needed).
- Collect discard data (ages, species ratio, lengths, fates) from gears targeting southern flounder (pound net, gigs, hook and line, trawls) (research on shrimp trawl bycatch underway, research for other gears needed).
- Develop and implement consistent strategies for collecting age and sex samples from commercial/recreational fisheries and independent surveys to achieve desired precision for stock assessment (underway).
- Collect age data from estuarine trawl survey and Pamlico Sound survey to more accurately estimate YOY abundance (instead of using length cutoffs based on length frequency plot interpretations) (underway).
- Tagging study to estimate emigration (unit stock) and mortality rates (underway).
- Expand, improve, or add inshore surveys of southern flounder to develop indices that we can be confident in for future stock assessments (still needed).
- Expand, improve or add fishery-independent surveys of the ocean component of the stock (still needed).
- Conduct studies to better understand ocean residency of southern flounder (still needed).
- Determine locations of spawning aggregations of southern flounder (tagging studies underway but more studies may be needed).
- Conduct sampling of the commercial/recreational ocean spear fishery harvest/discards (underway for commercial, still needed for recreational).
- Re-establish a RCGL survey to obtain harvest, discard, and effort information (still needed).
- Develop spatial model to account for inshore and ocean components of the stock (still needed).

FISHERY MANAGEMENT PLAN RECOMMENDATION

The NCMFC has requested a change to the FMP schedule to begin an amendment, which is currently under review by the secretary of the N.C. Department of Environment and Natural Resources.

LITERATURE CITED

Takade-Heumacher, H., and C. Batsavage. 2009. Stock status of North Carolina southern flounder (*Paralichthys lethostigma*). North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries, Morehead City, North Carolina.

NCDMF. 2015. Stock Assessment of Southern Flounder, *Paralichthys lethostigma*, in North Carolina Waters. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. SAP-SAR-2015-01. 297 p.

TABLES

Table 1. Summary of total length (mm) and age data for NCDMF commercial fishery sampling programs (includes harvest and some discard information)

Year	Mean length	Minimum length	Maximum length	Total measured	Modal age	Minimum age	Maximum age	Total aged
2005	402	46	793	28,972	2	0	7	83
2006	414	131	796	39,572	3	0	6	80
2007	413	90	745	23,768	2	0	5	94
2008	404	38	710	39,302	2	0	7	212
2009	405	92	719	33,403	2	1	6	34
2010	415	130	724	27,176	2	1	5	33
2011	409	123	770	32,000	3	1	6	90
2012	408	100	756	29,865	2	0	6	38
2013	399	16	804	33,776	1	1	5	245
2014	403	21	721	26,354	NA*	NA*	NA*	NA*

* Age data are not yet complete for 2014

Table 2. Summary of total length (mm) and age data for NCDMF recreational fishery sampling

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	433	334	672	202	3	1	6	112
2006	427	246	789	343	3	1	6	188
2007	437	355	610	220	2	1	8	137
2008	441	338	698	311	3	1	6	79
2009	431	304	661	306	2	1	4	45
2010	429	270	710	754	2	1	7	127
2011	447	347	651	478	2	1	6	102
2012	449	361	758	400	2	1	6	57
2013	440	338	695	390	3	1	5	49
2014	432	347	654	198	NA*	NA*	NA*	NA*

* Age data are not yet complete for 2014

Table 3. Summary of total length (mm) and age data for NCDMF fishery-independent sampling programs

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	198	7	644	3,769	2	0	4	516
2006	219	12	583	3,560	3	0	4	539
2007	190	12	570	3,812	1	0	5	513
2008	242	7	680	4,270	1	0	5	816
2009	251	24	689	3,230	1	0	5	414
2010	227	13	583	4,168	1	0	5	1,072
2011	294	26	736	2,604	1	0	6	720
2012	258	30	655	4,878	1	0	3	1,112
2013	229	20	684	3,534	1	0	6	678
2014	236	22	634	2,339	NA*	NA*	NA*	NA*

* Age data are not yet complete for 2014

Table 4. Annual relative abundance index values for southern flounder as catch per unit effort and standard error (SE) in NCDMF fishery-independent surveys (programs 120, 195, 135 and 915). Indices for programs 120 and 195 are considered juvenile (young of the year) abundance indices.

Year	P915 Index	P915 SE	P135 Index	P135 SE	P195 Index	P195 SE	P120 Index	P120 SE
1991			6.22	0.78	0.59	0.18	0.08	0.03
1992			7.45	1.20	5.69	1.64	0.18	0.07
1993			5.41	0.96	4.53	1.63	0.17	0.07
1994			1.34	0.22	5.50	2.07	0.15	0.06
1995			3.33	0.53	3.50	1.06	0.16	0.07
1996			0.98	0.21	2.82	0.73	0.59	0.23
1997			3.20	0.53	3.09	0.91	0.14	0.06
1998			1.75	0.44	0.13	0.05	0.05	0.02
1999			0.56	0.13	0.55	0.17	0.22	0.08
2000			2.46	0.62	0.30	0.07	0.28	0.11
2001			2.57	0.48	1.50	0.59	0.37	0.14
2002			2.81	0.50	2.62	0.99	0.36	0.14
2003	4.38	0.54	0.58	0.14	0.42	0.15	0.34	0.13
2004	4.82	0.51	2.54	0.47	0.31	0.13	0.28	0.11
2005	3.90	0.40	1.72	0.29	1.45	0.39	0.18	0.07
2006	3.01	0.48	1.79	0.50	0.48	0.16	0.18	0.07
2007	2.84	0.34	5.21	0.84	0.78	0.24	0.26	0.10
2008	6.42	0.83	2.19	0.46	1.66	0.68	0.15	0.06
2009	4.16	0.55	1.90	0.24	0.57	0.26	0.15	0.06
2010	6.45	0.83	1.64	0.44	0.35	0.20	0.27	0.10
2011	4.95	0.76	0.46	0.09	0.88	0.32	0.09	0.03
2012	4.49	0.47	2.52	0.58	5.38	2.60	0.23	0.09
2013	4.82	0.45	1.95	0.39	0.77	0.32	0.18	0.07
2014	3.25	0.36	1.39	0.60	0.50	0.27	0.17	0.07

Table 5. Management action taken as a result of Amendment 1 to the Southern Flounder FMP.

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	IMPLEMENTATION STATUS
Achieving Sustainable Harvest	Commercial: Accept management measures to reduce protected species interactions as the management strategy for achieving sustainable harvest in the commercial southern flounder fishery. Specific minimum measures for the flounder gill net fishery are provided in Issue Paper 10.1.1 (page 129). Recreational: Increase the minimum size limit to 15 inches and decrease the creel limit to 6 fish--20.2% harvest reduction	1, 2, 4	Commercial: No Action Required Recreational: Proclamation FF-29-2011 (refer to Supplement A to the 2005 FMP)
Ocean Harvest of Southern Flounder	Status quo and address research recommendations	1, 2,4,7	No Action Required
Large Mesh Gill Net Related Conflicts	Status quo (implement mediation and proclamation authority to address user conflicts with large mesh gill nets)	5,8	No Action Required
Minimum Distance Between Pound Nets and Gill Nets in Currituck Sound	Status quo (200-yard minimum distance between pound nets and gill nets)	5,8	No Action Required
Exploring the Elimination of the Recreational Commercial Gear License (RCGL)	Status quo and address research recommendations	5,8	No Action Required
Update on Southern Flounder Bycatch in the Commercial Crab Pot Fishery	Status quo and expand research on flatfish escape devices and degradable panels under commercial conditions to other parts of the state	3	No Action Required
Southern Flounder Discards in the Recreational Hook and Line Fishery	Status quo and expand research on factors impacting the release mortality of southern flounder and on deep hooking events of different hook types and sizes	3	No Action Required
Incidental Capture of Protected Species in Southern Flounder Large Mesh Gill Net	• Request funding for state observer program • Apply for Incidental Take Permit for large mesh gill	3	No Action Required

ISSUE	MANAGEMENT STRATEGY	OBJECTIVES	IMPLEMENTATION STATUS
and Pound Net Fisheries	net fishery • Continue gear development research to minimize protected species interactions		
Gear Requirements in the Flounder Pound Net Fishery	Status quo minimum mesh size for escape panels (5.5-inch stretched mesh) and recommend further research on 5.75-inch stretched mesh escape panels	3	No Action Required
Gear Requirements in the Flounder Gill Net Fishery	Status quo minimum mesh size (5.5 inches stretched mesh)	3	No Action Required

FIGURES

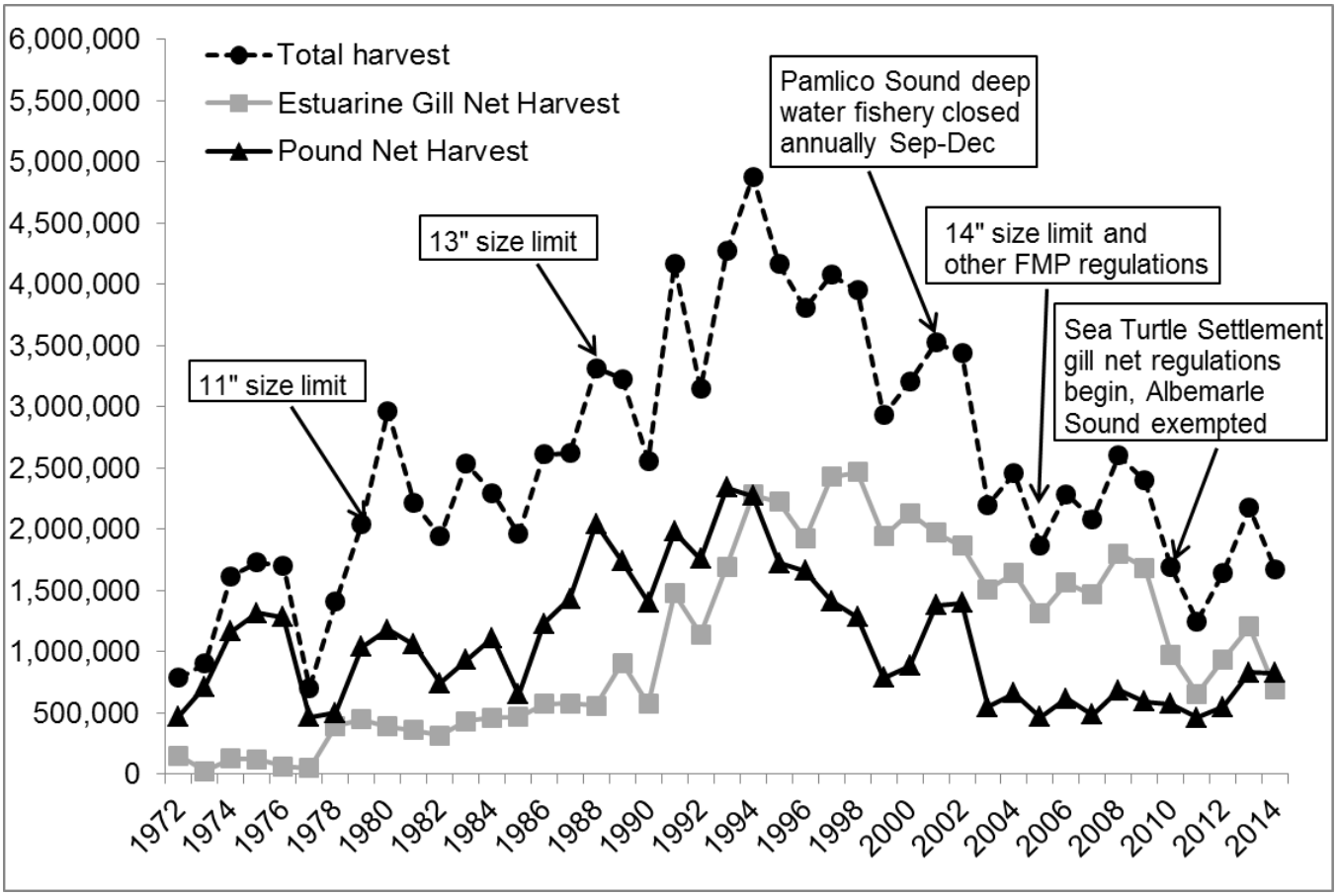


Figure 1. Landings (pounds) for total commercial fishery and top two gears (gill nets and pound nets) from N.C. Trip Ticket Program 1972-2014 with major fishery regulation changes.

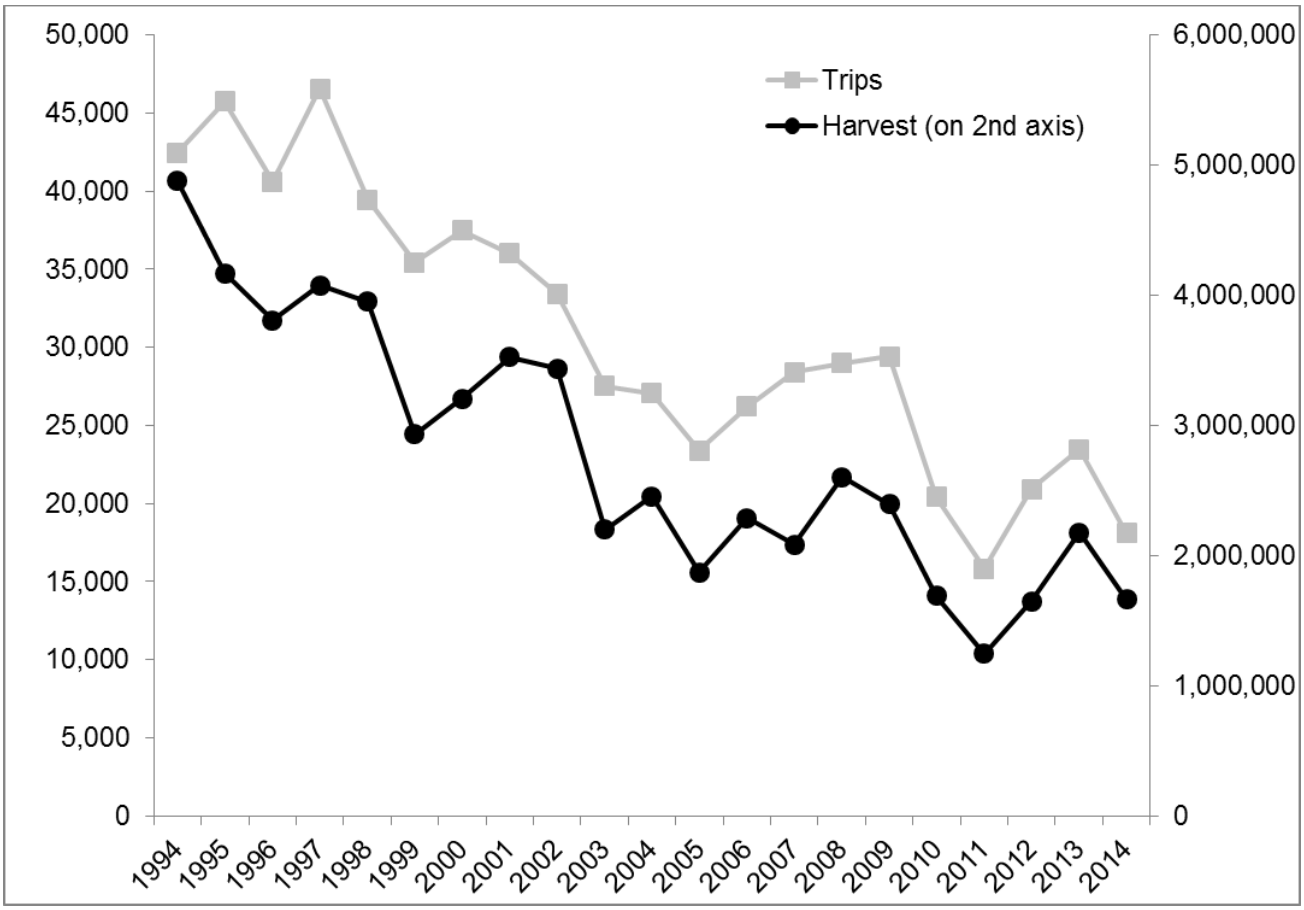


Figure 2. Commercial trips and harvest (pounds) from N.C. Trip Ticket Program, 1994-2014.

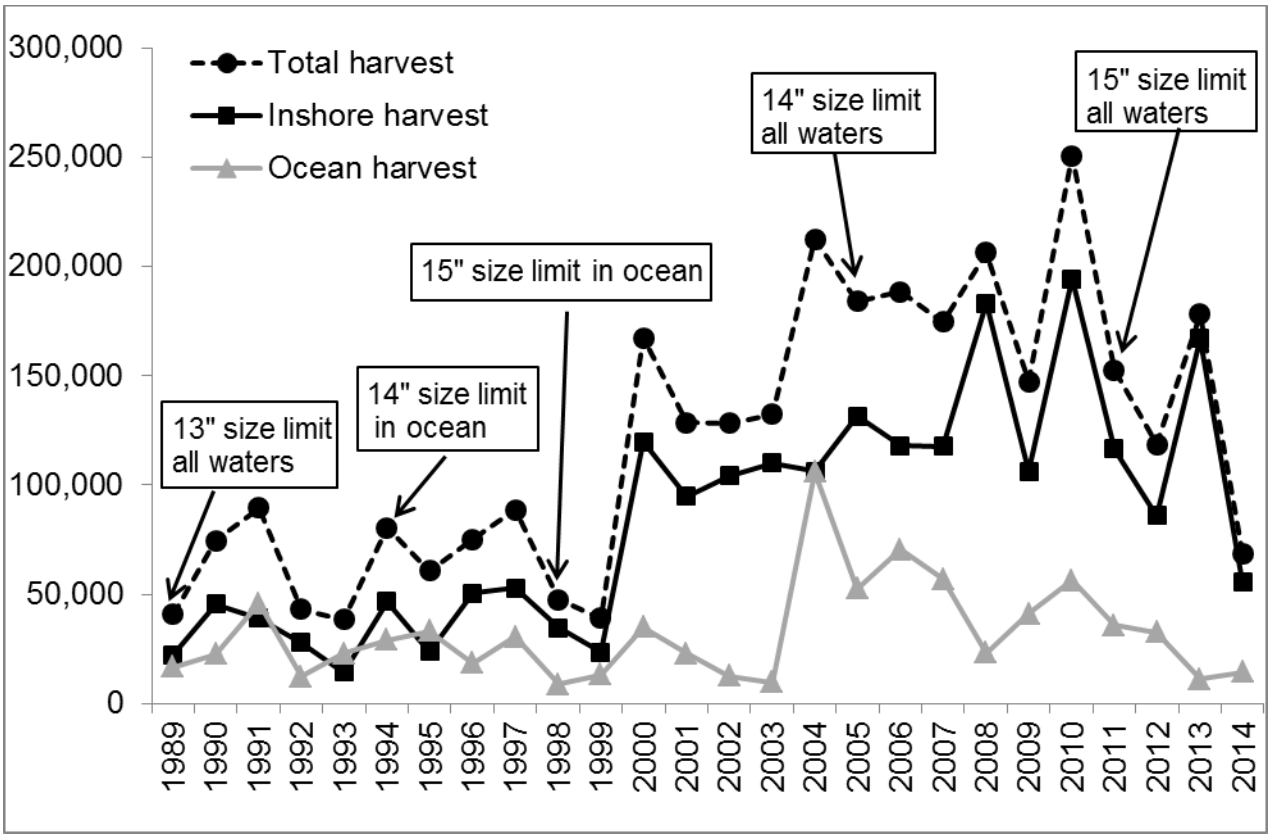


Figure 3. Recreational hook and line harvest in numbers of fish from MRIP data 1989-2014 and major fishery regulation changes.

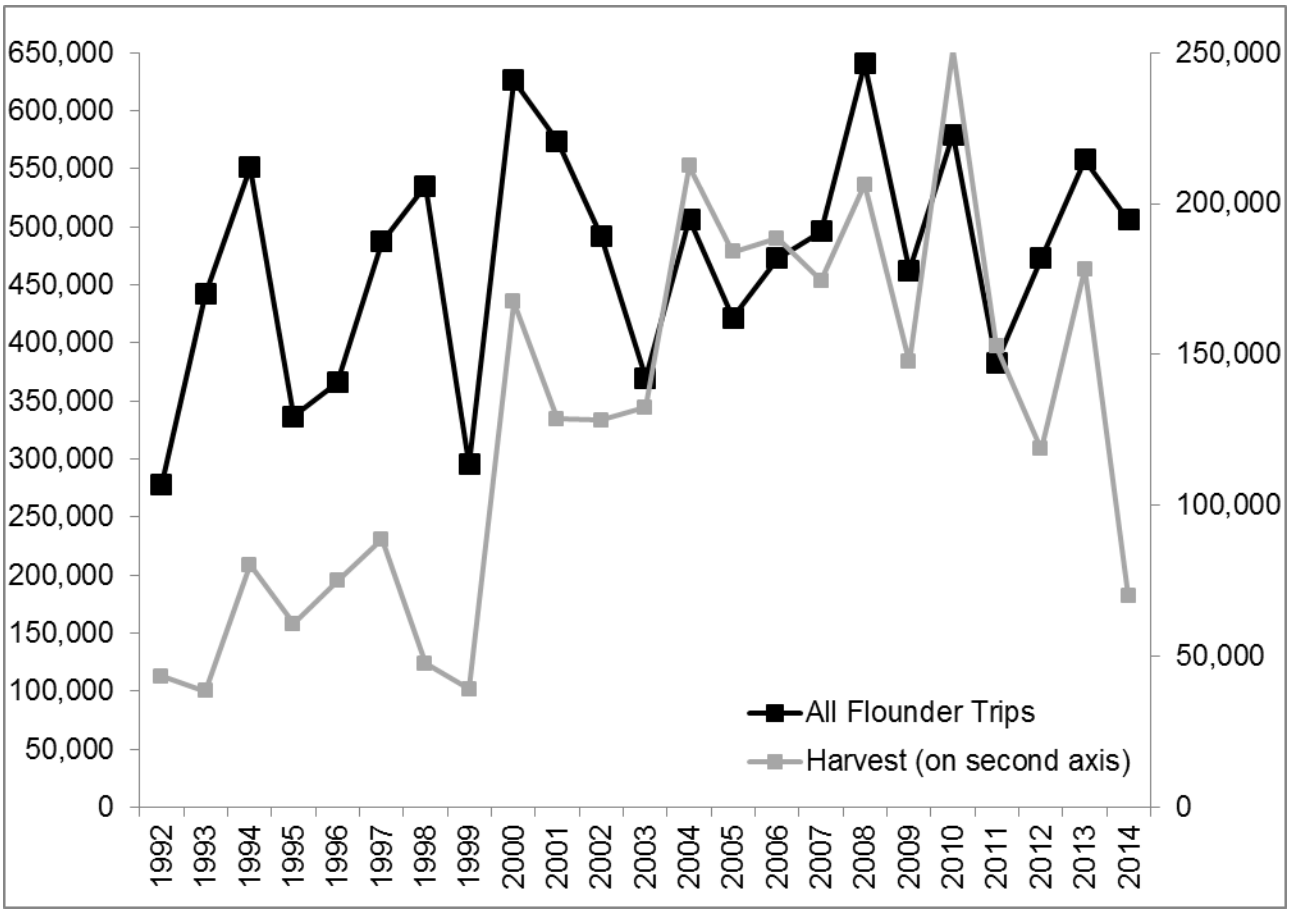


Figure 4. Recreational hook and line harvest (in numbers of fish) and all trips that harvested or released paralichthid flounder species, from MRIP data 1992-2014. Data from prior to 2004 were calibrated to align with MRIP estimates post-2004.

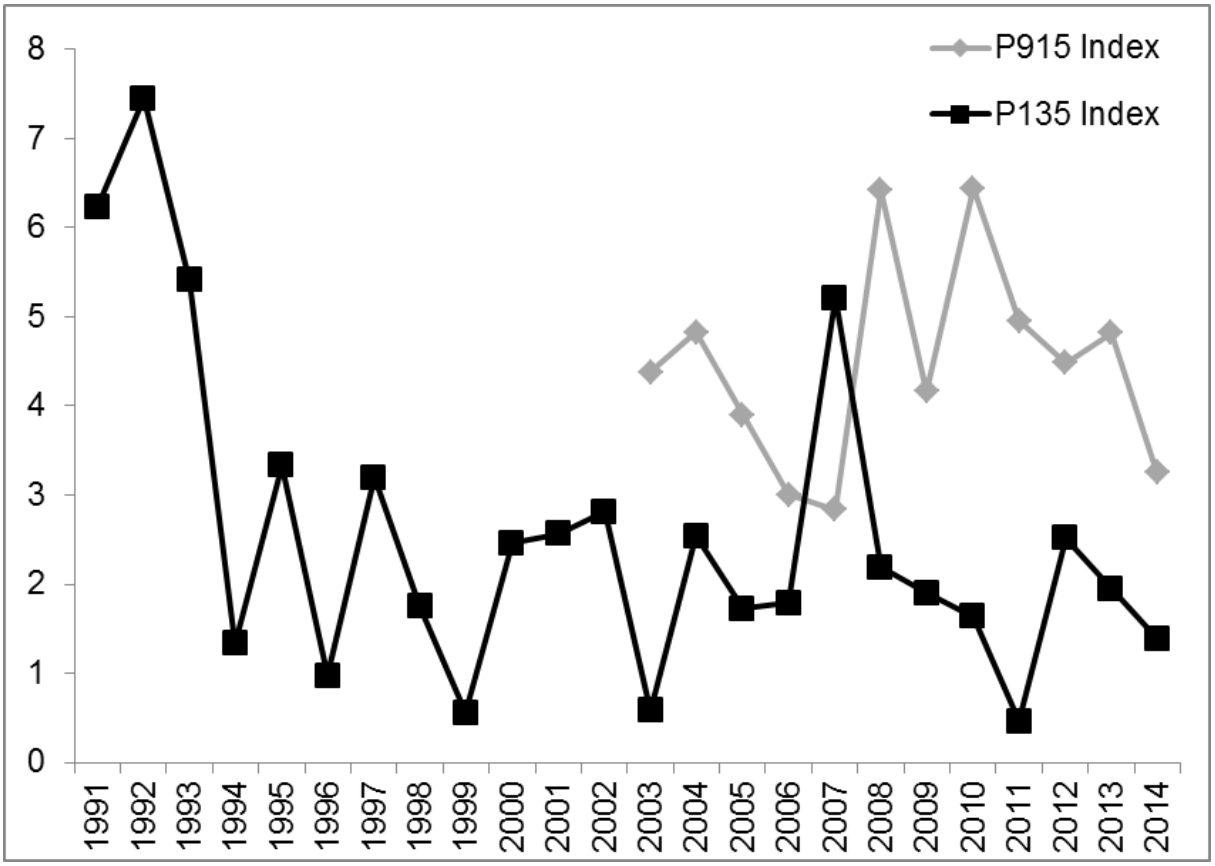


Figure 5. Annual relative abundance index values for southern flounder (juveniles and adults) caught in the Pamlico Sound Independent Gill Net Survey (P915) and Striped Bass Independent Gill Net Survey (P135). Survey catch per unit effort data was standardized using generalized linear models (including all significant variables).

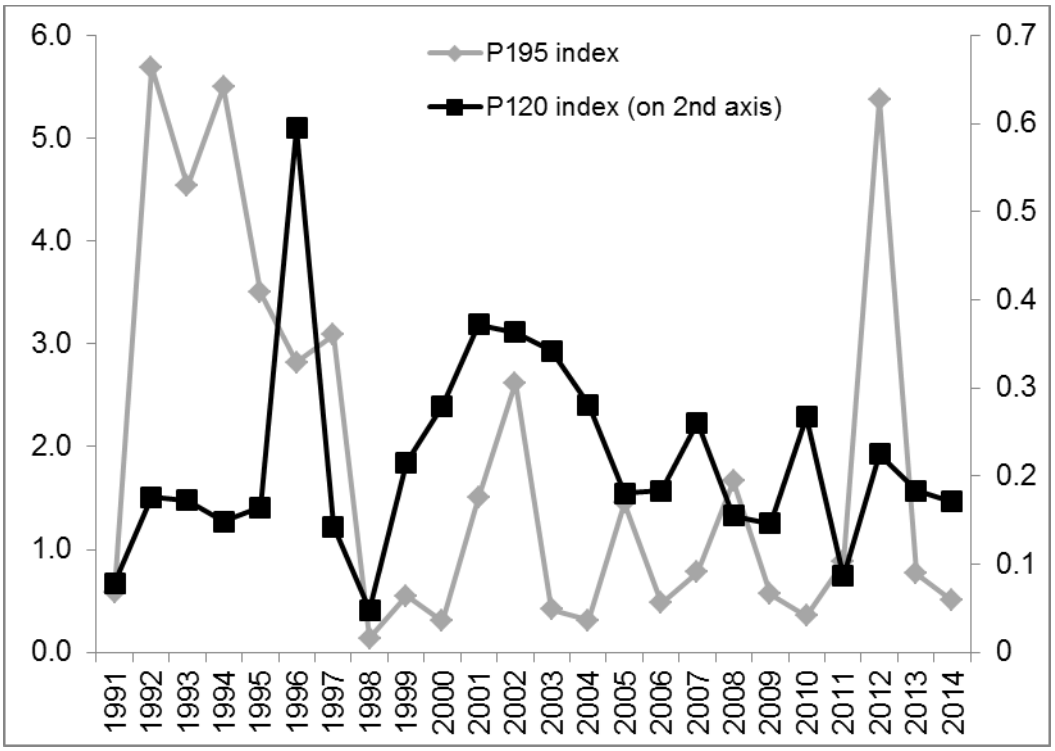


Figure 6. Annual relative abundance index values for southern flounder (juveniles and adults) caught in the Pamlico Sound Survey (P195) and the Estuarine Trawl Survey (P120). Survey catch per unit effort data was standardized using generalized linear models (including all significant variables).

FISHERY MANAGEMENT PLAN UPDATE
SPOTTED SEATROUT
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	NCDMF February 2012; ASMFC October 1984
Amendments:	ASMFC August 2011 – Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout
	ASMFC October 2011 – Omnibus Implementation Plan
Revisions:	N/A
Supplements:	Supplement A to the 2012 NCDMF FMP February 2014
Information Updates:	N/A
Schedule Changes:	N/A
Next Benchmark Review:	July 2017

Spotted seatrout are currently managed under the 2012 North Carolina Spotted Seatrout Fishery Management Plan (FMP) with guidance provided by the Atlantic States Marine Fisheries Commissions (ASMFC) Omnibus Amendment to the Interstate FMPs for Spanish Mackerel, Spot, and Spotted Seatrout. Supplement A was drafted as a proposal to consider maintaining short–term measures in the spotted seatrout fishery (40% reduction at 14-inch total length minimum size) to address several sources of uncertainty in the stock assessment through acquisition and assessment of additional data. This supplement examined sources of uncertainty in the assessment, the rationale for not implementing on schedule the North Carolina Spotted Seatrout FMP February 2014 management measures, and presented possible interim management measures. Three options were selected for presentation to the North Carolina Marine Fisheries Commission (NCMFC). At the February 2014 MFC meeting the commission voted to maintain short-term management measures in the spotted seatrout fishery (Proclamation FF-13-2012: 14-inch minimum size, 75-fish commercial trip limit with weekend closures in joint waters except in Albemarle and Currituck sounds; Proclamation FF-12-2012: 14-inch minimum size, four-fish recreational bag limit). These measures will remain effective until an amendment is completed.

As required in the approved 2012 FMP, a stock assessment was completed on schedule (2014/2015), peer reviewed, approved for management, and was presented to the NCMFC at its May 2015 business meeting. The North Carolina Division of Marine Fisheries (NCDMF) will present management options for guidance on moving forward with a review of the FMP or delaying the review until 2017. The NCMFC voted and approved changes to the FMP schedule reflecting the commissions desire to delay the review of the 2012 FMP until 2017.

Management Unit

The management unit for the North Carolina Spotted Seatrout FMP includes all spotted seatrout within the coastal and joint waters of North Carolina. The unit stock, or population unit, for North Carolina's assessment of spotted seatrout included all spotted seatrout from North Carolina and Virginia.

Goal and Objectives

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

1. Develop an objective management program that provides conservation of the resource and sustainable harvest in the fishery.

2. Ensure the spawning stock is of sufficient capacity to prevent recruitment-overfishing.

3. Address socio-economic concerns of all user groups.

4. Restore, improve, and protect important habitats that affect growth, survival, and reproduction of the North Carolina spotted seatrout stock.

5. Evaluate, enhance, and initiate studies to increase understanding of spotted seatrout biology and population dynamics in North Carolina.

6. Promote public awareness regarding the status and management of the North Carolina spotted seatrout stock.

STATUS OF THE STOCK

Stock Status

The 2014 North Carolina spotted seatrout stock assessment indicated that the spotted seatrout stock in North Carolina and Virginia is not overfished and overfishing in not occurring. Based on the results for this current assessment the NCDMF has updated the status of spotted seatrout to viable.

Stock Assessment

The 2014 assessment of the spotted seatrout in North Carolina and Virginia was conducted using a Stock Synthesis model that incorporated data (1991–2013) collected from commercial and recreational fisheries, two fishery-independent surveys, and a tagging study. This approach differs from the previous NCDMF assessment of spotted seatrout, which was applied to data available from 1991 through 2008. The previous assessment utilized the ASAP2 statistical catch-at-age model and used data more limited in both area and time. The previous model relied primarily upon fishery-dependent data, one fishery-independent index, and also included age data from the North Carolina portion of the stock only.

The time period for the new assessment is 1991 through 2012. The Stock Synthesis model has been thoroughly vetted through the stock assessment community and peer reviewed literature. This assessment relied on expanded fishery-independent data sources, included age data from the Virginia portion of the stock, a juvenile abundance index, and tag-return data from research conducted by Tim Ellis with North Carolina State University. The fishing year was changed from a calendar year to a biological year (defined as March 1 through February 28) to allow the model to incorporate cold stun mortalities within a single fishing year instead of across two calendar years. The maximum age was decreased from 12 years (previous assessment) to nine as the 12 year maximum was based on scale ages not otoliths. Only ages derived from otoliths were used in the current assessment.

Tagging data provided by Tim Ellis were included in the model but did not have a significant influence on results. Multiple model configurations were attempted to account for varying natural mortality based on everything from direct tagging estimates to estimates based on water temperature correlations: however, no model configuration incorporating varying natural mortality would produce results (converge). Tim Ellis' data did provide further evidence of the highs and lows associated with spotted seatrout natural mortalities and the need for a custom model that can incorporate these highly variable mortality rates. The NCDMF recognized the need to develop a model that will accept variable natural mortality estimates. Developing a custom model that can incorporate variable natural mortality was added as a research recommendation and the NCDMF will continue to investigate this during the next assessment.

The results of this assessment suggest the age structure of the spotted seatrout stock has been expanding during the last decade. However, an abrupt decline is evident in the model's estimate of recruitment after 2010, although this is not mirrored in the empirical survey data. Spawning stock biomass increased to its maximum in 2007 but has since declined to close to the time series average. In 2012, the estimate of spawning stock biomass was 2,513,270 pounds, which is greater than the currently defined threshold for spawning stock biomass (868,621 pounds); and suggests the stock is not currently overfished (Figure 1). Fishing mortality has varied without apparent trend, but periods of high fishing mortality seem to coincide with the decline in spawning stock biomass and may be attributed to cold stun events. The 2012 estimate of fishing mortality was 0.40, which is less than the fishing mortality threshold (0.66), indicating that the stock is not experiencing overfishing; however, the 2012 estimate of fishing mortality (0.40) is very near the target fishing mortality of 0.42 (Figure 2).

STATUS OF THE FISHERY

Current Regulations

The NCDMF currently allows the recreational harvest of spotted seatrout seven days per week with a minimum size limit of 14 inches total length and a daily bag limit of four fish. The commercial harvest is limited to a daily limit of 75 fish with a minimum size limit of 14 inches total length. It is unlawful for a commercial fishing operation to possess or sell spotted seatrout for commercial purposes taken from Joint Fishing Waters of the state from midnight on Friday to midnight on Sunday each week; the Albemarle and Currituck sounds are exempt from this weekend closure. There was a February 5 through June 15, 2014 closure due to a cold stun event.

Commercial Landings

Total commercial landings for Virginia and North Carolina combined have ranged from 98,988 to 760,595 pounds between 1991 and 2012 (Table 1; Figure 3). During the early to mid-1990s, landings in the ocean and estuarine areas were more similar than in the remainder of the time series in which estuarine landings have dominated.

Recreational Landings

Recreational data are collected through the Marine Recreational Information Program (MRIP). Recreational harvest (Type A + B1) ranged from 245,815 to 1,307,341 pounds between 1991 and 2012 (Table 2; Figure 4). In terms of numbers, recreational landings (Type A + B1) has ranged from 208,110 to 727,714 fish during the same time period (Table 2; Figure 4). Estimates of live releases (Type B2) usually exceeded landings (Type A + B1), especially in recent years. Like live releases (Type B2), estimates of dead discards (dead B2) have shown a general increase from 1991 through 2012 (Table 2; Figure 4).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fishing activity is monitored through fishery dependent sampling conducted by the NCDMF since 1982. Data collected in this program allow the size and age distribution of spotted seatrout to be characterized by gear/fishery. Mean, minimum, and maximum lengths have not varied much between years or across the entire time series for either commercial or recreational data. Data are represented in Tables 3 and 4 and Figure 5.

Fishery-Independent Monitoring

The best-fitting Generalized Linear Model (GLM) for the Program 120 index of age-0 abundance for spotted seatrout included year, sampling location, bottom temperature, and bottom salinity as significant covariates. The resulting index varied without trend over the time series (Table 5; Figure 6). Peaks in age-0 relative abundance were observed in 2008 and 2012, suggesting relatively higher recruitment in those years.

A fishery independent gill net survey was initiated by the NCDMF in May of 2001. The survey utilizes a stratified random sampling scheme designed to characterize the size and age distribution for key estuarine species in Pamlico Sound. By continuing a long-term database of age composition and developing an index of abundance for spotted seatrout this survey will help managers assess the spotted seatrout stocks without relying solely on commercial and recreational fishery dependent data. The best-fitting GLM for the spring index included year, depth, bottom temperature, and bottom DO as significant covariates. The final model for the summer index included year, depth, bottom temperature, and bottom salinity. The best model for the fall index included year, depth, and bottom salinity. The GLM analysis indicated that year was the only significant covariate for the southern index so this index was instead calculated using the traditional estimator for a random stratified average.

All four Program 915 indices varied without trend over the respective time series (Table 5; Figures 7-10). A peak was observed in 2009 in the spring (Figure 7), summer (Figure 8), and southern (Figure 10) indices. This corresponds with the peak observed in 2008 in the Program

120 age-0 index (Figure 6). The fall index exhibited a peak in 2006 (Figure 9). All the Program 915 indices suggest an increase in 2012 to varying degrees.

MANAGEMENT STRATEGY

Reduce F to maintain a 20% SPR which will increase the likelihood of sustainability through an expanded age structure and an increase in the spawning stock biomass. This strategy should provide a greater cushion for the population that would likely lead to faster recovery of the population after cold stun events. Consider revising reference points after the stock is reassessed in the next plan review based on the response of the population to the management measures selected in the initial FMP. The Director will maintain authority to intervene in the event of a catastrophic cold stun event and do what is necessary in terms of temporary closures by water body (Table 8).

MANAGEMENT AND RESEARCH NEEDS

The following research needs were compiled from those listed in the issue papers in Section 10, as well as those outlined in Section 11.1 Data Needs, and in Appendix 4 of the 2012 North Carolina Spotted Seatrout FMP. Improved management of spotted seatrout is dependent upon research needs being met. Research needs are not listed in order of priority**.**

- Develop a juvenile abundance index to gain a better understanding of a stock recruitment relationship – ongoing, using program 120 since 2004
- Research the feasibility of including measures of temperature or salinity into the stock-recruitment relationship could be researched - not completed
- Determine batch fecundity estimates for North Carolina – not completed
- Size specific fecundity estimates for North Carolina spotted seatrout – not completed
- Area specific spawning surveys could help in the delineation of area specific closures to protect females in spawning condition – not completed
- Investigation of the relationship of temperature with both adult and juvenile mortality – not completed
- Incorporate cold stun event information into the modeling of the population – attempted using stock synthesis model, unsuccessful.
- Estimate or develop a model to predict the impact of cold stun events on local and statewide spotted seatrout abundance – attempted using stock synthesis model, unsuccessful.
- Obtain samples (length, age, weight, quantification) of the cold stun events as they occur – obtained samples in 2001, 2014, and 2015 (length, weight, sex, age)(did not quantify extent of kills)
- Define overwintering habitat requirements of spotted seatrout – not conducted
- Determine factors that are most likely to influence the severity of cold stun events in North Carolina, and separate into low and high salinity areas – Tim Ellis and the spotted seatrout Plan Development Team worked on this but were unable to incorporate into models.
- Investigate the distribution of spotted seatrout in nursery and non-nursery areas – not completed
- Further research on the possible influences of salinity on release mortality of spotted seatrout – not completed
- Survey of fishing effort in creeks with conflict complaints – not completed
- Determine targeted species in nursery areas and creeks with conflict complaints – not completed

- Microchemistry, genetic, or tagging studies are needed to verify migration patterns, mixing rates, or origins of spotted seatrout between North Carolina and Virginia – Tim Ellis data (2008-2013), NCDMF CRFL study 2014 - present
- Tagging studies to verify estimates of natural and fishing mortality – Ellis data and ongoing
- Tagging studies to determine if there are localized populations within the state of North Carolina (e.g., a southern and northern stock) – Ellis data and ongoing
- A longer time series and additional sources of fishery-independent information – longer series available as well as 915 survey for rivers and southern portion of state
- Increased observer coverage in a variety of commercial fisheries over a wider area - ongoing
- Expand nursery sampling to include SAV bed sampling in high and low salinity areas during the months of July through September – not completed
- Evaluate the role of shell hash and shell bottom in spotted seatrout recruitment and survival, particularly where SAV is absent – not completed
- Evaluate the role of SAV in the spawning success of spotted seatrout – not completed

FISHERY MANAGEMENT PLAN RECOMMENDATIONS

Based on the 2014 stock assessment the NCDMF recommended to the NCMFC at their May 2015 business meeting to delay review of the 2012 spotted seatrout FMP until 2017 but keeping the review within the 5 year mandatory review cycle.

NCDMF – Delay the review of the 2012 spotted seatrout FMP until 2017.

NCMFC – Voted to approve changes to the FMP schedule reflecting the commission's approval to delay review of the 2012 FMP until 2017.

LITERATURE CITED

NCDMF. 2012. North Carolina spotted seatrout fishery management plan. NCDMF, Morehead City, North Carolina. 344 p.

NCDMF. 2014. Stock Assessment of Spotted Seatrout, *Cynosion nebulosus*, in Virginia and North Carolina Waters. NCDMF, Morehead City, North Carolina. 142 p.

TABLES

Table 1. Commercial landings of spotted seatrout harvested in North Carolina from 1989 through 2014.

Year	Species	Pounds
1989	Spotted Seatrout	451,909
1990	Spotted Seatrout	250,634
1991	Spotted Seatrout	660,662
1992	Spotted Seatrout	526,271
1993	Spotted Seatrout	449,886
1994	Spotted Seatrout	412,358
1995	Spotted Seatrout	574,296
1996	Spotted Seatrout	226,580
1997	Spotted Seatrout	232,497
1998	Spotted Seatrout	307,671
1999	Spotted Seatrout	546,675
2000	Spotted Seatrout	376,574
2001	Spotted Seatrout	105,714
2002	Spotted Seatrout	175,555
2003	Spotted Seatrout	181,462
2004	Spotted Seatrout	130,961
2005	Spotted Seatrout	129,601
2006	Spotted Seatrout	312,620
2007	Spotted Seatrout	374,722
2008	Spotted Seatrout	304,430
2009	Spotted Seatrout	320,247
2010	Spotted Seatrout	200,822
2011	Spotted Seatrout	75,239
2012	Spotted Seatrout	265,016
2013	Spotted Seatrout	367,401
2014	Spotted Seatrout	241,995

Table 2. Annual recreational landings and releases of spotted seatrout in North Carolina and Virginia, 1991–2012.

Biological Year	Landings (A+B1)		Released Alive (B2)	Dead Discards
	Number	Pounds	Number	Number
1991	408,751	612,003	260,832	26,083
1992	387,354	579,154	165,892	16,589
1993	328,397	535,723	228,239	22,824
1994	608,350	883,392	476,756	47,676
1995	442,642	650,805	567,457	56,746
1996	209,698	285,940	379,473	37,947
1997	370,916	608,476	355,763	35,577
1998	350,062	518,748	232,977	23,298
1999	582,633	1,022,945	554,627	55,462
2000	361,517	608,476	523,341	52,334
2001	208,110	245,815	515,052	51,505
2002	227,472	309,970	592,990	59,299
2003	221,098	390,218	349,880	34,988
2004	357,012	526,905	694,776	69,478
2005	651,745	776,909	1,560,866	156,086
2006	585,136	901,470	1,016,368	101,637
2007	706,556	1,307,341	1,776,286	177,629
2008	727,714	1,177,269	1,913,335	191,333
2009	624,731	986,128	1,580,954	158,096
2010	210,692	433,649	2,342,308	234,231
2011	476,920	987,671	3,210,337	321,034
2012	629,219	1,038,377	2,037,673	203,767

Table 3. Mean, minimum, and maximum lengths of spotted seatrout collected from the commercial fishery in North Carolina from 1991 through 2013.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
1991	383	195	730	1,220
1992	422	46	734	2,072
1993	404	144	754	2,192
1994	392	179	738	1,380
1995	432	192	739	2,504
1996	408	179	701	751
1997	395	207	760	2,920
1998	390	212	756	3,098
1999	422	255	768	4,057
2000	448	152	779	2,327
2001	417	272	781	1,363
2002	415	220	735	3,180
2003	435	241	752	1,168
2004	422	242	709	2,193
2005	433	253	698	1,977
2006	418	225	745	4,905
2007	442	57	788	6,577
2008	436	43	770	4,741
2009	425	71	706	5,238
2010	448	300	784	3,208
2011	422	229	706	970
2012	422	222	685	3,805
2013	425	46	723	4,193

Table 4. Numbers of spotted seatrout sampled and measured by MRIP by state, 1991–2012.

Biological Year	North Carolina		Virginia	
	Number Sampled	Number Measured	Number Sampled	Number Measured
1991	1,318	742	53	46
1992	930	543	62	57
1993	672	485	93	69
1994	1,569	1,076	311	195
1995	1,308	853	190	152
1996	642	307	93	72
1997	880	622	164	109
1998	923	551	52	46
1999	934	699	121	97
2000	535	330	87	75
2001	478	326	19	18
2002	414	283	29	23
2003	211	130	117	80
2004	582	294	77	71
2005	1,143	712	21	17
2006	1,417	658	47	30
2007	1,328	529	168	103
2008	1,099	792	152	108
2009	1,045	772	56	45
2010	441	333	42	32
2011	770	652	86	67
2012	1,473	988	164	85

Table 5. GLM-standardized indices of abundance used as input into the 2014 North Carolina spotted seatrout stock assessment model.

Year	Program 120 (age-0) June–July	Program 915 May–June	Program 915 July–August	Program 915 September–November	Program 915 (southern) May–June
2003		0.0368	0.0163	0.0459	
2004	0.188	0.0169	0.0242	0.0361	
2005	0.539	0.0125	0.0188	0.0342	
2006	1.57	0.0482	0.0295	0.0979	
2007	1.26	0.0535	0.0273	0.0432	
2008	3.55	0.0471	0.0307	0.0558	0.442
2009	1.31	0.0818	0.0395	0.0590	1.18
2010	0.435	0.0370	0.0271	0.0484	0.984
2011	0.875	0.0151	0.0270	0.0387	0.162
2012	3.05	0.0644	0.0291	0.0761	0.560

Table 6. Number of females per sample year and age by season from 1990-2013.

Summer											Winter									
Sample Year	0	1	2	3	4	5	6	7	9	Total	Sample Year	0	1	2	3	4	5	6	7	Total
1990											1990	5	11	1		1				18
1991	2	134	36	7	1	1				181	1991	29	207	47	4	1	1			289
1992		89	62	17		1	1			170	1992	4	131	19	17	4				175
1993	1	135	52	24	10		1			223	1993	13	97	10	12	4	3			139
1994	1	82	54	17	9	1		1	1	166	1994	8	241	12	10	4				275
1995	3	106	44	15	6	4				178	1995	49	127	47	15	7				245
1996	7	81	72	21	5	3				189	1996	40	83	55	43	5	3	1		230
1997	1	82	32	39	12	7	2			175	1997	2	139	49	26	7				223
1998	1	56	74	33	30	1				195	1998	23	120	54	7	1	2			207
1999		116	85	70	11	4	3			289	1999	26	121	54	56	8	1	2		268
2000		49	65	7	10			1		132	2000	7	89	44	17	9				166
2001	1	40	30	8	4					83	2001	24	95	43	7		3			172
2002		79	43	75	33	2				232	2002	53	126	43	34	3	4	1		264
2003		42	20	2	2	2	1			69	2003	10	97	36	2	1				146
2004		51	43	9	5		2			110	2004	33	226	41	5	1				306
2005		138	46	24	21	3				232	2005	56	183	24	8	11	1			283
2006		171	53	21	8	6				259	2006	14	330	85	21	4				454
2007		19	98	36	4		1	1		159	2007	13	105	75	19	4	1		1	218
2008		62	63	36	9	1	1			172	2008	4	163	89	36	3				295
2009		28	92	31	8	2	2			163	2009	54	139	63	35	22	2			315
2010		23	38	12	4	1				78	2010	130	81	40	16	7	4			278
2011		33	8	3						44	2011	20	144	5	1					170
2012		93	47	2	2					144	2012	4	224	16	1		1			246
2013		19	141	19	2					181	2013	4	107	71	4					186
Total	17	1,728	1,298	528	196	39	14	3	1	3,824	Total	626	3,419	1,024	396	108	26	4	1	5,604

Table 7. Number of males per sample year and age by season from 1990-2013.

Summer												Winter									
Sample Year	0	1	2	3	4	5	6	7	8	9	Total	Sample Year	0	1	2	3	4	5	6	7	Total
1990												1990	8	10		1					19
1991	3	95	52	3				1			154	1991	13	63	18	3	3	2			102
1992		45	67	5							117	1992	3	50	19	5		1			78
1993		63	36	12	5		1				117	1993	5	77	18	3					103
1994	3	76	20	15	6						120	1994	6	107	8	1	2				124
1995	3	114	23	7	4	2					153	1995	28	55	22	7	5				117
1996	8	97	35	7	1						148	1996	36	75	37	9	2	3	1		163
1997	5	148	15	12	7						187	1997	6	116	23	4	1			1	151
1998		107	63	7	3	2	1			1	184	1998	8	85	18	2	3	1			117
1999		110	68	19	3						200	1999	13	97	28	18	3	2	2		163
2000		37	55	6	6	1					105	2000	2	35	23	6	3				69
2001		45	18	8	1						72	2001	17	62	15	15		1			110
2002		109	26	7	6	2	1	1			152	2002	23	57	6	7	5	2			100
2003		17	10	5	1			1			34	2003	8	75	18	1	2	1	1		106
2004		23	19	11							53	2004	18	108	14	6	1	2			149
2005		44	33	8	4						89	2005	19	103	16	3	6				147
2006		25	47	2	2	2			1		79	2006	9	158	15	8	5	7		1	203
2007		5	82	6	3		2				98	2007	13	69	35				1		118
2008		22	44	21	2			1			90	2008	5	54	23	15	2				99
2009		10	50	16	12						88	2009	31	93	31	9	11	2			177
2010		8	28	7	4	2					49	2010	73	60	23	10	5	1			172
2011		4	2	1							7	2011	6	68	1						75
2012		27	36		4	1					68	2012	3	84	9						96
2013	1	9	91	7	2						110	2013	2	44	49	3					98
Total	23	1,240	920	192	76	12	5	4	1	1	2,474	Total	229	1,488	781	235	81	35	20	2	2,871

Table 8. Management actions taken as a result of development of the N.C. Spotted Seatrout FMP.

ISSUE	MFC SELECTED MANAGEMENT STRATEGY	OBJECTIVES ADDRESSED	REGULATORY ACTION
Achieving Sustainable Harvest	• *½ reduction needed, 6 fish bag, 14-inch minimum size, and weekend closure for commercial gears year-round (no possession on weekends).* • *A maximum of 2 fish over 24 inches for recreational fishermen* • *The small mesh gill net attendance requirement is extended to include weekends, December through February* ***Management Strategy Modified in November 2011*** *Immediately: 14-inch minimum size limit, 4 recreational bag limit, 75 fish commercial trip limit, no gillnets in joint waters on weekends.* *2014: 14-inch minimum size limit, 3 fish recreational bag limit with a December 15- January 31 closure, 25 fish commercial trip limit (no closure)* *If Cold Stun Occurs: close spotted seatrout harvest through June 1and retain 4 fish recreational bag limit and 75 fish commercial trip limit*	1,2	Repeal Rule 3M.0504 and utilize proclamation authority in 3M.0512
	• *Revisit the Spotted Seatrout FMP in 3 years to determine if sustainable harvest measures are working*	1,2	
Enforcement of Size, Creel Limit and Gear Regulations in Joint, Coastal or Inland Fishing Waters	• *Development of a mutual aid agreement between DMF Marine Patrol and WRC Wildlife Enforcement Officers for Inland fishing waters*	1,2,3	
Management Measures to Address User Group Competition	• Move forward with the mediation policy process to resolve conflict between spotted seatrout fishermen	1,2,3	

Impacts of Cold Stun Events on the Population	• Remain status quo with the assumption that the Director will intervene in the event of a catastrophic event and do what is necessary in terms of temporary closures by water body	1,2,3	Repeal Rule 3M.0504 and utilize proclamation authority in 3M.0512
	• *More extensive research on cold stun events by DMF, Universities, etc.*	1,2,3,5	
Use of Gigs to Harvest Spotted Seatrout December-March	• Status quo. DMF to continue to track contributions of gigs to overall landings.	1,2,3	

FIGURES

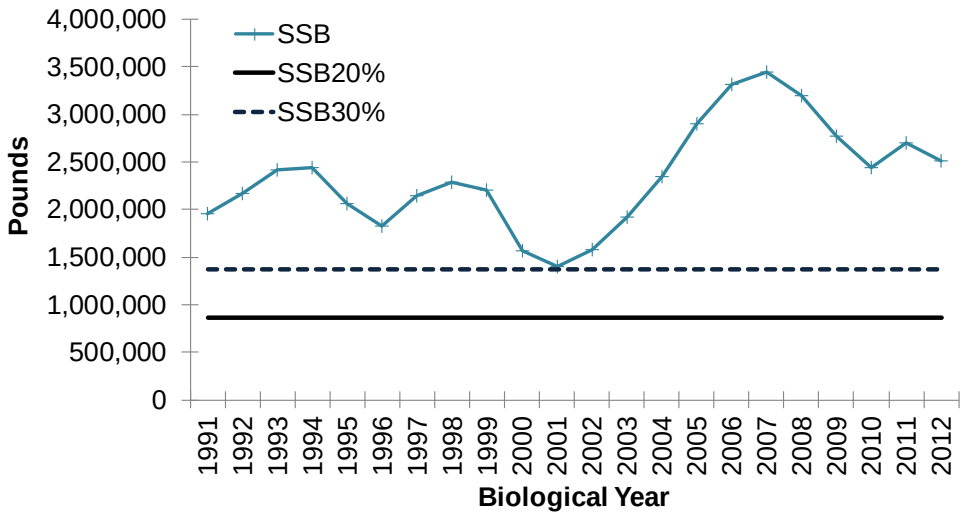


Figure 1. Annual predicted spawning stock biomass compared to estimated $SSB_{Threshold}$ ($SSB_{20\%}$) and SSB_{Target} ($SSB_{30\%}$).

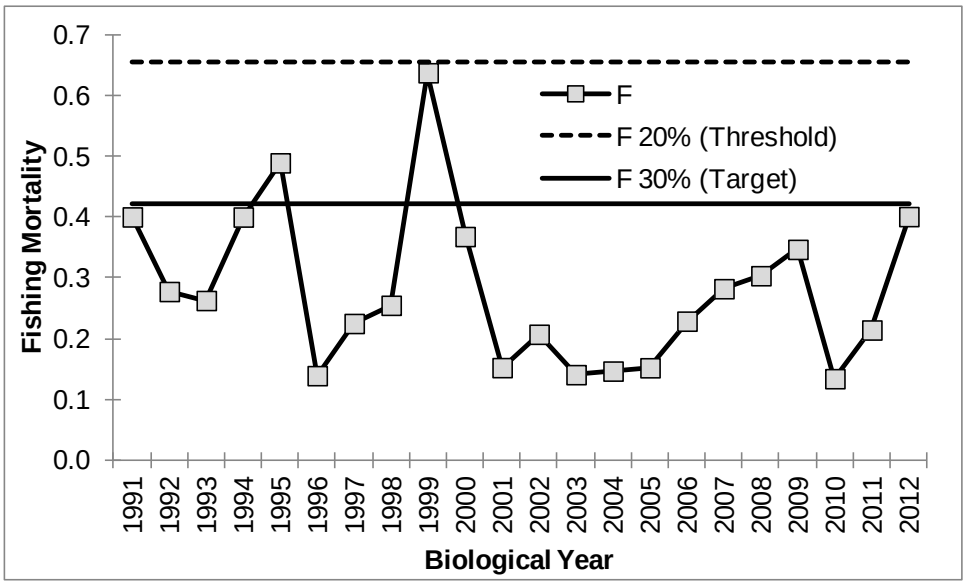


Figure 2. Annual predicted fishing mortality rates (numbers-weighted, ages 1–4) compared to estimated $F_{Threshold}$ ($F_{20\%}$) and F_{Target} ($F_{30\%}$).

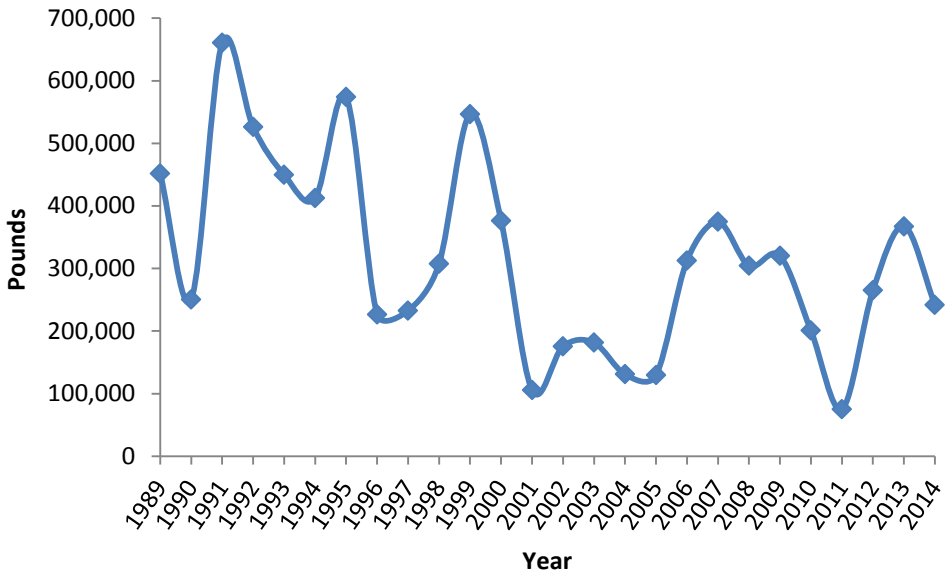


Figure 3. Commercial landings of spotted seatrout harvested in North Carolina from 1989 through 2014.

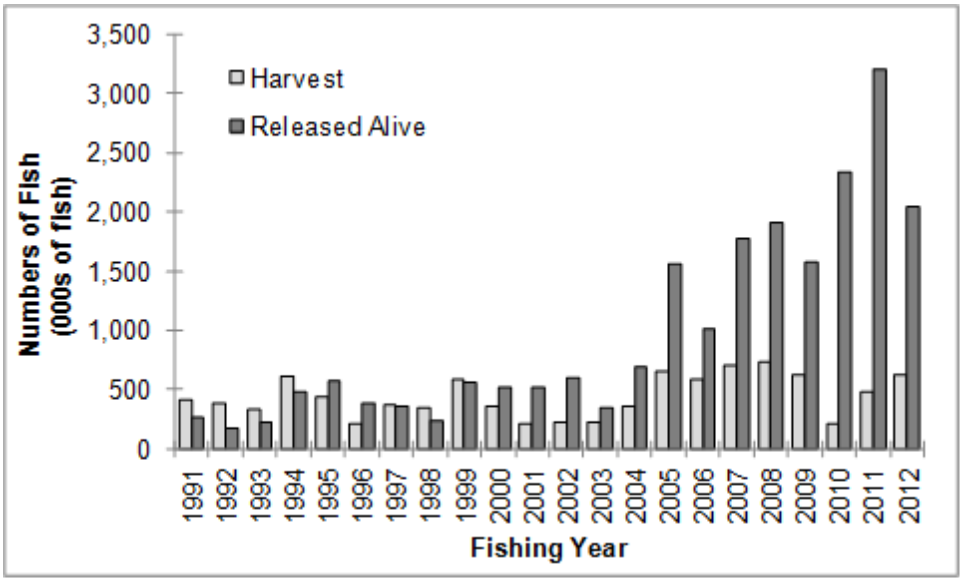


Figure 4. Annual recreational fishery landings (Type A+B1) and live releases (Type B2) of spotted seatrout in Virginia and North Carolina, 1991–2012.

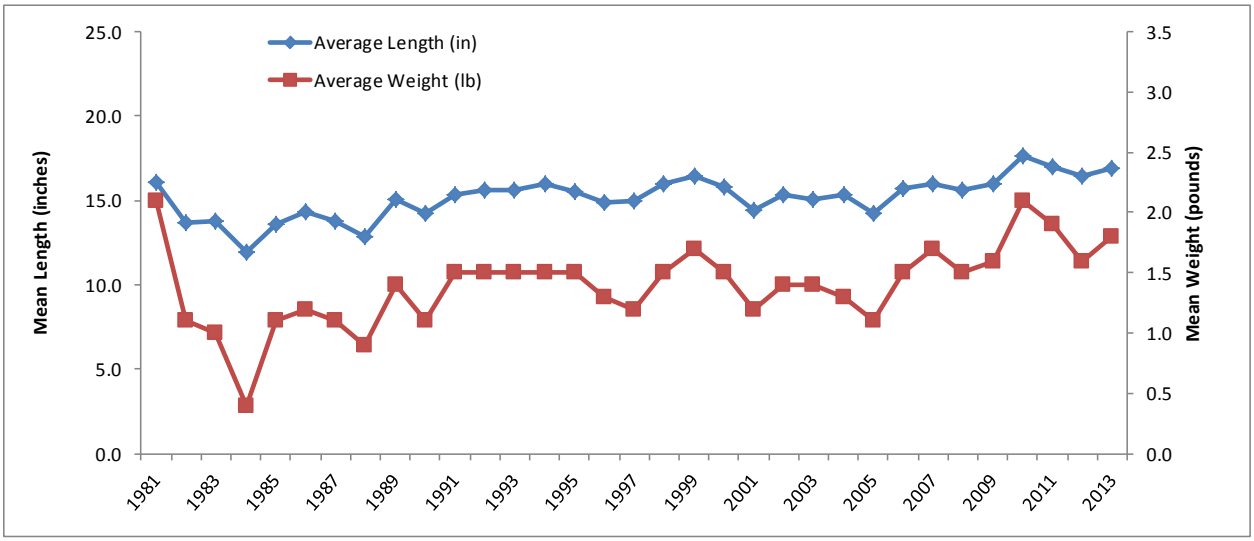


Figure 5. Average length and weight of spotted seatrout measured through the MRIP in North Carolina from 1981 through 2013.

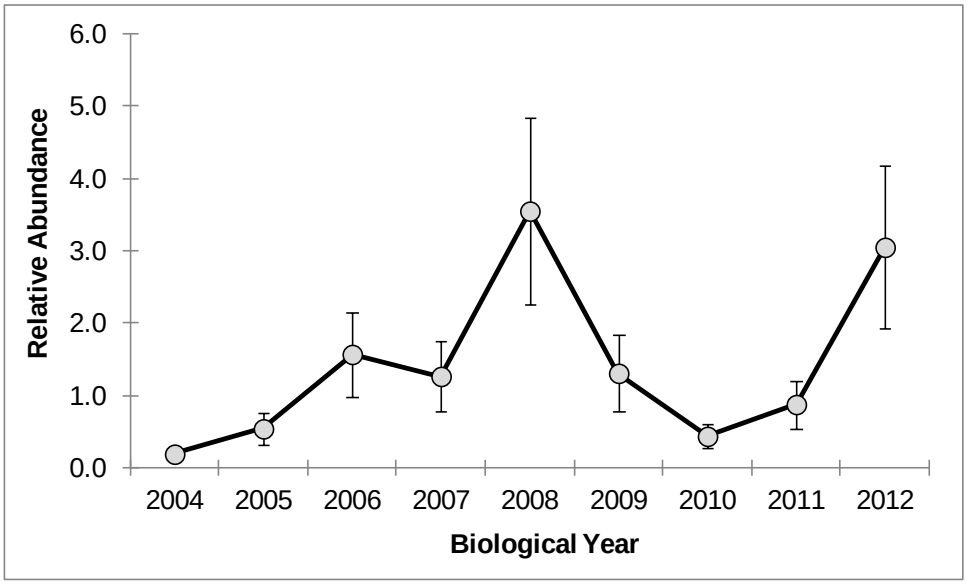


Figure 6. GLM-standardized index of relative abundance for age-0 spotted seatrout collected from Program 120 during June and July, 2004–2012. Error bars represent ± 1 standard error.

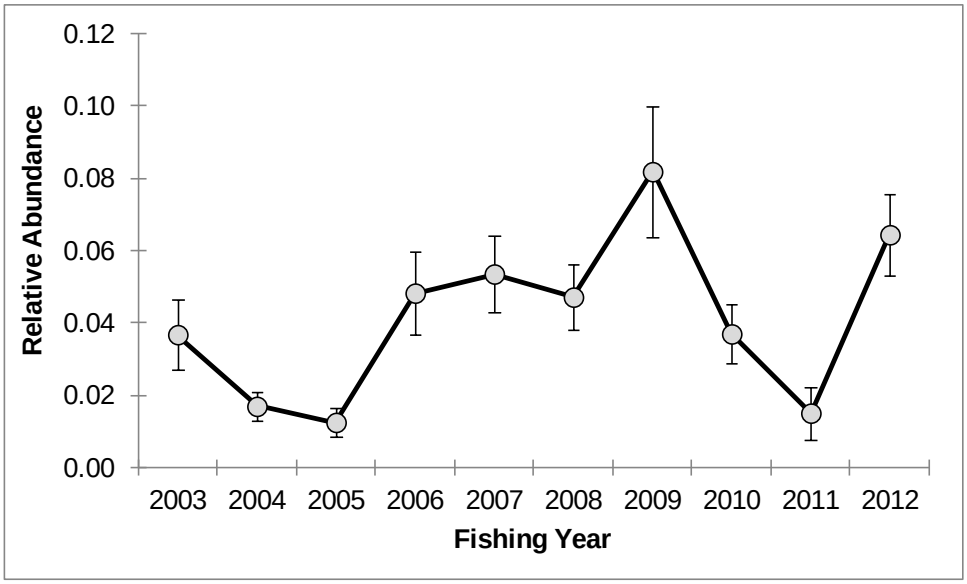


Figure 7. GLM-standardized index of relative abundance for spotted seatrout collected from Program 915 during spring (May–June), 2004–2012. Error bars represent ± 1 standard error.

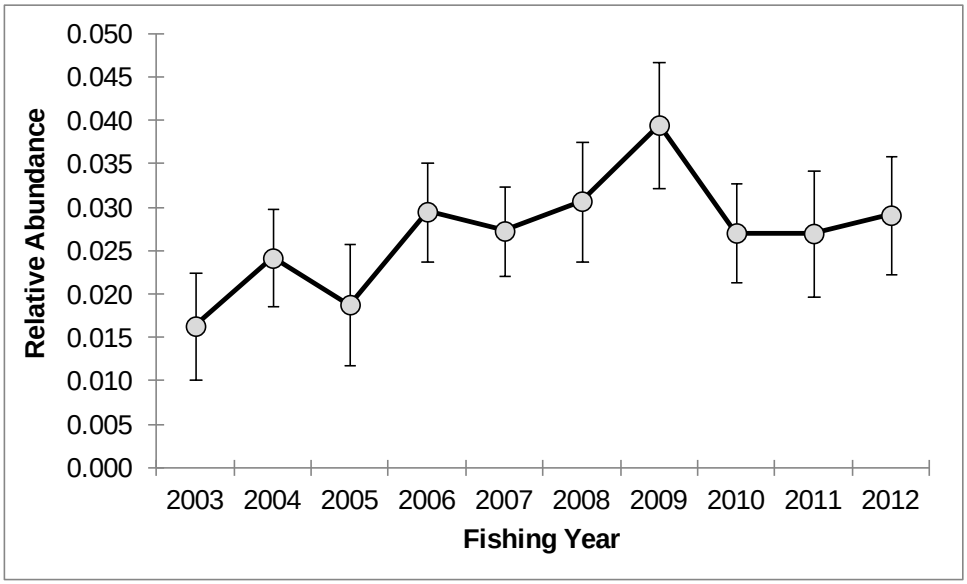


Figure 8. GLM-standardized index of relative abundance for spotted seatrout collected from Program 915 during summer (July–August), 2004–2012. Error bars represent ± 1 standard error.

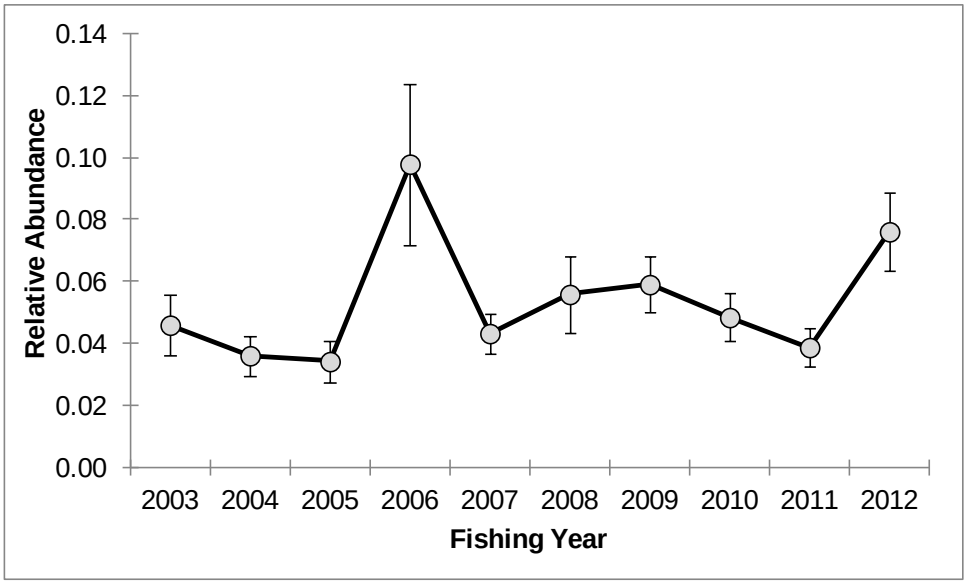


Figure 9. GLM-standardized index of relative abundance for spotted seatrout collected from Program 915 during fall (September–November), 2004–2012. Error bars represent ± 1 standard error.

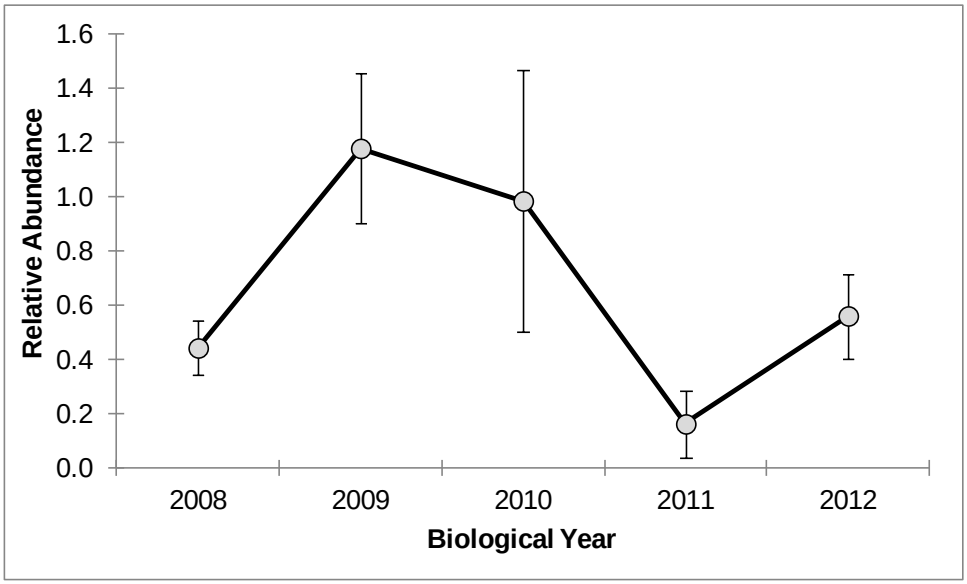


Figure 10. GLM-standardized index of relative abundance for spotted seatrout collected from Program 915 during spring (May–June) in the southern sampling stations, 2008–2012. Error bars represent ± 1 standard error.

FISHERY MANAGEMENT PLAN UPDATE
STRIPED MULLET
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	April 2006
Amendments:	Amendment 1 – Scheduled for completion April 2016
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	2021 (projected)

The North Carolina Fishery Management Plan (FMP) for Striped mullet was adopted in April 2006 and reclassified the stock as viable. The management plan established minimum and maximum landings thresholds of 1.3 million pounds and 3.1 million pounds, respectively. If landings fall below the minimum threshold the North Carolina Division of Marine Fisheries (NCDMF) would initiate further analysis of the data to determine if the decrease in landings is attributed to stock decline or decreased fishing effort. If landings exceed the 3.1 million pounds the NCDMF would initiate analysis to determine if harvest is sustainable and assess what factors are driving the increase in harvest. The striped mullet FMP established a possession limit of 200 mullets (white and striped in aggregate) per person in the recreational fishery.

Preparation of Amendment 1 to the N.C. Striped Mullet FMP began in October 2013 and was approved to be sent for public comment by the Marine Fisheries Commission in August 2014. The revised FMP was presented to the Marine Fisheries Commission in November 2014 and preferred management options were selected. Amendment 1 is scheduled to be completed in November 2015 with implementation of rules in April 2016.

Management Unit

Coastal and joint waters of North Carolina.

Goal and Objectives

The goal of the 2006 North Carolina Striped Mullet FMP is to ensure the long-term self-sustainability and sustainable harvest of the North Carolina striped mullet stock (NCDMF 2006).

Objectives:

1. Develop an objective management program that provides conservation of the resource and sustainable harvest in the fishery.

2. Ensure that the spawning stock is of sufficient capacity to prevent recruitment-overfishing.

3. Address socio-economic concerns of all user groups.

4. Restore, improve, and protect critical habitats that affect growth, survival, and reproduction of the North Carolina striped mullet stock.

5. Evaluate, enhance, and initiate studies to increase our understanding of striped mullet biology and population dynamics in North Carolina.

6. Promote public awareness regarding the status and management of the North Carolina striped mullet stock.

STATUS OF THE STOCK

Stock Status

Results of the 2013 stock assessment determined overfishing was not occurring, the overfished status could not be determined. Based on these results the striped mullet stock is considered "Viable".

Stock Assessment

A population assessment of the North Carolina striped mullet stock was conducted using the Stock Synthesis model, which incorporated data from commercial fisheries and three fishery-independent surveys from 1994 to 2011. Stock Synthesis was also used to calculate reference points. The Stock Synthesis model can incorporate information from multiple fisheries, multiple surveys, and both length and age composition data. The structure of the model allows for a wide range of model complexity depending upon the data available. The strength of the synthesis approach is that it explicitly models both the dynamics of the population and the processes by which one observes the population and its fisheries. That is, the comparison between the model and the data is kept close to the natural basis of the observations, instead of manipulating the observations into the format of a simpler model. Another important advantage is that the Stock Synthesis model can allow for (and estimate) selectivity patterns for each fishing fleet and survey (NCDMF 2013).

Spawning stock biomass increased from 2003 through 2007 and has since declined. Recruitment has also declined in recent years, though a slight increase was observed in 2011. Fishing mortality (F) has increased in recent years, but F in the terminal year (F_{2011} = 0.437) was below both the fishing mortality target ($F_{35\%}$ = 0.566) and threshold ($F_{25\%}$ = 0.932). Based on these results, the stock is not undergoing overfishing. A poor stock-recruit relationship resulting in unreliable biomass-based reference points prevents determining if the stock is currently overfished (NCDMF 2013).

STATUS OF THE FISHERY

Current Regulations

There were no size restrictions, but as of July 1, 2006 there was a 200 mullet (white and striped aggregate) daily possession limit per person in the recreational fishery and the mutilated finfish rule was modified to exempt mullet when used as bait.

Commercial Landings

Since 1994 striped mullet landings have ranged from a low of 1,460,850 pounds in 1994 to a high of 2,829,086 pounds in 2000. From 2003 to 2009 landings were steady between 1,598,617 and 1,728,607 pounds before increasing to 2,082,832 pounds in 2010. Since 2010 landings have fluctuated between approximately 1.5 and 2 million pounds. At no point in the time series have landings dropped below or risen above the established levels that would trigger a closer examination of the data (Figure 1).

Recreational Landings

The Marine Recreational Information Program is primarily designed to sample anglers who use rod and reel as the mode of capture. Since the majority of striped mullet are caught with cast nets for bait, recreational harvest data are imprecise. Misidentification between striped mullet and white mullet is also common. Bait mullet are usually released by anglers before observation by creel clerks and therefore cannot be identified to the species level.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The total number of striped mullet measured in fishery independent programs has ranged from 5,339 to 8,796 from 2005-2014. Mean length varied little, generally falling between 348 and 363 mm. Minimum and maximum lengths generally fell within a small range, though in 2011 the minimum was 166 mm which is much lower than the minimum in other years (Table 1).

Fishery-Independent Monitoring

Modal age was two in all years except 2005, 2013, and 2014 when the modal age was one. Minimum age was zero in every year except 2010 when the minimum age was one. Maximum age ranged from six in 2012 and 2013 to 14 in 2011. From 2005 through 2008 the maximum age was 10 and in 2009 the maximum age was 13. The number of fish aged varied little from 2005 through 2011 though in 2009 only 349 fish were aged. The number of age samples increased from 2012 through 2014 ranging from 933 to 998 over that time period (Table 2).

To provide the most relevant index from the NCDMF Striped Mullet Electroshock Survey, data were limited to those collected during January through April, when the majority of striped mullet occurred in the Neuse River. Since the survey primarily catches adult striped mullet, juveniles were excluded from analysis. A sample represents all the fish collected over a 500 m transect. Striped mullet CPUE was stable at approximately 100 fish per sample from 2005 through 2009 before spiking in 2010 and 2011 to approximately 160 fish per sample. Striped mullet CPUE

dropped dramatically in 2012, potentially due to hurricanes, before increasing to near the time series average in 2013 and 2014 (Figure 2).

To provide the most relevant index from the Independent Gill Net Survey, data were limited to those collected from shallow river areas during October-November, when and where the majority of striped mullet occurred. Because the survey primarily catches adult striped mullet, juveniles were excluded from analysis. From 2004 through 2012 striped mullet CPUE fluctuated between 3 and 8 striped mullet per sample before jumping to 13.5 striped mullet per sample in 2013 and 19.8 striped mullet per sample in 2014 (Figure 3).

MANAGEMENT STRATEGY

The proposed management strategy for the striped mullet fisheries in North Carolina is to: 1) optimize resource utilization over the long-term, 2) reduce conflict, and 3) promote public education. The first strategy will be accomplished by protecting critical habitats, and monitoring stock status. Inshore gill net conflicts will be dealt with on a case-by-case basis and management actions will be implemented to address specific fishery related problems. Prior to April 2006, user conflicts in the Atlantic Ocean were to be handled by adopting current gill net restrictions on Bogue Banks that currently are in proclamation as Rule. Due to the sale of two of the three subject ocean fishing piers, the restrictions will remain in annually issued proclamations to maintain needed flexibility. A minimum distance requirement will be examined for the conflict between gill netters and stop netters in western Bogue Banks. The DMF will work to enhance public information and education (NCDMF 2006).

The 2006 striped mullet FMP established minimum and maximum commercial landings triggers. These triggers were set two standard deviations from the average of commercial landings from 1994-2002. Commercial landings below the minimum trigger of 1.30 million lb. would initiate further analysis of the striped mullet stock data to determine if a sharp decrease in landings is attributed to stock decline or decreased fishing effort. If commercial landings exceed the maximum landings trigger of 3.10 million lb. the striped mullet stock would be reassessed to determine if it is sustainable and evaluate if market shifts have occurred that need to be addressed. The striped mullet stock will be reassessed after five years (NCDMF 2006). See Table 3 for a summary of management strategies and outcomes.

MANAGEMENT AND RESEARCH NEEDS

See Table 4 for a summary of management and research recommendations pertaining to striped mullet.

FISHERY MANAGEMENT PLAN RECOMMENDATION

Amendment I to the North Carolina Striped Mullet Fishery Management Plan is scheduled for completion in 2016. Landings have not fallen below or exceeded trigger levels established by the 2006 fishery management plan in the time series of landing data. Therefore, it is recommended to maintain the timing of the Benchmark Review “as is” on the current FMP schedule.

LITERATURE CITED

NCDMF (North Carolina Division of Marine Fisheries). 2006. North Carolina fishery management plan—striped mullet. NCDMF, Morehead City, North Carolina. 202 p.

NCDMF (North Carolina Division of Marine Fisheries). 2013. Stock assessment of striped mullet (*Mugil cephalus*) in North Carolina waters. NCDMF, Morehead City, North Carolina. 161 p.

NFT (NOAA Fisheries Toolbox). 2011. Stock Synthesis, text version 3.21d.

TABLES

Table 1. Mean, minimum, and maximum length of striped mullet measured in North Carolina dependent sampling programs from 2005-2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	348.53	199	574	5,636
2006	353.04	197	563	7,202
2007	348.31	180	698	7,340
2008	361.20	208	612	8,341
2009	362.05	202	568	5,693
2010	356.57	206	577	7,561
2011	357.43	166	561	5,339
2012	359.08	200	565	8,796
2013	363.70	212	617	6,434
2014	352.28	195	610	5,390

Table 2. Modal, minimum, and maximum age of striped mullet aged in North Carolina from 2005-2014.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	1	0	10	654
2006	2	0	10	685
2007	2	0	10	699
2008	2	0	10	771
2009	2	0	13	349
2010	2	1	8	748
2011	2	0	14	633
*2012	2	0	6	933
*2013	1	0	6	991
*2014	1	0	7	998

*Ages based on preliminary data.

Table 3. Summary of management strategies and outcomes.

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
MFC Rules (adopted by the MFC on April 27, 2006)		
Implement a recreational harvest limit of 200 mullet per person, per day – currently there are no bag restrictions for mullet.	1, 2, 3, and 6	Completed, MFC Rule April 2006 adoption 15ANCAC 03M.0502 (a), (b)
Modify mutilated finfish rule to exempt mullet when used as bait.	1, 2, 3, and 6	15ANCAC 03M.0101

Table 4. Summary of management and research recommendations from the 2006 striped mullet FMP.

MANAGEMENT STRATEGY	OBJECTIVES	OUTCOME
Environmental Degradation		
Advocate stronger regulatory programs of other agencies as well as work with them to enhance protection of habitat that is critical to striped mullet.	1 and 4	CHPP approved in 2005.
Continue to make recommendations on all state, federal and local permits to minimize impacts to critical habitat areas, especially those pertaining to dredging, beach nourishment and shoreline stabilization (jetties, groins). The MFC should fully utilize its permit commenting authority as outlined in G.S. 143B-289.52.	1 and 4	Ongoing, DMF comments submitted and MFC reviews thru Habitat & Water Quality AC.
Identify, research, and designate additional areas as primary nursery areas that may be important to striped mullet as well as other fisheries.	1 and 4	Ongoing (Program 120 and Program 146).
Develop and maintain accurate maps and documentation of wetlands, soft bottom, SAVs, and water column.	1 and 4	Ongoing CHPPs, SHA work group.
Enhance existing efforts to restore the function and value of degraded wetlands, soft bottom, SAVs, and water column.	1 and 4	Part of CHPPs implementation plan.
Continue to investigate the impacts of bottom disturbing gear on habitat.	1 and 4	CHPP revision scheduled for 2009 and will complete a comprehensive review of all gears and habitat impacts.
Work with the CRC to modify shoreline stabilization regulations and guidelines to minimize impacts to marine and estuarine resources.	1 and 4	Ongoing with CHPPs, shore stabilization workgroup.

Advocate stronger regulatory programs of other agencies as well as work with them to enhance protection of water quality critical to striped mullet.	1 and 4	Ongoing with CHPPs.
Support research on the causes of hypoxia and anoxia and impacts on striped mullet populations in North Carolina's estuarine waters.	1 and 4	No Action
Request that EMC adopts measures needed to fully achieve the identified nutrient reduction goals. Initiate nutrient load reduction planning for all watersheds.	1 and 4	No Action
Support additional research to document and quantify the influences of significant weather events on water quality and assess impacts on the striped mullet population.	1, 4, and 5	No Action
Recommend and support development and implementation of additional measures to reduce sediment delivery and associated turbidity throughout coastal waters.	1 and 4	Ongoing CHPPs, New storm-water rules.
Recommend and support restoration of non-coastal wetlands and floodplains to offset for losses, in order to improve water quality by restoring natural water filtering and storage processes.	1 and 4	Ongoing through permit process.
Fishing Issues		
To fully quantify finfish bycatch in North Carolina commercial fisheries, the establishment of a long-term, fishery-dependent observer program is needed.	1	Ongoing; Began an observer program for PSGNRA in 2000, and expanded into other areas of state. Funding is time-limited. Recently began using observers on alternative platforms which may reduce the type of finfish bycatch data collected.
Establish a 200 daily possession limit per person in the recreational fishery.	1, 2, and 4	Adopted by the MFC on April 27, 2006.
Implement public outreach to reduce waste of mullets in the recreational fishery.	1 and 6	A pamphlet for the WRC fish ID website was updated, but no program was established for public outreach to minimize the waste of mullet in the recreational fishery.
Continue improving estimates of recreational hook and line, and bait harvest.	1	Needed but some MRIP and CRFL mail survey data.

Continue sampling the commercial bait mullet cast net fishery to improve the estimates of striped mullet and white mullet harvest.	1	Ongoing through the division.
Continue ongoing annual socioeconomic surveys with commercial fishermen, including those who participate in the striped mullet fishery, in order to monitor its social and economic components.	1, and 5	Ongoing through the division.
Continue ongoing RCGL surveys in order to monitor landings, as well as the social and economic elements of the striped mullet fishery.	1, 2, 4, and 5	Needed, RCGL survey discontinued 2008.
Research recommendations		
Implement no new management measures at this time but establish minimum and maximum landings thresholds of 1.3 million pounds and 3.1 million pounds, respectively.	1, 2, and 4	Ongoing, annual review for stock status report.
Continue annual age determination and creation of age-length keys.	1, 2, and 4	Age structures are being collected, ongoing.
Validate juvenile abundance indices.	1, 2, and 4	Sampling began in 2003, electroshock juvenile sampling conducted September-April each year; ongoing. NOAA Bridge Net Survey sample back-log funded for processing through CRFL grant beginning July 2013. Seeking SEAMAP funding for long-term continuation of program.
Annual review of commercial and recreational fisheries.	1, 2, 4 and 5	Commercial: ongoing, annual review for stock status report. Recreational: needed.
Improve data on maturity, identification of spawning locations, and larval/juvenile movement	1, 2, and 4	Needed, seeking CRFL funding for updating maturity information.
Establish a long-term database of adult striped mullet from fishery-independent surveys for the development of an annual abundance index	1, 2, and 4	Ongoing through division independent gill net survey and striped mullet electroshock survey.
Continue independent cast net sampling to improve estimates of the proportion of striped mullet and white mullet in this fishery.	1, 2, and 4	Needed; independent sampling discontinued.
User Conflicts		
Adopt the current Bogue Bank gill net proclamation as rule.	3	As of April 2006, due to the sale of two of the three subject ocean fishing piers, proclamation authority was maintained for flexibility. Did not go into rule.

Mediate the conflict between gill netters and stop netters	3	Mediation completed, proclamation M-14-2006 issued for Bogue Banks area.
Inshore gill net conflicts should continue to be handled on a case-by-case basis and to implement management actions to address specific fishery related problems	3	Mediation process for conflicts has been established within the Division and outreach materials developed. Adopted as preferred action in southern flounder and spotted seatrout FMP. Also, recent rule changes to large mesh (4”-6.5”) gill net fishery restricts fishing by area and during certain times as needed to protect sea turtles. Conflict in Deer and Schoolhouse creeks, mediation unsuccessful, Proclamation M-9-2013 issued to address recurring conflict between residents and fishermen using seines and gill nets.

FIGURES

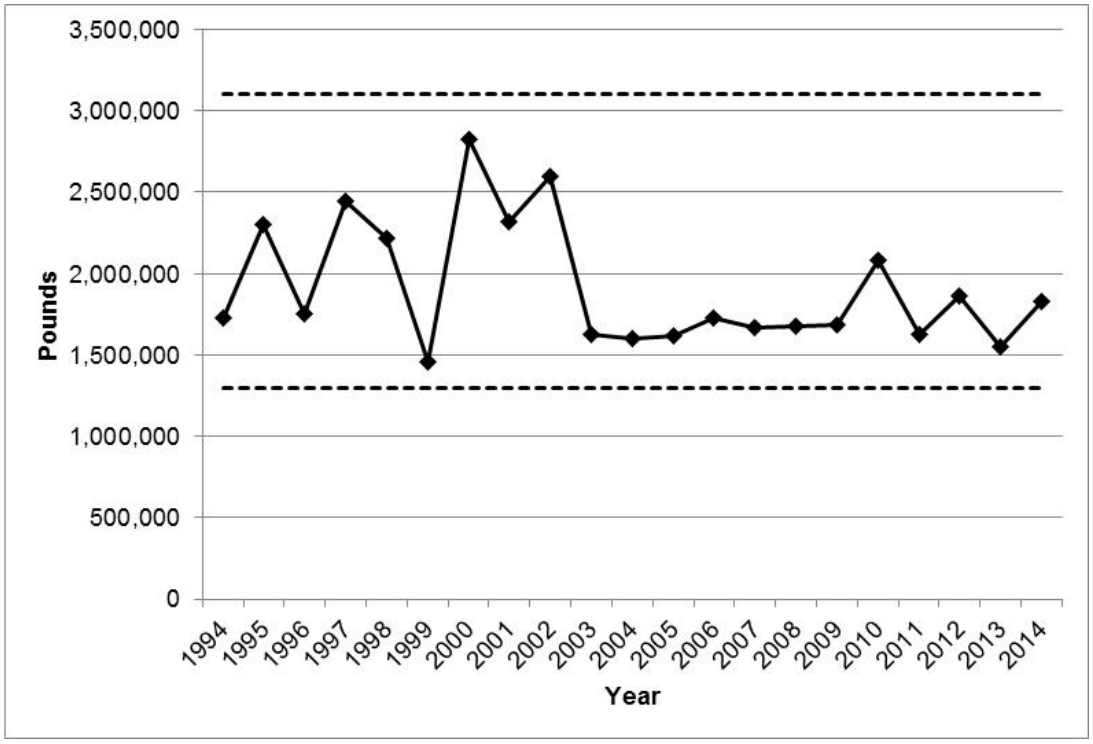


Figure 1. Commercial landings of striped mullet from 1994-2014. Dashed lines represent upper (3.1 million pounds) and lower (1.3 million pounds) landings thresholds that would trigger a closer examination of data.

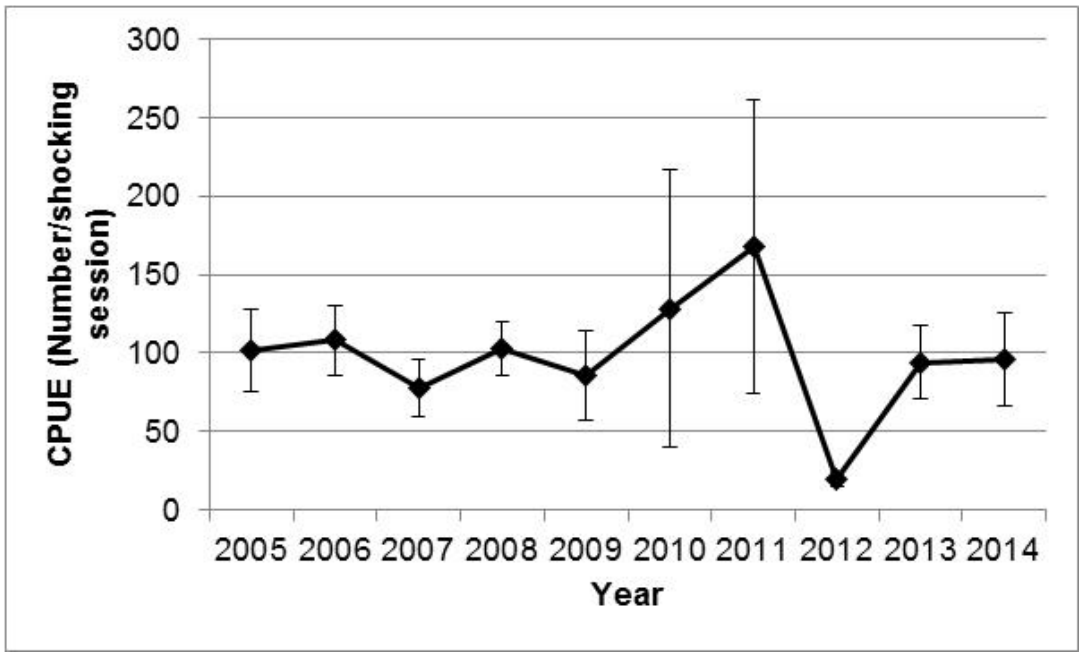


Figure 2. CPUE (number/500 m shocking session) of striped mullet from the Striped Mullet Electroshock Survey (P146) from 2005-2014. To provide the most relevant index data were limited to those collected during January through April. Error bars represent standard error.

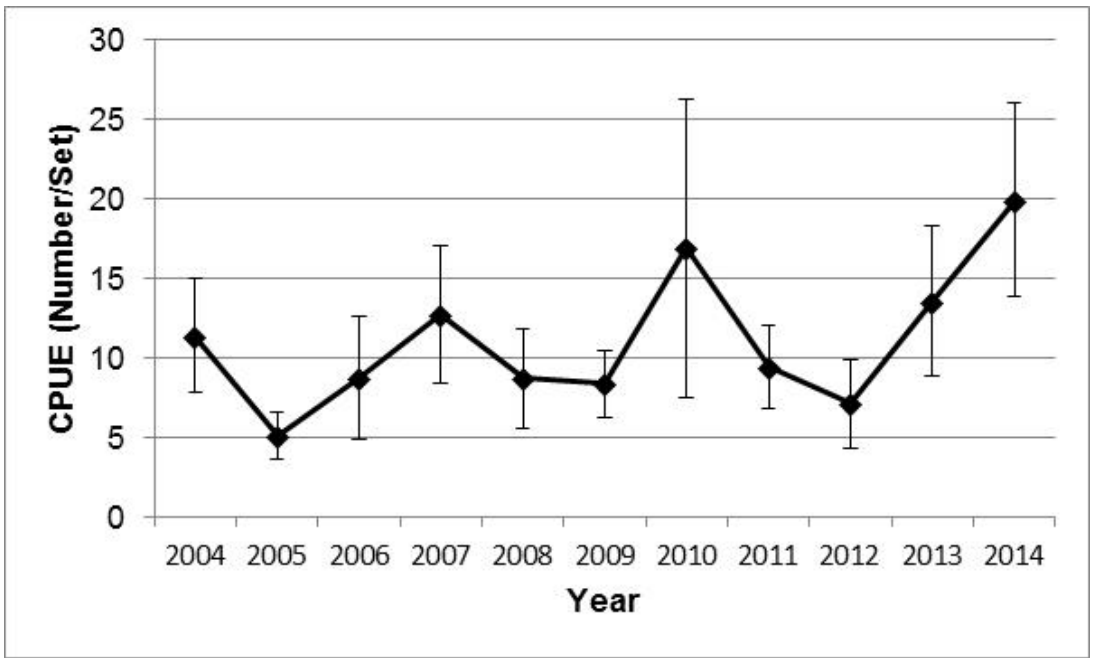


Figure 3. CPUE (number/set) of striped mullet from the Independent Gill Net Survey (P915). In order to provide the most relevant index only shallow river area samples collected during October-November 2004-2014 were included. Error bars represent standard error.

FISHERY MANAGEMENT PLAN UPDATE
AMERICAN SHAD
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	October 1985
Amendments:	Amendment 1 (April 1999) Amendment 3 (February 2010)
Revisions:	Technical Addendum #1 (February 2000) Addendum 1 (August 2002)
Supplements:	Supplement (October 1988)
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	ASMFC scheduled for 2017

The Atlantic States Marine Fisheries Commission (ASMFC) coastwide stock assessment completed in 2007, found that American shad (*Alosa sapidissima*) stocks were at all-time lows and did not appear to be recovering to acceptable levels. Therefore under ASMFC's Fishery Management Plan (FMP) for Shad and River Herring Amendment 3, individual states were required to develop Implementation Plans (ASMFC 2010). Implementation Plans consisted of two parts: 1. Review and update of the fishing/recovery plans required under Amendment 1 for the stocks within their jurisdiction; and 2. Habitat plans. The updated fishing/recovery plan meets the requirements and is known as the North Carolina American Shad Sustainable Fishery Plan (SFP) (NCDMF 2011).

Addendum I (2002) changed the conditions for marking hatchery-reared alosines. The addendum clarifies the definition and intent of *de minimis* status for the American shad fishery. It also further modifies and clarifies the fishery-independent and fishery dependent monitoring requirements of Technical Addendum #1.

Technical Addendum #1 (2000) modified several technical errors and provided clarification of several monitoring requirements in Amendment 1.

Amendment 1 (1999) reported that the majority of American shad stocks to not be overfished, but almost all were believed to be at or near historically low levels. Therefore Amendment 1 required increased annual reporting requirements on juveniles, adult spawning stocks, annual fishing mortality, and habitat. A fishing mortality threshold (overfishing) was defined as a reference point of $F_{30.}$

The Supplement (1988) reassessed the research priorities identified in the original FMP (1985) and created a new listing of research priorities.

The Original 1985 FMP does not require any specific management approach or monitoring programs within the management unit, asking only that states provide annual summaries of restoration efforts and ocean fishery activity. It specified four management objectives: regulate exploitation, improve habitat accessibility and quality, initiate programs to introduce alosine stocks into historic waters, and recommend and support research programs.

Management Unit

American shad and hickory shad management authority lies with the Atlantic Coastal states from Maine through Florida and is coordinated through the ASMFC. Responsibility for management action in the Economic Exclusive Zone (EEZ), located from 3-200 miles from shore, lies with the Secretary of Commerce through the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA) in the absence of a federal FMP.

Goal and Objectives

Migratory stocks of American shad have been managed under the ASMFC since 1985. These species are currently managed under Amendment 3 (American shad) and Amendment 1 (hickory shad) to the ASMFC FMP, Technical Addendum #1, and Addendum 1. The goal of Amendment 2 and 3 is to protect, enhance, and restore East Coast migratory spawning stocks of American shad, hickory shad, alewife, and blueback herring in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass. To achieve this goal, the plan adopts the following objectives:

1. Maximize the number of juvenile recruits emigrating from freshwater stock complexes.

2. Restore and maintain spawning stock biomass and age structure to achieve maximum juvenile recruitment.

3. Manage for an optimum yield harvest level that will not compromise Objectives 1 and 2.

4. Maximize cost effectiveness to the local, state, and federal governments, and the ASMFC associated with achieving Objectives 1 through 3.

STATUS OF THE STOCK

Stock Status

The most recent coastwide stock assessment of American shad stated that populations in the Albemarle Sound and Roanoke River are stable and low, whereas a determination of stock status could not definitively be assigned for the Tar/Pamlico, Neuse and Cape Fear rivers due to limited information (ASMFC 2007).

Amendment 3 required all states and jurisdictions without an approved sustainable fishery plan to close their fisheries (with the exception of catch and release fisheries) for American shad by January 1, 2013. In March 2012, the North Carolina Division of Marine Fisheries (NCDMF) North Carolina American Shad SFP was approved by ASMFC; it includes sustainable fishery parameters for the following areas: Albemarle Sound/Roanoke River, Tar/Pamlico River, Neuse River, and Cape Fear River.

Annual updates are completed each year to track those sustainable fishery parameters in each system.

Stock Assessment

The NCDMF American Shad SFP, effective in 2013, identified sustainability parameters for four regions of the state: Albemarle Sound/Roanoke River, Tar/Pamlico, Neuse, and Cape Fear River systems. As a directed roe fishery, all parameters are based on the female portion of the stock.

The Albemarle Sound/Roanoke River system has three sustainability parameters: female catch per unit effort (CPUE) based on the NCDMF Albemarle Sound Independent Gill Net Survey (IGNS), CPUE based on the North Carolina Wildlife Resources Commission (NCWRC) electrofishing survey, and female relative fishing mortality (*F)* based on commercial landings and a three year average of the NCDMF IGNS index. As written in the SFP, exceeding the female CPUE based on IGNS or the female relative *F* parameters for three consecutive years will trigger management action. The female CPUE based on the NCWRC electrofishing survey will be used in conjunction with a second index for triggering management action.

The Tar/Pamlico, Neuse, and Cape Fear River systems have two sustainability parameters for the corresponding areas: female CPUE based on the NCWRC electrofishing survey, and female relative *F* based on the NCWRC electrofishing survey.

In 2013 and 2014, annual updates were completed for all areas to determine if any sustainability parameters were exceeding the thresholds. The Tar/Pamlico, Neuse, and Cape Fear River systems were not exceeding any of the thresholds and no management changes were made to those fisheries. The Albemarle Sound/Roanoke River system exceeded two thresholds, the CPUE index based on the NCWRC electrofishing survey and the female relative *F,* during the 2013 commercial fishing season. These parameters exceeding the threshold required management actions to be implemented for the 2014 fishing season. In February 2014, the North Carolina Marine Fisheries Commission (NCMFC) chose to reduce the American shad season in the Albemarle Sound/Roanoke River to March 3-24 to reduce overall commercial landings. The 2014 fishing season continued with the same seasonal dates.

STATUS OF THE FISHERY

Current Regulations

The NCMFC enacted a rule in 1995, which established a closed season for American shad and hickory shad (*Alosa mediocris*). It is unlawful to take these species by any method except hook-and-line from April 15 through December 31. The ocean intercept fishery for American shad was closed to all harvest January 1, 2005 (ASMFC 2002).

In the Albemarle, Croatan, Roanoke, and Currituck sounds and tributaries, floating gill nets of 5.25 inch stretch mesh (ISM) to 6.5 ISM, were limited to 1,000 yards and could only be utilized from March 3 through March 24, 2014. The western portion of Albemarle Sound near the mouth of the Roanoke River was closed to gill netting from February through mid-November. The large mesh net restrictions were imposed for striped bass conservation but also provided measures of protection for American shad. Gill nets of less than 3.25 ISM were not allowed due

to the river herring closure, except during the discretionary river herring harvest season (Chowan River only). Gill nets with a mesh length of 3.25 ISM could not exceed 800 yards and were allowed the entire spring. Attendance for small mesh gill nets (3.0 – 4.0 ISM) was required June 1-December 1, 2014. In 2014 interim management measures were implemented for sea turtles that made it unlawful to fail to fish nets at least once during a 24 hour period in the Albemarle Sound Management Area (ASMA).

In areas outside of the ASMA there is a rule that limits the amount of large mesh (4.0 -6.5 ISM) gill net sets in internal coastal waters to 3,000 yards. In an effort to reduce sea turtle interactions, that rule has been suspended in the majority of internal coastal waters and net yardage allowance has been reduced to 2,000 or 1,000 yards in the Tar/Pamlico, Neuse and Cape Fear systems. Nets can be set in lengths no greater than 100 yards and must have at least a 25-yard space between each individual length of net. Only single overnight sets are allowed; nets can be set one hour prior to sunset and must be retrieved within one hour of sunrise, with no sets allowed Friday, Saturday or Sunday evenings. Additionally, in certain areas of the Tar/Pamlico and Neuse rivers, gill nets with a mesh size less than 5.0 ISM must be attended at all times.

Commercial Landings

Figure 1 shows all American shad landings in North Carolina from 1950-2013. Landings show a decreasing trend through 1990, until average landings leveled off through 2013. Commercial harvest is sporadic and cyclical and annual trends show these changes. Figure 2 describes that landings break down by the four areas of the state, as stated in the NCDMF American Shad SFP. Albemarle Sound accounts for on average, approximately 75%of total state landings; the last 5 years ranged from 67-79%.

Recreational Landings

Recreational landings for American shad are minimal throughout the Albemarle Sound/Roanoke River, Tar/Pamlico, and Neuse Rivers. These areas accounted for approximately 6,000-9,000 pounds of harvested fish in 2012 and 2013. The bulk of the North Carolina recreational fishery occurs in the Cape Fear River system where harvest numbers average around 30,000 pounds and substantial effort is targeted on American shad.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial landings are reported from the NCDMF Trip Ticket Program (TTP). This program requires dealers to complete a trip ticket for each transaction with a fisherman and to submit these reports to the NCDMF on a monthly basis.

Table 1 includes mean, minimum and maximum lengths and total number of commercial samples pooled across all gears and areas in the state. Table 2 describes the variation in modal, minimum and maximum ages throughout the dependent sampling. The Albemarle Sound area (including Albemarle, Roanoke, Croatan and Currituck sounds and their tributaries) accounts for approximately 70%of the state's total harvest, contributing the highest percentage of the in-river fisheries.

Fishery-Independent Monitoring

American shad are monitored using the NCDMF IGNS and NCWRC electrofishing surveys to estimate CPUEs and fishing mortality in the Albemarle Sound/Roanoke River area. In other areas of the state, NCWRC conducts electrofishing surveys to estimate abundance and the fishing mortality. Table 3 describes the modal, minimum, and maximum age and the number of fish aged throughout 2005 – 2014 in NCDMF independent surveys.

MANAGEMENT STRATEGY

Albemarle Sound/Roanoke River:
Figures 3 shows the female CPUE based on the NCDMF IGNS. Figure 4 shows the CPUE based on the NCWRC electrofishing survey. Figure 5 shows the female relative *F* based on commercial landings and a three year average of the NCDMF IGNS index.

Tar/Pamlico system:
Figure 6 shows the female CPUE based on the NCWRC electrofishing survey and figure 7 shows the female relative *F* based on the NCWRC electrofishing survey.

Neuse system:
Figure 8 shows the female CPUE based on the NCWRC electrofishing survey and figure 9 shows the female relative *F* based on the NCWRC electrofishing survey.

Cape Fear River system:
Figure 10 shows the female CPUE based on the NCWRC electrofishing survey and figure 11 shows the female relative *F* based on the NCWRC electrofishing survey.

The 2014 update of the SFP sustainability parameters throughout the state demonstrated that all of the parameters were within the sustainable targets.

MANAGEMENT AND RESEARCH NEEDS

The following list of research needs have been identified in order to enhance the state or knowledge of the shad and river herring resources, population dynamics, ecology and the various fisheries for alosine species, as found in the ASMFC FMP Amendment 3.

STOCK ASSESSMENT AND POPULATION DYNAMICS

- Continue to assess current aging techniques for shad and river herring, using known-age fish, scales, otoliths and spawning marks. Known age fish will be available from larval stocking programs that mark each year class. Conduct biannual aging workshops to maintain consistency and accuracy in aging fish sampled in state programs.
- Investigate the relation between juvenile production and subsequent year class strength for alosine species, with emphasis on the validity of juvenile abundance indices, rates and sources of immature mortality, migratory behavior of juveniles, natural history and ecology of juveniles, and essential nursery habitat in the first few years of life.
- Validate estimates of natural mortality for American shad stocks.
- Establish management benchmarks for data poor river systems identified within the stock assessment.

- Estimate and evaluate sources of mortality for alosine species from bycatch, and bait and reduction fisheries.
- Determine fishery specific catch, harvest, bycatch, and discard reporting rates.
- Estimate and evaluate river specific mortality from upstream and downstream passage of adults and downriver passage of juveniles past migratory barriers.
- Determine which stocks are impacted by mixed stock fisheries (including bycatch fisheries). Methods to be considered could include otolith microchemistry, oxytetracycline otolith marking, and/or tagging.
- Evaluate assumptions critical to in-river tagging programs in Georgia, South Carolina, and Maryland that are used to estimate exploitation rate and population size.
- Develop approaches to estimate relative abundance of spawning stocks in rivers without passage facilities and in rivers with passage facilities with unknown passage efficiencies. • Evaluate predation by striped bass and other predators as a factor of mortality for alosines. Research predation rates and impacts on alosines.
- Quantify fishing mortality (in-river, ocean bycatch, bait fisheries) for major river stocks after ocean closure of directed fisheries.
- Develop comprehensive and cost effective angler use and harvest survey techniques for use by Atlantic coastal states to assess recreational fisheries for American shad.
- Determine and update biological data inputs used in assessment modeling (fecundity-at-age, mean weight-at-age for both sexes, partial recruitment vector/maturity schedules) for American shad and river herring stocks in a variety of coastal river systems, including both semelparous and iteroparous stocks.
- Evaluate and ultimately validate large-scale hydroacoustic methods to quantify American shad escapement (spawning run numbers) in major river systems. Identify how shad respond (attract/repelled) by various hydroacoustic signals.

HABITAT

- Identify ways to improve fish passage efficiency using hydroacoustics to repel alosines from turbine intakes or discharges or pheromones or other chemical substances to attract them to passage entrances. Test commercially available acoustic equipment at existing fish passage facility to determine effectiveness. Develop methods to isolate/manufacture pheromones or other alosine attractants.
- Determine the effects of passage impediments on all life history stages of American shad including turbine mortality and river and barrier specific passage efficiencies. Highest priority would be the lowermost obstruction.
- Develop and implement techniques to determine shad and herring population targets for tributaries undergoing restoration (dam removals, fishways, supplemental stocking, etc.).
- Characterize tributary habitat quality and quantity for alosine reintroductions and fish passage development.
- Determine impacts to American shad populations from changing ocean environment
- Identify and quantify potential American shad spawning and rearing habitat not presently utilized and conduct an analysis of the cost of recovery.
- Develop appropriate Habitat Suitability Index Models for alosine species in the fishery management plan. Possibly consider expansion of species of importance or go with the most protective criteria for the most susceptible species.
- Determine factors that regulate and potentially limit downstream migration, seawater tolerance, and early ocean survival of juvenile alosines.
- Review studies dealing with the effects of acid deposition on anadromous alosines. • Determine effects of change in temperature and pH for all life stages.
- Determine optimal and tolerance for salinity, dissolved oxygen, pH, substrate, current velocity, depth, temperature, and suspended solids.

- Determine hard limits and range levels for water quality deemed appropriate and defensible for all alosines with emphasis on freshwater migratory, spawning, and nursery areas.
- There has been little research conducted on habitat requirements for hickory shad. Although there are reported ranges of values for some variables, such as temperature or depth, there is no information on tolerances or optimal for all life stages. Research on all life stages is necessary to determine habitat requirements.
- Determine impacts of declining submerged aquatic vegetation beds on juvenile cover and rearing habitat.
- Determine impacts of thermal power generation projects (e.g., nuclear and coal) that withdraw water for cooling (potential entrainment and impingement of fish) and discharge heated water (thermal barriers to migration, habitat degradation) on estuarine juvenile rearing and migration corridors.
- Determine impacts to migrating American shad (both spawning adults and out-migrating juveniles and adults) by proposed in-stream power generation developments such as tidal stream generation that draws energy from currents.
- Determine potential threats and their level of impact to coastal American shad habitat from: marine acidification; pharmaceutical, wastewater, pesticide contamination; 58 invasive species; niche displacement; and global climate change are in need of further study.
- Determine the impacts to migrating American shad (both spawning adults and migrating juveniles) by proposed wind power generation developments in near shore ocean environments.
- Conduct fish passage research and development with the goal of improving the efficiency of existing and future installations of fish passage measures and facilities in order to restore desired access to and utilization of critical American shad spawning and juvenile rearing habitat.
- Conduct studies to determine whether passing migrating adults upstream earlier in the year in some rivers would increase production and larval survival, and opening downstream bypass facilities sooner would reduce mortality of early emigrants (both adult and early-hatched juveniles).
- Conduct studies to determine the effects of dredging on diadromous habitat and migration.

LIFE HISTORY

- Conduct studies on energetics of feeding and spawning migrations of alosines on the Atlantic coast.
- Evaluate impacts of invasive species such as zebra mussels and flathead catfish on larval and juvenile survival.
- Conduct studies of egg and larval survival and development.
- Focus research on within-species variation in genetic, reproductive, morphological, and ecological characteristics, given the wide geographic range and variation at the intraspecific level that occurs in alosines.
- Ascertain how abundance and distribution of potential prey affect growth and mortality of early life stages.
- Conduct research on hickory shad migratory behavior. This may explain why hickory shad populations continue to increase while other alosines are in decline.

STOCKING AND HATCHERIES

- Refine techniques for hormone induced tank spawning of American shad. Secure adequate eggs for culture programs using native broodstock.
- Refine larval marking techniques such that river and year class can be identified when year classes are later recaptured as juveniles or adults.

SOCIOECONOMICS

- Conduct and evaluate historical characterization of socio-economic development (potential pollutant sources and habitat modification) of selected alosine rivers along the Atlantic coast.
- Collect information from consumptive and non-consumptive users on: demographic information (e.g., age, gender, ethnicity/race), social structure information (e.g., historical participation, affiliation with NGOs, perceived conflicts), other cultural information (e.g., occupational motivation, cultural traditions related to resource's use), and community information.
- In order to improve the management-oriented understanding of historical stock trends and related assessments, the social and economic history of the river herring fisheries should be documented for time periods equivalent to the stock return level sought by the biological standards and this analysis should including documenting market trends, consumer preferences including recreational anglers, the role of product substitutes such as Atlantic herring and menhaden, and the levels of subsistence fisheries as can be obtained.
- Before recommending, re-authorizing and/or implementing stock enhancement programs for a given river system, it is recommended that state agencies or other appropriate management organization conduct ex-ante socioeconomic cost and benefit (e.g., estimate non-consumptive and existence values, etc.) analysis of proposed stocking programs

LITERATURE CITED

ASMFC (Atlantic States Marine Fisheries Commission). 2002. Technical Addendum I to the Amendment 1 of the Interstate Fishery Management Plan for Shad and River Herring. Washington, D.C.

ASMFC (Atlantic States Marine Fisheries Commission). 2007. American Shad Stock Assessment report for Peer Review. Washington, D.C.

ASMFC (Atlantic States Marine Fisheries Commission). 2010. Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring. Washington, D.C.

NCDMF (North Carolina Division of Marine Fisheries) and WRC (North Carolina Wildlife Resources Commission). 2011. North Carolina American Shad Sustainable Fishery Plan, Report to the Atlantic States Fisheries Commission Shad and River Herring Technical Committee. Updated 2014.

TABLES

Table 1. Length data sampled from the American shad commercial fishery throughout North Carolina.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	446	186	557	1061
2006	430	296	515	861
2007	438	322	523	1015
2008	436	145	526	899
2009	429	242	741	923
2010	434	305	520	1148
2011	444	245	507	1283
2012	444	235	552	1549
2013	453	304	571	1574
2014	455	295	508	1026

Table 2. Aging data collected from North Carolina American shad dependent sampling programs.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	5	3	8	477
2006	6	3	8	499
2007	6	3	8	440
2008	6	3	9	447
2009	7	4	10	435
2010	6	3	9	453
2011	6	3	8	437
2012	5	3	8	536
2013	7	3	9	471
2014	7	3	9	433

Table 3. Aging data collected from North Carolina American shad independent sampling programs.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	5	3	7	194
2006	3	3	8	180
2007	5	3	8	176
2008	5	3	8	188
2009	6	4	9	126
2010	6	3	8	197
2011	6	2	8	79
2012	5	3	8	156
2013	7	3	8	210
2014	6	3	8	122

FIGURES

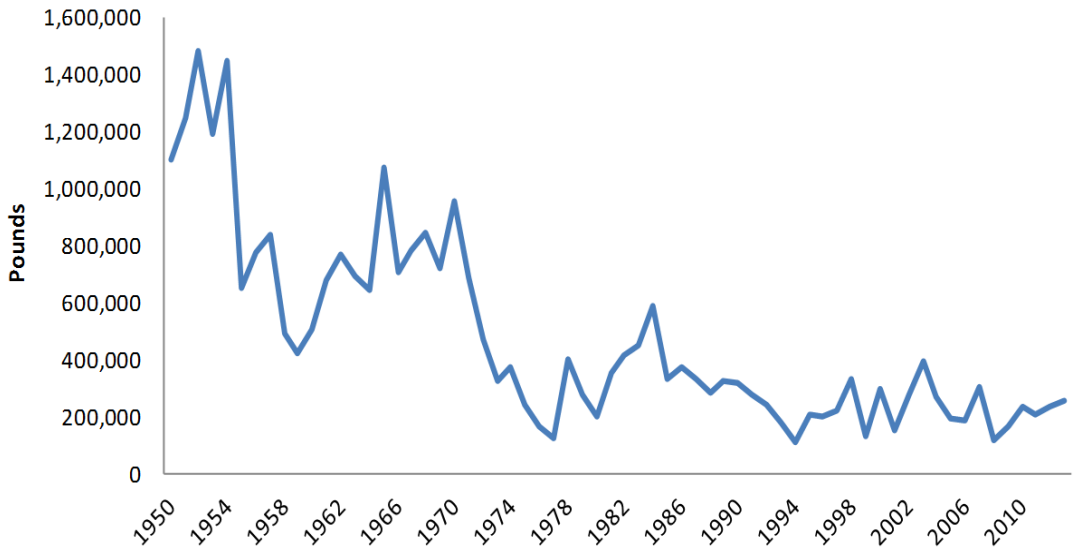


Figure 1. Total historical landings of American shad in North Carolina, all waterbodies combined.

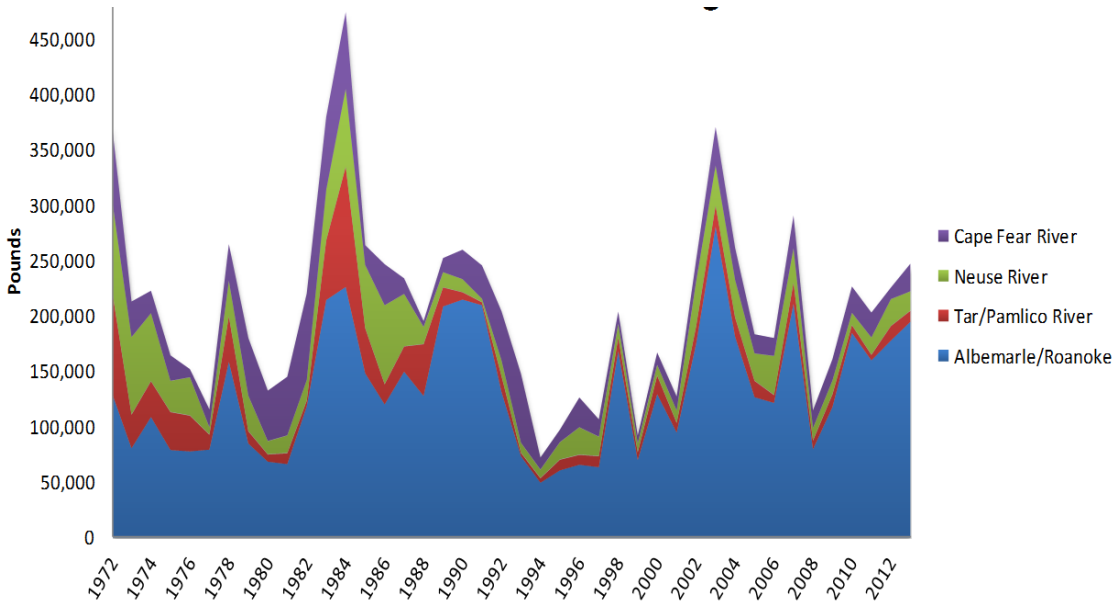


Figure 2. Landings of American shad in North Carolina by major waterbody.

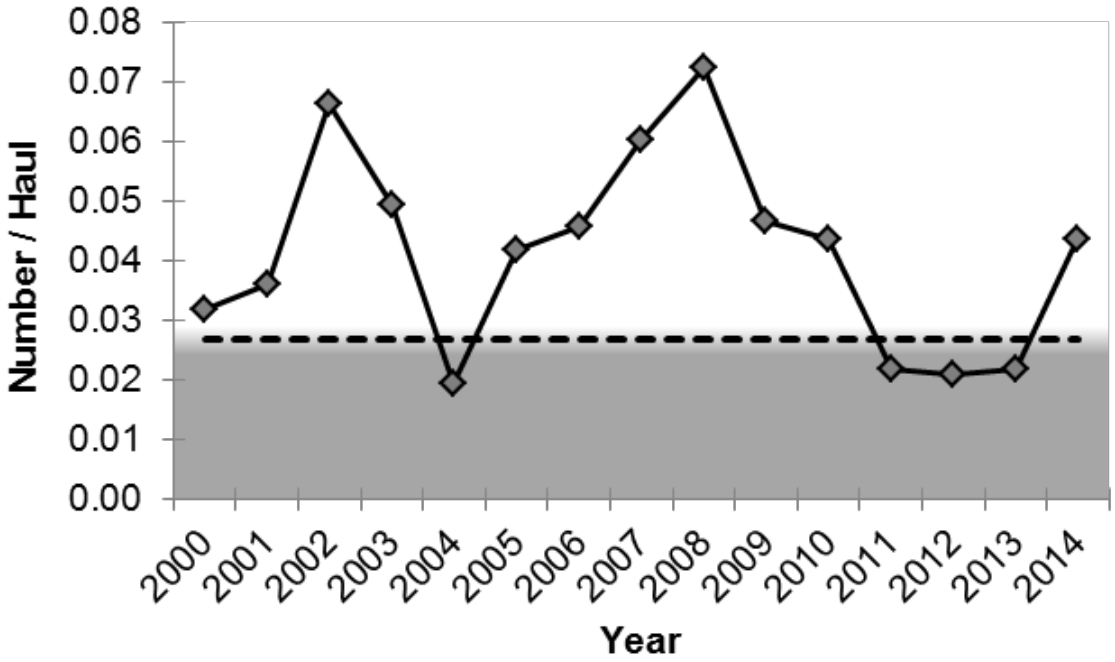


Figure 3. Albemarle Sound/Roanoke River sustainability parameter for female CPUE in the IGNS, 2000-2014. Grey areas represent a parameter exceeding the threshold.

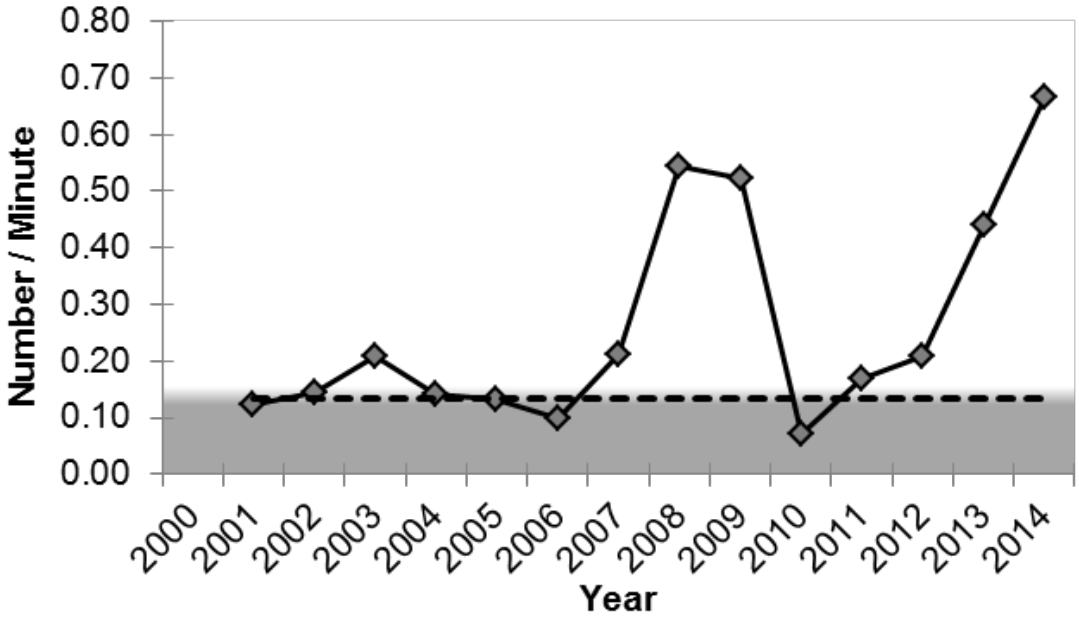


Figure 4. Albemarle Sound/Roanoke River sustainability parameter for female CPUE in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

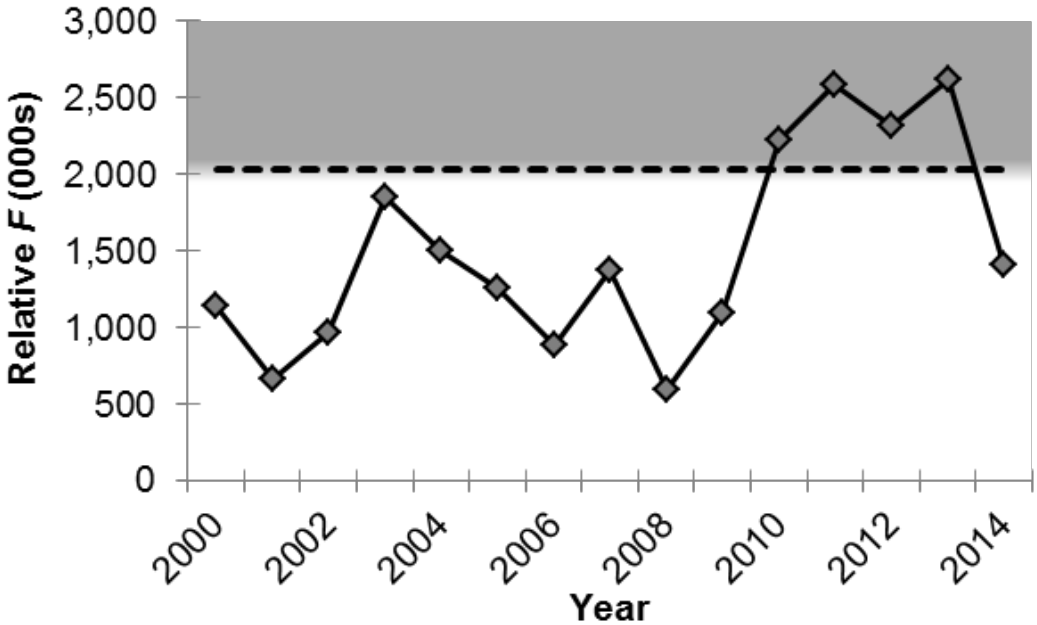


Figure 5. Albemarle Sound/Roanoke River sustainability parameter for female relative *F* in the IGNS, 2000-2014. Grey areas represent a parameter exceeding the threshold.

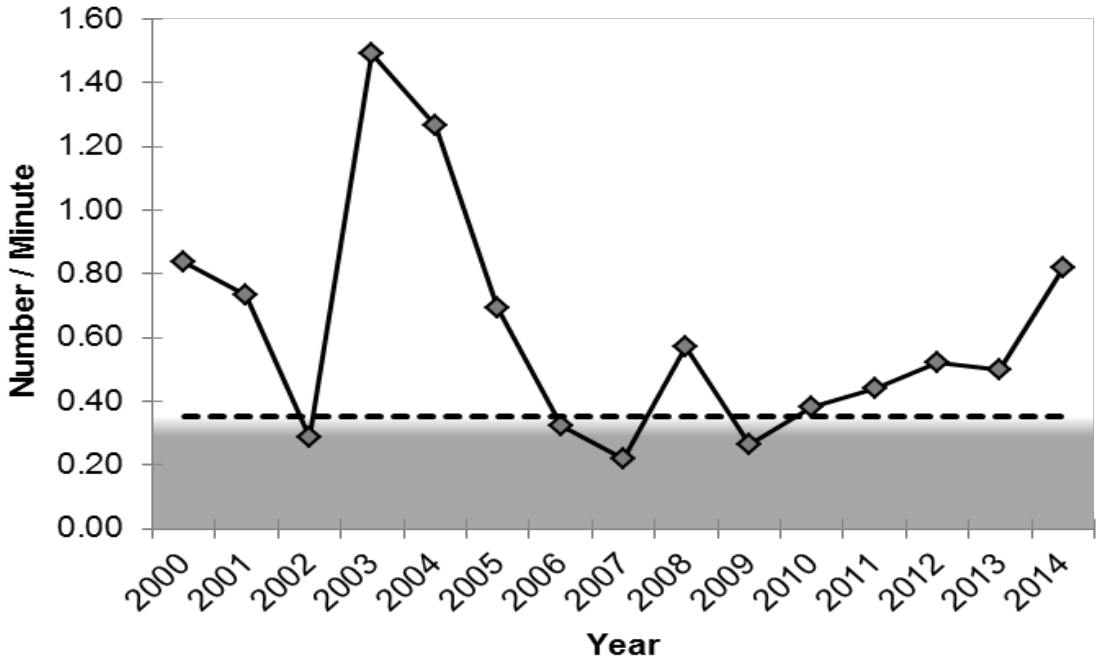


Figure 6. Tar/Pamlico River system sustainability parameter for female CPUE in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

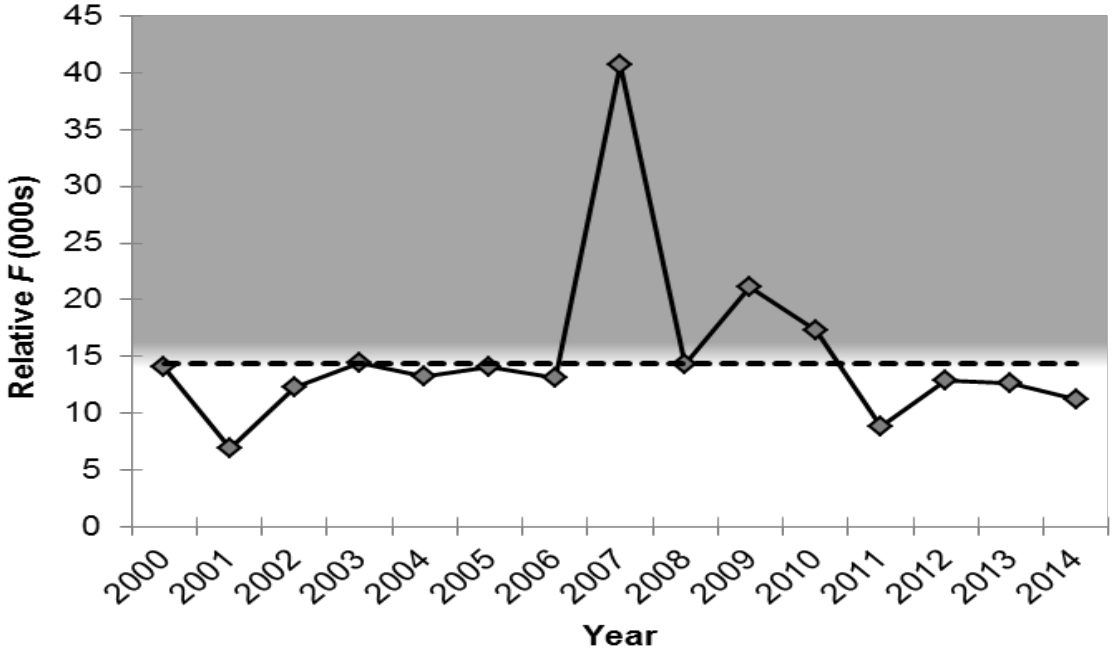


Figure 7. Tar/Pamlico River system sustainability parameter for female relative *F* in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

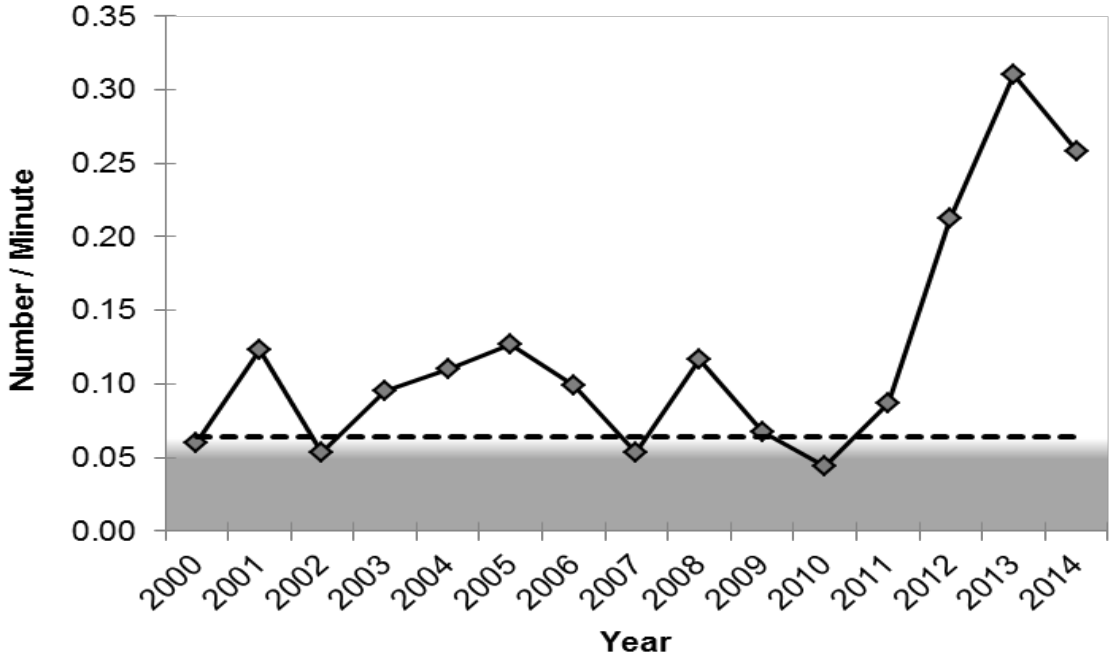


Figure 8. Neuse River system sustainability parameter for female CPUE in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

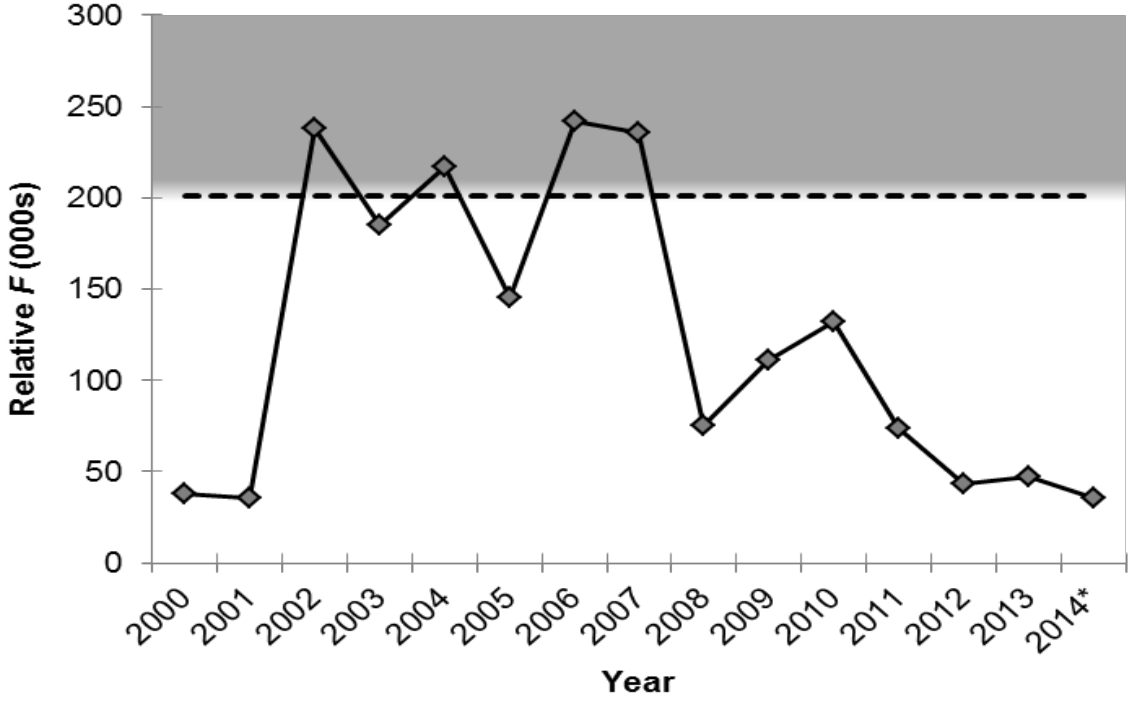


Figure 9. Neuse River system sustainability parameter for female relative *F* in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

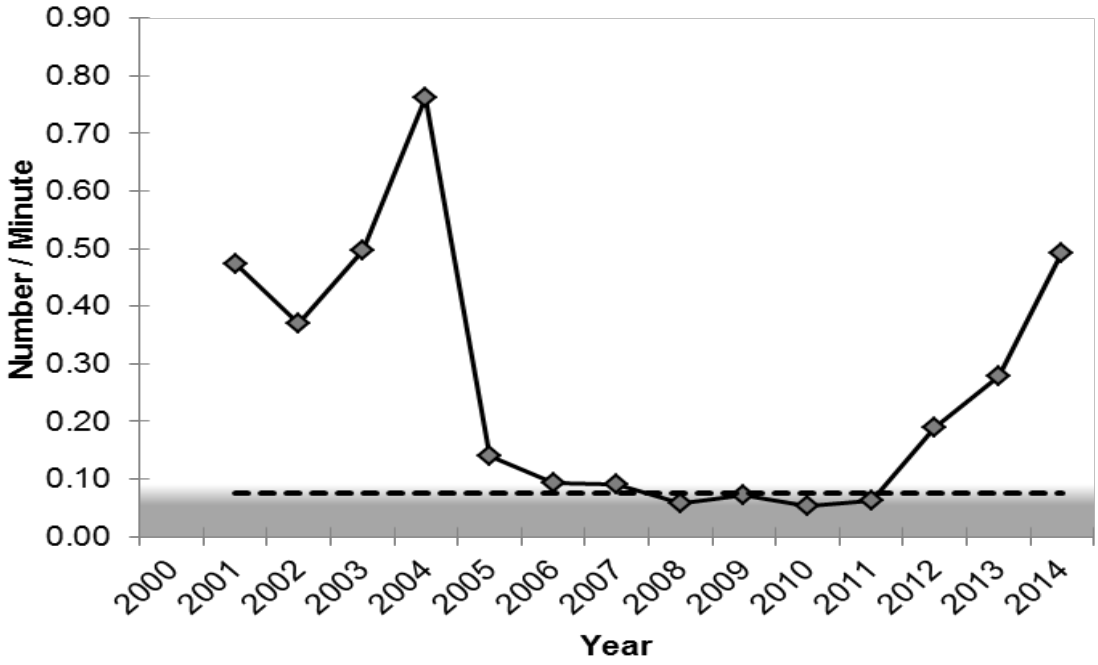


Figure 10. Cape Fear River system sustainability parameter for female CPUE in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

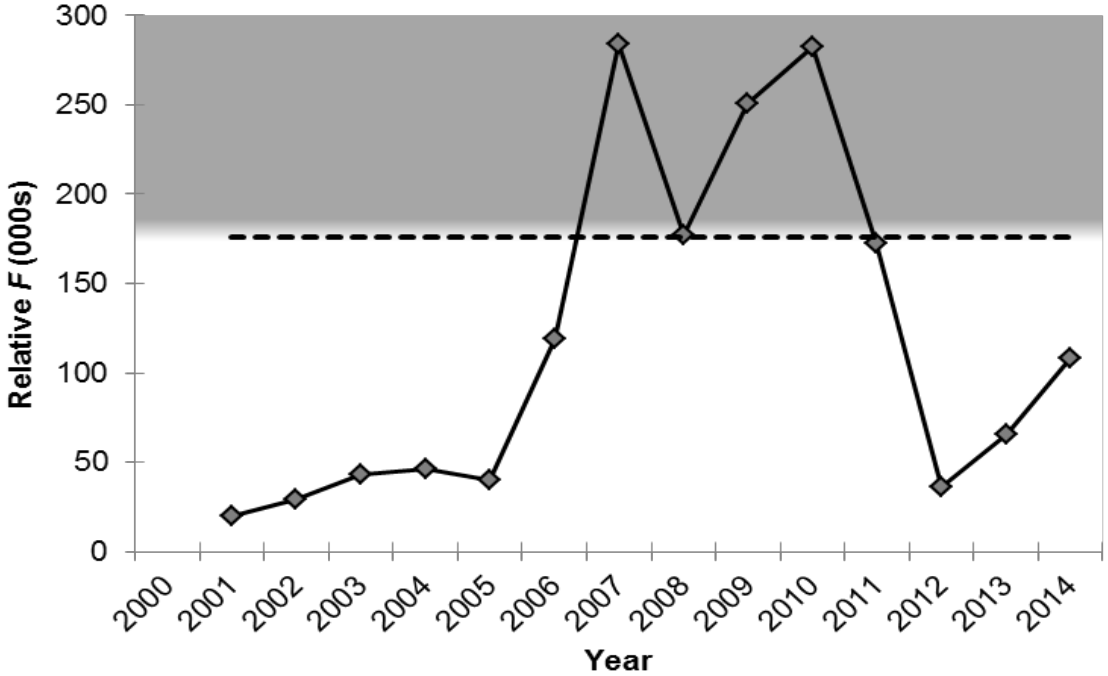


Figure 11. Cape Fear River system sustainability parameter for female relative *F* in NCWRC electrofishing survey, 2000-2014. Grey areas represent a parameter exceeding the threshold.

FISHERY MANAGEMENT PLAN UPDATE
ATLANTIC CROAKER
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	October 1987
Amendments:	Amendment 1 - November 2005 (implemented January 2006) Addendum I - March 2011 Addendum II - August 2014
Revisions:	N/A
Supplements:	N/A
Information Updates:	N/A
Schedule Changes:	N/A
Next Benchmark Review:	2016

The Fishery Management Plan for Atlantic croaker was adopted in 1987 (ASMFC 1987) and included states from Maryland through Florida. Upon review the South Atlantic State/Federal Fisheries Management Board (hereinafter referred to as Board) found its recommendations to be vague and recommended that an amendment be prepared to define management measures necessary to achieve the goals of the FMP. The Interstate Fisheries Management Program Policy Board also adopted the finding that the original FMP did not contain any management measures that states were required to implement (ASMFC 2014).

In 2002, the Board directed the Atlantic Croaker Technical Committee to conduct the first coast wide stock assessment of the species in preparation of developing an amendment. The stock assessment was developed in 2003 and approved by a Southeast Data Assessment Review panel for use in management in June 2004. Amendment 1 was approved in November 2005 and fully implemented by January 1, 2006 (ASMFC 2005).

Amendment 1 expanded the management area to include the states from New Jersey through Florida. The amendment defined two Atlantic coast management regions: the south-Atlantic region, including the states Florida through South Carolina; and the mid-Atlantic region, including the states from North Carolina through New Jersey (ASMFC 2005).

Amendment 1 established biological reference points to define overfished and overfishing stock status for the mid-Atlantic region only. Amendment 1 did not require any specific measures restricting recreational or commercial harvest of Atlantic croaker, though states with more conservative measures were encouraged to maintain those regulations. Through adaptive management, the Board may revise Amendment 1, and regulatory and/or monitoring requirements could be included in the resulting addendum, along with procedures for

determining *de minimis* status and implementing alternative management programs via conservation equivalency.

Amendment 1 specified "triggers" for initiation of a stock assessment in non-assessment years. If upon review of the data the technical committee felt there was sufficient evidence of changes in the stock, a stock assessment could be initiated in the absence of hitting the triggers. The triggers considered by the technical committee were:

1. Relative percent change in landings
    a. A stock assessment will be triggered if the most recent year's commercial landings are less than 70% of the previous two year's landings.
    b. A stock assessment will be triggered if the most recent year's recreational landings are less than 70% of the previous two year's average landings.
2. Biological Data Monitoring:
    a. The technical committee will compare the most recent year's mean length data from the recreational fishery to the average of the last two year's mean lengths.
    b. The technical committee will compare the most recent year's mean size (length and weight) data from the commercial fishery to the average of the last two years mean size (length and weight) data.
    c. The technical committee will monitor the overall age composition (proportion at age) and calculate the mean size at age for the age groups that are present in the state samples.
3. Effort vs. Landings (commercial)
    a. CPUE considerations for the near future: as effort data increases in quality, the trigger should change from a commercial landings basis to commercial CPUE by gear type. At this time, the technical committee will monitor effort (e.g. trips or days fished) vs. landings, on a gear type basis, to track parallel trends.
4. The technical committee will continue to derive a MRFSS CPUE, on a directed trip basis, to examine state-by-state catch rates on an annual basis.
5. Surveys

    The first trigger is the only hard trigger, though the others were monitored annually for substantial changes.

Addendum I to Amendment 1 was initiated in August 2010. Addendum I consolidated the stock into one management unit and established a procedure by which the board may approve peer-reviewed biological reference points without a full administrative process, such as an amendment or addendum (ASMFC 2011).

Addendum II to Amendment 1 was initiated in February 2014 and was approved in August 2014. Addendum II establishes the use of the Traffic Light Approach as a precautionary management framework in the management of Atlantic croaker. The management framework utilizing the Traffic Light Approach replaces the management triggers as stipulated in Addendum I (ASMFC 2014).

Management Unit

Single region New Jersey through east coast of Florida.

Goal and Objectives

The goal of Amendment 1 is to utilize interstate management to perpetuate the self-sustaining Atlantic croaker resource throughout its range and generate the greatest economic and social benefits from its commercial and recreational harvest and utilization over time. The four objectives of Amendment 1 are:

1. Manage the fishing mortality rate for Atlantic croaker to provide adequate spawning potential to sustain long-term abundance of the Atlantic croaker population.

2. Manage the Atlantic croaker stock to maintain the spawning stock biomass above the target biomass levels and restrict fishing mortality to rates below the threshold.

3. Develop a management program for restoring and maintaining essential Atlantic croaker habitat.

4. Develop research priorities that will further refine the Atlantic croaker management program to maximize the biological, social, and economic benefits derived from the Atlantic croaker population.

STATUS OF THE STOCK

Stock Status

Stock status is based on the data and results of the 2010 stock assessment (ASMFC 2010). Atlantic croaker is not experiencing overfishing and likely not overfished. Biomass has been increasing and the age-structure of the population has been expanding since the late 1980s, it is unlikely the stock is in trouble.

Stock Assessment

A statistical catch-at-age model was used to assess Atlantic croaker. This model combines the catch-at-age data from the commercial and recreational fisheries with information from fishery-independent surveys and biological information such as growth rates and natural mortality rates to estimate the size of each age class and the exploitation rate of the population. Biological reference points in the 2010 stock assessment are ratio based and apply to the entire stock. Overfishing is occurring if F/F_{MSY} is greater than 1 and the stock is considered overfished if $SSB/(SSB_{MSY}(1-M))$ is less than 1.

Atlantic croaker is not experiencing overfishing. Biomass has been increasing and fishing mortality decreasing since the late 1980s. Biomass conclusions are based on information from the data compiled for the assessment, namely increasing indices of relative abundance and expanding age structure in the catch and indices. Model estimated values of fishing mortality (*F*), spawning stock biomass (SSB), and biological reference points are too uncertain to be used to determine overfished stock status. Stock status cannot be assessed with confidence until the discards of Atlantic croaker from the South Atlantic shrimp trawl fishery can be adequately estimated and incorporated into the stock assessment (ASMFC 2014).

STATUS OF THE FISHERY

Current Regulations

There are no commercial or recreational regulations on Atlantic croaker in North Carolina.

Commercial Landings

Commercial harvest of Atlantic croaker in North Carolina ranged from 1,928,223 to 14,429,197 pounds from 1994 to 2014 and was estimated at 2,629,793 pounds in 2014. In general harvest has been decreasing since 2003 but between 2013 and 2014 there was a 36% increase in landings (Figure 1) largely due to an in increase in effort from the ocean fly net fishery.

Recreational Landings

Recreational harvest of Atlantic croaker in North Carolina ranged from 99,298 to 355,009 pounds from 1994 to 2014 and was estimated at 227,826 pounds in 2014. While recreational harvest has fluctuated there has generally been a decreasing trend though, the number of releases has generally increased. Harvest increased by 85,946 pounds from 2013 to 2014 and releases increased by 729,877 individuals from 2013 to 2014 (Table 1).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The number of Atlantic croaker lengths obtained from fishery dependent sources from 2005 through 2014 ranged from 4,265 to 10,313. Mean length varied little ranging from 261.59 mm to 303.83 mm. Minimum length varied ranging from 96 mm to 144 mm. Maximum length varied ranging from 423 mm to 806 mm (Table 2).

Fishery-Independent Monitoring

The Atlantic croaker juvenile abundance index (JAI) from the Pamlico Sound Survey from 2005 through 2015 has varied without trend. The JAI has ranged from 82.7 individuals per tow in 2009 to 1,175.44 individuals per tow in 2010. There has been a decreasing trend since 2012 with a JAI in 2014 of 324.14 individuals per tow. The mean JAI over the 10 year time series is 417.58 individuals per tow (Table 3).

The number of Atlantic croaker aged in North Carolina from 2005 through 2014 has ranged from 237 to 1,071 in 2014. The modal age has ranged from zero in 2008 to five in 2007. While the modal age has varied, in six of the 10 years it was one or two. Minimum age was zero in every year while the maximum age ranged from seven to 15. From 2005-2010 the maximum age was between 13 and 15 and from 2011-2014 the maximum age was between seven and eight (Table 4).

MANAGEMENT STRATEGY

Per Addendum II to Amendment 1 the Traffic Light Approach is used as a precautionary management framework for Atlantic croaker. The Traffic Light Approach provides guidance in

lieu of a current stock assessment for Atlantic croaker. Under this management program, if thresholds for both population characteristics (adult abundance and harvest) achieve or exceed the proportion of threshold for the specified three year period, then management action is taken. See Table 5 for a summary of management strategies.

MANAGEMENT AND RESEARCH NEEDS

There are no research or monitoring programs required of the states except for the submission of an annual compliance report. See Table 6 for a summary of management and research needs.

LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 1987. Fishery management plan for Atlantic croaker. Washington DC: ASMFC. Fishery Management Report No. 10. 90 p.

ASMFC. 2005. Amendment I to the interstate fishery management plan for Atlantic croaker. Washington (DC): ASMFC. Fishery Management Report No. 44. 92 p.

ASMFC. 2010. Atlantic croaker 2010 benchmark stock assessment. Washington (DC): ASMFC. 366 p.

ASMFC. 2011. Addendum I to Amendment I to the Atlantic croaker fishery management plan. Washington (DC): ASMFC. 7 p.

ASMFC. 2014. Addendum II to Amendment I to the Atlantic croaker fishery management plan. Washington (DC): ASMFC. 7 p.

TABLES

Table 1. North Carolina recreational harvest of Atlantic croaker 1994-2014, with landings in number of pounds, and number of discards.

Year*	Harvest Number	Harvest (lb.)	Discard Number
1994	1,179,735	351,230	3,110,528
1995	850,606	326,135	1,172,716
1996	662,240	346,501	1,218,799
1997	661,116	309,457	1,443,568
1998	387,427	161,117	1,060,928
1999	442,185	212,991	1,368,478
2000	391,056	201,306	1,569,385
2001	635,552	355,009	1,256,807
2002	408,944	242,184	925,806
2003	490,399	317,606	1,552,315
2004	511,418	306,029	1,656,049
2005	326,777	168,797	1,401,413
2006	556,024	222,286	2,578,819
2007	461,162	131,185	1,608,120
2008	317,940	132,731	1,419,019
2009	368,990	131,742	1,912,670
2010	478,156	241,993	1,598,139
2011	246,676	99,298	1,798,230
2012	288,813	105,530	1,255,215
2013	411,880	141,880	1,984,701
2014	541,474	227,826	2,714,578

*1994-2003 use old MRFSS calculation method and 2004-2014 use the new MRIP calculation method.

Table 2. Total number measured, mean, minimum, and maximum length of Atlantic croaker from North Carolina commercial landings.

Year	Mean Length (mm)	Minimum Length (mm)	Maximum Length (mm)	Total Number Measured
2005	303.83	125	500	9,514
2006	288.41	120	630	9,121
2007	287.91	118	494	7,541
2008	281.00	116	495	7,299
2009	284.12	123	486	9,344
2010	285.77	128	452	10,313
2011	291.32	96	806	7,780
2012	285.52	144	454	5,008
2013	284.33	143	437	4,265
2014	261.59	113	423	5,945

Table 3. Atlantic croaker juvenile abundance index (number per tow) from the Pamlico Sound Survey (P195) from 2005-2014.

Year	N	CPUE	PSE
2005	52	225.67	20
2006	54	131.54	16
2007	51	113.36	20
2008	54	312.38	22
2009	54	82.7	17
2010	54	1,175.44	17
2011	54	90.47	19
2012	54	1,149.18	14
2013	54	570.95	14
2014	54	324.14	16

Table 4. Total number aged, modal, minimum, and maximum age of Atlantic croaker in North Carolina from 2005-2014.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	3	0	14	597
2006	1	0	13	658
2007	5	0	15	321
2008	0	0	15	739
2009	1	0	14	709
2010	4	0	13	703
2011	1	0	8	237
2012	2	0	7	349
2013	1	0	8	577
2014	2	0	8	1,071

Table 5. Summary of management strategies and needs.

Management Strategy	Objectives	Outcome
Establish Traffic Light method for monitoring the stock in non-assessment years	1,2,3,4	Addendum 2 to Amendment 1, approved August 2014. Replaced triggers established by Amendment 1
Change management unit to single coast wide stock (New Jersey to east coast of Florida and set new biological reference points	1,2,3,4	Addendum 1 to Amendment 1, approved March 2011
Establish triggers to be used in monitoring stock in non-assessment years ASMFC annual state compliance reports submitted in July each year	1,2,3,4	Amendment 1 to the Interstate Fisheries Management Plan for Atlantic croaker, approved November 2005
Encourage the use of circle hooks to minimize recreational discard mortality	1,2,4	Needed
Consider approval of *de minimis* requests from Delaware, South Carolina, Georgia, and Florida	2	Ongoing
Consider basic research and monitoring information needed for informed management in light of budgetary constraints	1,2,3,4	Ongoing

Table 6. Summary of management and research recommendations.

Management Strategy/Research Need	Objectives	Outcome
Fishery-Dependent Priorities		
High		
Encourage fishery-dependent biological sampling, including extraction of ageing structures, to improve age-length keys. Age-length keys should be representative of all gear types in the fishery. Supplement underrepresented length bins with additional ageing samples to avoid the necessity of weighting length-at-age estimates by length frequencies.	1, 2	Ongoing in North Carolina
Obtain gear specific effort information and improve fishery-dependent catch and effort statistics and catch size and age structure.	1, 2	Ongoing in North Carolina
Recover detailed historical landings data from NOAA as indicated by historical summaries.	1, 2, 4	Needed
Moderate		
Develop and implement state-specific commercial scrap	1, 2	Ongoing in North

fisheries monitoring programs to evaluate relative importance of croaker scrap landings.		Carolina
Conduct studies on discard mortality from varying gears in recreational and commercial fisheries.	1, 2, 4	Ongoing; needed in North Carolina
Assess and monitor the effects of bycatch reduction devices (BRD's) on croaker catch.	1, 2, 4	Ongoing in North Carolina
Monitor fisheries with significant croaker bycatch and determine extent of unutilized bycatch and F on fish less than age 1.	1, 2, 4	Ongoing in North Carolina
Determine the onshore versus offshore components of the croaker fishery.	1, 2	Needed
Increase observer coverage of commercial discards.	1, 2	Ongoing in North Carolina
Fishery-Independent Priorities		
Moderate		
Expand fishery-independent surveys and subsample for individual weights and ages, especially in the southern range.	1, 2, 3	Ongoing in North Carolina
Continue monitoring juvenile croaker populations in major nursery areas.	1, 2, 3	Ongoing in North Carolina
Develop coast wide juvenile croaker indices to clarify stock status.	1, 2	Ongoing
Modeling/Quantitative Priorities		
High		
Develop size, age, and sex specific relative abundance estimates from fishery-independent and fishery-dependent data.	1, 2	Ongoing
Identify and evaluate environmental covariates in stock assessment models.	3, 4	Needed
Moderate		
Incorporate bycatch estimates into croaker assessment models.	1, 2	Needed
Analyze croaker YPR to establish a minimum size that maximizes YPR.	1, 2	Needed
Life History, Biological, and Habitat Priorities		
High		
Conduct studies on fecundity and reproductive dynamics and develop maturity schedules.	1, 2, 4	Work by Fabrizio and Tuckey examining the effects of hypoxia on reproduction of Chesapeake Bay croaker in progress
Conduct studies on growth and age structure throughout species range.	1, 2, 4	Ongoing in North Carolina
Conduct collaborative coast wide genetics and tagging studies to determine migratory patterns, stock identification, and stock mixing.	1, 2, 3, 4	Needed
Moderate		
Identify essential habitat requirements.	3, 4	Ongoing in North Carolina

Re-examine historical ichthyoplankton studies of the Chesapeake Bay for an indication of the magnitude of estuarine spawning.	3, 4	Needed
Low		
Determine species interactions and predator-prey relationships between croaker (prey) and predator species targeted in more valued fisheries.	2, 3, 4	Ongoing in North Carolina, work by Binion (NCSU)
Assess the impacts of any dredging activity (i.e., for beach re-nourishment) on all life history stages of croaker.	2, 3, 4	Needed
Management, Law Enforcement, and Socioeconomic Priorities		
Moderate		
Determine the optimum utilization (economic and biological) of a long term fluctuating croaker population.	1, 2, 3, 4	Needed
Evaluate socioeconomic aspects of croaker fisheries.	1, 2, 3, 4	Needed

FIGURES

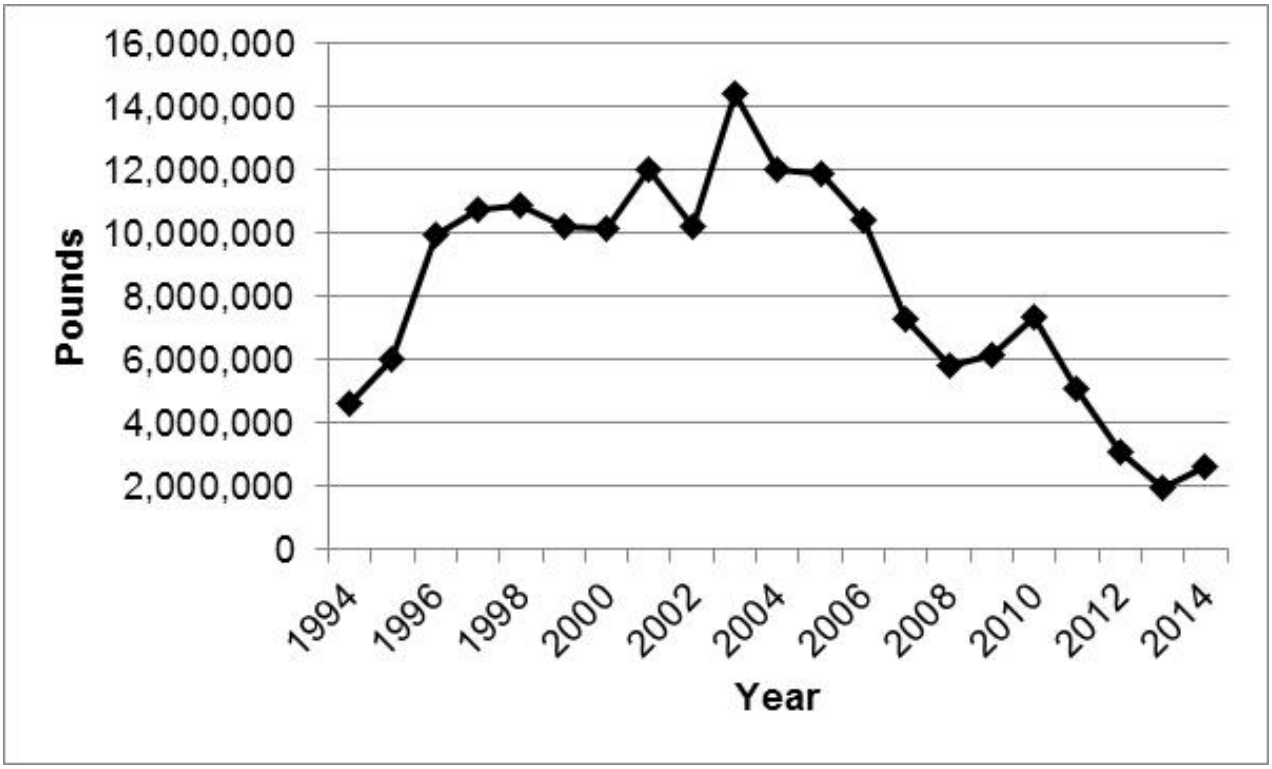


Figure 1. North Carolina commercial landings of Atlantic croaker from 1994-2014.

FISHERY MANAGEMENT PLAN UPDATE
ATLANTIC MENHADEN
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	August 1981
Amendments:	Amendment 1 – July 2001 Amendment 2 – December 2012
Revisions:	Revision – October 1992 Addendum I – August 2004 Addendum II – October 2005 Technical Addendum I – February 2006 Addendum III – October 2006 Addendum IV – November 2009 Addendum V – November 2011 Technical Addendum I – May 2013
Supplements:	Supplement – October 1986
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	2020

The revised Atlantic States Marine Fisheries Commission (ASMFC) Atlantic Menhaden Fishery Management Plan (FMP) was approved in 1992. The revised FMP was the result of an updated stock assessment. In 2001, Amendment 1 to the FMP was approved. This Amendment adopted a new stock assessment, and new overfishing definition, as well as required mandatory reporting for all menhaden purse seine fisheries. Addendum I of Amendment 1 was approved in August 2004 to modify the biological reference points, stock assessment schedule and revise the habitat section. The 2003 stock assessment used a new model with a fecundity-based biological reference point to determine stock status. Addendum II was approved by the ASMFC Atlantic Menhaden Management Board and established a five-year annual cap on reduction fishery landings in Chesapeake Bay and was implemented in 2006. Addendum II also established a research program to determine menhaden population in the Chesapeake Bay and to address localized depletion. Addendum III mirrors the intent and provisions of Addendum II but incorporates 2005 landings data and allows for the transfer of under-harvest to the following year's harvest. Addendum III was passed in November of 2006. The ASMFC Atlantic Menhaden Management Board approved Addendum IV in November of 2009 which extended the Chesapeake Bay reduction fishery harvest cap, established through Addendum III, for an additional three years (2011 to 2013). In 2010, the ASMFC Atlantic Menhaden Management Board tasked the Atlantic Menhaden Technical Committee (TC) to develop alternative reference points. In addition, the Policy Board directed the Multispecies TC to work with the Menhaden TC to explore reference points that account for predation. Addendum V was approved in

November 2011 and established a new interim fishing mortality threshold and target (based on maximum spawning potential or MSP) with the goal of increasing abundance, spawning stock biomass, and menhaden availability as a forage species. The new threshold and target equates to a MSP of 15% and 30%, respectively. The development of Amendment 2 established a 170,800 MT (376,549,545 pounds) total allowable catch (TAC) beginning in 2013 that will continue until completion of and Board action on the next benchmark stock assessment, scheduled in 2014. The Board adopted new biological reference points for biomass based on maximum spawning potential (MSP), with the goal of increasing abundance, spawning stock biomass, and menhaden availability as a forage species. In 2013, Technical Addendum I established a set aside program for episodic events. The 2014 Atlantic menhaden stock assessment was completed and menhaden are not overfished and overfishing is not occurring.

Management Unit

The management unit is defined as the Atlantic menhaden resource throughout the range of the species within U.S. waters of the northwest Atlantic Ocean from the estuaries eastward to the offshore boundary of the EEZ.

Goal and Objectives

The goal of Amendment 2 is to manage the Atlantic menhaden fishery in a manner that is biologically, economically, socially and ecologically sound, while protecting the resource and those who benefit from it. When fully implemented, the Amendment is designed to minimize the chance of a population decline due to overfishing, reduce the risk of recruitment failure, reduce impacts to species which are ecologically dependent on Atlantic menhaden, and minimize adverse effects on participants in the fishery.

STATUS OF THE STOCK

Stock Status

Based on the current adopted benchmarks, the Atlantic menhaden stock status is not overfished and overfishing is not occurring. The biological reference point used to determine the fecundity target is defined as the mature egg production one would expect when the population is being fished at the threshold fishing mortality rate. Population fecundity, a measure of reproductive capacity, was estimated to be well above both the threshold and the target in recent years. In fact, in 2013, fecundity is estimated to have been 71% higher than the target value, which is calculated to be 100 trillion eggs. This means that the spawning stock in 2013 appears to be more than adequate to produce the target number of eggs, and thus the population is not overfished.

Stock Assessment

The 2014 benchmark stock assessment for Atlantic menhaden was initiated in late 2012. The TC initiated the most recent benchmark stock assessment to identify and evaluate all available data sources and explore alternative model configurations as recommended by the 2009 peer review panel. In this benchmark assessment, significant changes were made to growth, maturity, natural mortality, indices of relative abundance, and fishery selectivities. Additionally, this benchmark assessment incorporates a “fleets-as-areas” base model configuration such that

the reduction and bait fisheries were divided into northern and southern regions, creating four separate fleets.

STATUS OF THE FISHERY

Current Regulations

No regulatory changes were made in 2014 to affect menhaden.

Effective January 1, 2013 a law was passed making it unlawful to harvest menhaden with a purse seine net deployed by a mother ship and one or more runner boats within North Carolina's three-mile jurisdiction.

Commercial Landings

Atlantic menhaden landings have been on a decline throughout the last ten years, due to changes in management decisions. Landing exceeded 13 million pounds in 2005 and in 2014 was estimated at almost 800,000 pounds (Table 1). The 2013 and 2014 declines were due to total allowable catch initiated in Amendment 2. Gill nets are the most common gear used throughout the state.

Recreational Landings

Data are not available for recreational landings.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Atlantic menhaden are sampled in a variety of North Carolina Division of Marine Fisheries (NCDMF) dependent surveys for compliance with ASMFC requirements. However, these surveys were not used in the most recent benchmark stock assessment. These include the sink net fishery, the winter trawl fishery , the estuarine gill net fishery and the sciaenid pound net fishery. Commercial landings of Atlantic menhaden are monitored through the NCDMF Trip Ticket Program. Table 2 describes the mean, minimum, and maximum lengths of Atlantic menhaden sampled from the North Carolina commercial fishery. Average lengths in the menhaden commercial fishery have remained fairly consistent from 2005 to 2014.

Fishery-Independent Monitoring

Atlantic menhaden are sampled in a variety of NCDMF independent surveys for compliance with ASMFC. However, these surveys were not used in the most recent benchmark stock assessment. Atlantic menhaden are sampled in the estuarine trawl survey, the Pamlico Sound trawl survey; the striped bass juvenile trawl survey and alosine seine survey in Albemarle Sound. Analysis results include juveniles size categories ranging from <90mm in May, <110 mm in June, <125 mm in July and August, and <150 mm in September and October.

MANAGEMENT STRATEGY

In May 2015, the ASMFC Atlantic Menhaden Management Board approved a TAC for the 2015 and 2016 fishing seasons at 187,880 metric tons (414,204,498 pounds) per year, a 10% increase from the 2014 TAC. The increase responds to the positive findings of the 2015 Atlantic menhaden benchmark assessment which indicates the resource is not overfished nor experiencing overfishing relative to the current biological reference points. The Board also committed to moving forward with the development of an amendment to establish ecological based reference points that reflect Atlantic menhaden's role as a forage species. The amendment will also consider changes to the current state-by-state allocation scheme.

MANAGEMENT AND RESEARCH NEEDS

Many of the research and modeling recommendations from the last benchmark stock assessment remain relevant for the update stock assessment as well. The highest priorities are to:

- Develop a coastwide fishery independent index of adult abundance at age to replace or augment the existing Potomac River pound net index in the model. Possible methodologies include an air spotter survey or an industry-based survey with scientific observers on board collecting the data. In all cases, a sound statistical design is essential (involve statisticians in the development and review of the design; some trial surveys may be necessary). NOTE: An industry funded feasibility study conducted in 2011 further supported the need for this work. A subcommittee of the Atlantic Menhaden Technical Committee began discussions for development of a coastwide aerial survey in 2008. At the time of this update assessment, a contract has been awarded to develop the survey design, with results expected by the end of 2012. The Technical Committee is in consensus that an index of adult abundance is the highest priority research recommendation but recognizes that implementation of the survey will require significant levels of funding.
- Develop a spatially-explicit model, once sufficient age-specific data on movement rates of menhaden are available and develop multispecies statistical catch-at-age model to estimate menhaden natural mortality at age.
- A more complete examination of the industry is needed to properly analyze the potential impacts of the plan and the current amendment.
- Study specific habitat requirements for all life history stages.

LITERATURE CITED

Atlantic Menhaden Technical Committee (AMTC). 2006 Stock Assessment Report for Atlantic Menhaden. A report prepared for the Atlantic Menhaden Management Board, Atlantic States Marine Fisheries Commission, Washington, DC, 139 p.

Atlantic States Marine Fisheries Commission (ASMFC). 1981. Fishery Management Plan for Atlantic Menhaden. ASMFC, Washington, D.C. 146 p.

Atlantic States Marine Fisheries Commission (ASMFC). 1992. Fishery Management Plan for Atlantic Menhaden: 1992 revision. FMR No. 22. ASMFC, Washington, D.C. 159 p.

Atlantic States Marine Fisheries Commission (ASMFC). 1999a. Atlantic Menhaden Stock Assessment Report for Peer Review. Stock Assessment Report No. 99-01 (supplement) of the ASMFC. 146 p.

Atlantic States Marine Fisheries Commission (ASMFC). 1999b. Terms of Reference & Advisory Report for the Atlantic Menhaden Stock Assessment Peer Review. Stock Assessment Report No. 99-01 of the ASMFC.16 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2001. Amendment 1 to The Interstate Fishery Management Plan for Atlantic Menhaden. ASMFC, Washington, D.C. 146 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2002. Law Enforcement Committee, Guidelines for Resource Managers on the Enforceability of Fishery Management Measures. ASMFC, Washington, DC.

Atlantic States Marine Fisheries Commission (ASMFC). 2004. Atlantic Menhaden Stock Assessment Report for Peer Review. Atlantic States Marine Fisheries Commission, Stock Assessment Report No. 04-01 (supplement), 145 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2009. Interstate Fisheries Management Program Charter. ASMFC, Washington, D.C. 23 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2010. Atlantic menhaden stock assessment and review panel reports. ASMFC stock assessment report no. 10-02, 325 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2011. Addendum V to Amendment 1 to the Atlantic Menhaden Fishery Management Plan. ASMFC, Arlington, VA 17 p.

Atlantic States Marine Fisheries Commission (ASMFC). 2012. Atlantic menhaden stock assessment update report. ASMFC, Arlington, VA, 228 p.

SEDAR. 2015. SEDAR 40 – Atlantic Menhaden Stock Assessment Report. SEDAR, North Charleston SC. 643 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=40.

TABLES

Table 1. North Carolina Atlantic menhaden annual commercial landings, 2005-2014.

Year	Landings (pounds)
2005	13,386,245
2006	962,648
2007	1,134,167
2008	645,231
2009	2,124,733
2010	1,299,130
2011	3,529,967
2012	538,783
2013	454,172
2014	794,658

Table 2. Atlantic menhaden length data sampled from the North Carolina commercial fishery, 2005-2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	223	102	341	1,041
2006	203	95	348	1,431
2007	206	122	383	1,112
2008	205	100	325	1,061
2009	230	100	343	1,066
2010	226	147	319	225
2011	236	95	347	1,400
2012	220	70	362	789
2013	237	141	385	847
2014	225	123	324	1,528

FISHERY MANAGEMENT PLAN UPDATE
BLACK DRUM
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	June 2013
Amendments:	None
Revisions:	None
Supplements:	None
Information Updates:	February 2015
Schedule Changes:	None
Next Benchmark Review:	February 2020

The Atlantic States Marine Fisheries Commission (ASMFC) formed a Black Drum Working Group and conducted a series of webinars and conference calls in February and March 2011 compiling data on the status of black drum from New Jersey to Florida. General trends in these black drum fishery dependent and independent data sources and the feasibility of developing a coastwide stock assessment were presented to the Interstate Fisheries Management Program Policy Board in August 2011. The Policy Board accepted the working group's recommendation to initiate an Interstate Fisheries Management Plan (FMP) for black drum. In November 2011, the Management Board also voted to initiate the FMP and a stock assessment concurrently. A Public Information Brochure (PIB) outlining the Commission's intent to develop an Interstate FMP for black drum was released and sent out for public comment in February 2012. In October 2012, the Management Board approved the Draft FMP for black drum for public comment. Public hearings were held in April and March 2013 to solicit comments on a range of issues from the Draft FMP, including management goals and objectives; recreational and commercial management measures; flexibility to react to new assessment information; de minimis levels and exemptions; monitoring requirements and recommendations; and recommended measures for implementation by NOAA Fisheries in federal waters. In April 2013, the Black Drum Technical Committee met for a data workshop to compile fishery independent and dependent data to be used in the first coastwide benchmark stock assessment for black drum. In June 2013, the ASMFC adopted the Interstate FMP for Black Drum and required all states to maintain their current regulations for black drum and implement a maximum possession limit and minimum size limit (of no less than 12 inches) by January 1, 2014. States were also required to further increase the minimum size limit (to no less than 14 inches) by January 1, 2016. In response to the ASMFC request, the North Carolina Marine Fisheries Commission implemented a 14- to 25-inch total length slot size limit (with one fish over 25 inches), 10-fish recreational bag limit and a 500-pound commercial trip limit effective January 1, 2014.

Management Unit

In North Carolina, black drum are included in the Interjurisdictional FMP, which defers to Atlantic States Marine Fisheries Commission (ASMFC) FMP compliance requirements. The FMP includes all states from Florida to New Jersey. The management unit is defined as the black drum (*Pogonias cromis*) resource throughout the range of the species within U.S. waters of the northwest Atlantic Ocean from the estuaries eastward to the offshore boundaries of the EEZ (ASMFC 2013).

Goal and Objectives

The goal of the Black Drum FMP is to provide an efficient management structure to implement coastwide management measures. The objectives of the FMP include:

1. Provide a flexible management system to address future changes in resource abundance, scientific information, and fishing patterns among user groups or area.

2. Promote cooperative collection of biological, economic, and sociological data required to effectively monitor and assess the status of the black drum resource and evaluate the management efforts.

3. Manage the black drum fishery to protect both young individuals and established breeding stock.

4. Develop research priorities that will further refine the black drum management program to maximize the biological, social, and economic benefits derived from the black drum population.

STATUS OF THE STOCK

Stock Status

The stock status of black drum is currently “viable”. The 2015 ASMFC Black Drum Stock Assessment determined that the stock is not overfished and not experiencing overfishing. Prior to the completion of the stock assessment the stock status was listed as “unknown”.

Stock Assessment

Variable catch history in state surveys and fisheries coupled with complex migratory patterns made the use of traditional statistical catch-at-age models difficult, thus a data–poor modeling approach was used for the first coastwide benchmark stock assessment (ASMFC 2015). Data-poor models estimate reference points based on historical catch data and life history information. A Depletion-Based Stock Reduction analysis (DB-SRA) model was used to estimate biomass and maximum sustainable yield (MSY). While the median biomass has declined steadily from the 1900s, the assessment determined that black drum is not overfished and not experiencing overfishing. The median biomass was estimated to be 90.78 million pounds, well above the median biomass that produces maximum sustainable yield (B_{MSY}; 47.26 million pounds).

STATUS OF THE FISHERY

Current Regulations

- Minimum Size Limit
- It is unlawful to possess black drum less than 14 inches total length or greater than 25 inches total length, except that one (1) black drum over 25 inches total length may be retained.

- Harvest Limits
- It is unlawful to possess more than ten (10) black drum per person per day by hook and line or for recreational purposes.

- It is unlawful for any commercial fishing operation, regardless of the number of persons, license holders or vessels involved, to possess more than 500 pounds of black drum per trip.

Commercial Landings

Black drum are primarily caught as bycatch in several North Carolina commercial fisheries; however, they are predominately landed in the estuarine gill net and pound net fisheries. The commercial harvest of black drum has been highly variable over the last ten years (Table 1, Figure 1). On average 116,725 pounds of black drum were landed annually from 2005 to 2014. Commercial landings have ranged from a low of 51,023 pounds in 2014 to a high of 301,998 pounds in 2008. Commercial landings decreased 60% from 2013 to 2014 following the implementation of stricter size and commercial trip limits.

Recreational Landings

The recreational harvest has also been highly variable over the last ten years (Table 2, Figure 1). Recreational anglers landed 713,047 pounds in 2013, almost double the 10-year average. The harvest (pounds of fish) dropped 92% from 2013 to 2014. In 2014, 60,552 pounds of black drum were landed, the lowest of the 10-year time series. Recreational releases (number of fish) increased 198% from 2013 to 2014.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial black drum landings are monitored through the North Carolina trip ticket program. Under this program licensed fishermen can only sell commercial catch to licensed North Carolina Division of Marine Fisheries (NCDMF) fish dealers. The dealer is required to complete a trip ticket every time a licensed fisherman lands fish. Trip tickets capture data on gears used to harvest fish; area fished, species harvested, and total weights of each individual species. Trip tickets are submitted to NCDMF on the 10th of the month following the month in which the landings occurred. Landings are available approximately 30-45 days after they are submitted from the dealers. Commercial fishing activity is monitored through fishery dependent sampling conducted under Title III of the Interjurisdictional Fisheries Act and has been ongoing since 1982. Biological samples (lengths, aggregate weights) are obtained from the NCDMF commercial

fisheries dependent sampling program (P400s). Black drum lengths and aging structures are collected at local fish houses or on the water. Subsequent to sampling a portion of the catch, the total weight of the catch by species and market grade are obtained for each trip, either by using the trip ticket weights or some other reliable estimate.

The mean length of commercially harvested black drum has remained stable over the time series, ranging from 14 inches to 17 inches (Table 3). The minimum and maximum observed total lengths appeared not to change following the implementation of the 14- to 25-inch slot limit. However, the preliminary 2015 data indicates the mean size of commercially caught black drum has increased to 21 inches and the minimum has increased to 17 inches.

The Marine Recreational Intercept Program (MRIP) is the primary survey used to collect data on angler harvest and effort. MRIP provides estimates of catch and effort at a regional level from the recreational fishing community and consists of two components, the Access-Point Angler Intercept Survey (APAIS) and the Coastal Household Telephone Survey (CHTS). The CHTS uses a random digit dialing telephone survey approach to collect marine recreational fishing effort information from residential households located in coastal counties. Individual catch and discard data for calculation of catch rate at the species level are collected through APAIS, an onsite intercept survey conducted at fishing access-sites (e.g., boat ramps, beaches, piers, marinas, etc.). Creel clerks collect intercept data year-round (in two-month waves) by interviewing anglers completing fishing trips in one of four fishing modes (man-made structures, beaches, private boats, and for-hire vessels). Individual lengths (inches-TL) and weights (pounds) are recorded for each individual species sampled. Results from both component surveys are combined at the state, area, fishing mode and wave level to provide estimates of the total number of fish caught, released, and harvested; the weight of the harvest; the total number of trips; and total participation in marine recreational fishing.

The mean total length (TL) of recreational caught black drum ranged from 10 inches to 16 inches (Table 4). The mean length increased 3 inches and the minimum length 6 inches following the implementation of the 14 inch minimum size limit in 2014. The maximum length decreased 3 inches following the implementation of the 14- to 25-inch slot limit in 2014.

Fishery-Independent Monitoring

A fishery independent gill net survey was initiated by the NCDMF in May of 2001. The survey utilizes a stratified random sampling scheme designed to characterize the size and age distribution for key estuarine species in Pamlico Sound (Pamlico Sound Independent Gill Net Survey, North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries Completion Report, Grant F-70, 1991-2013). By continuing a long-term database of age composition and developing index of abundance for black drum this survey will help managers assess the black drum stocks without relying solely on commercial and recreational fishery dependent data. Additionally, data collected is used to help improve bycatch estimates, evaluate the success of management measures, and look at habitat usage.

The annual weighted black drum CPUE from the independent gill net survey has ranged from a high of 3.52 in 2002 to a low of 0.38 in 2012 (Table 5, Figure 3). In 2014, the CPUE was 0.76 slightly below the time-series average. Proportional Standard Error (PSE) has ranged from 12 to 33.

Black drum age structures are collected from various fishery independent (scientific surveys) and dependent (fisheries) sources throughout the year. In 2014, 409 black drum were collected ranging in age from 0 to 31 years (Table 6). The majority of black drum collected from harvest (14 to 25 inches total length) are ages 1-3.

MANAGEMENT STRATEGY

Data poor models such as the one used for 2015 ASMFC Back Drum Stock Assessment are designed to estimate reference points based on historical catch data and the life history of a particular species.. Due to the uncertainty of the inputs and the nature of data poor methods the ASMFC stock assessment subcommittee (SASC) recommended that a precautionary maximum sustainable yield (MSY) estimate of 2.12 million pounds with an interquartile range of 1.60-3.05 million pounds as the recommended target reference point (Figure 2). The threshold MSY or overfishing limit (OFL) was set at 4.12 million pounds. The SASC also recommended that future assessments include “rumble-strip” approach that has been implemented by the Mid-Atlantic Fisheries Management Council for other data poor species. This method allows managers to examine a set of indicators that detect major changes in harvest and F that could trigger a reassessment of the reference points.

See Table 7 for current management strategies and implementation status of the ASMFC Black Drum FMP.

MANAGEMENT AND RESEARCH NEEDS

The FMP outlines management and research needs for black drum. The ASMFC Black Drum Plan Review Team (PRT) will annually review and prioritize the research needs annually as part of the Commission’s FMP Review Process. The research recommendations outlined in the 2015 Black Drum Stock Assessment include:

<u>High Priority</u>

- Age otoliths that have been collected and archived.
- Collect information to characterize the size composition of fish discarded in recreational fisheries.
- Collect information on the magnitude and sizes of commercial discards. Obtain better estimates of bycatch of black drum in other fisheries, especially juvenile fish in the southern Atlantic states.
- Increase biological sampling in commercial fisheries to better characterize the size and age composition of commercial fisheries by state and gear.
- Increase biological sampling in recreational fisheries to better characterize the size and age composition by state and wave.
- Obtain estimates of selectivity-at-age for commercial fisheries by gear, recreational harvest, and recreational discards.
- Continue all current fishery-independent surveys and collect biological samples for black drum on all surveys.
- Develop fishery-independent adult surveys. Consider long line and purse seine surveys. Collect age samples, especially in states where maximum size regulations preclude the collection of adequate adult ages.

Moderate Priority

- Conduct reproductive studies, including: age and size-specific fecundity, spawning frequency, spawning behaviors by region, and movement and site fidelity of spawning adults.
- Conduct a high reward tagging program to obtain improved return rate estimates. Continue and expand current tagging programs to obtain mortality and growth information and movement at size data.
- Improve sampling of night time fisheries.
- Conduct studies to estimate catch and release mortality rates in recreational fisheries.

LITERATURE CITED

ASMFC (Atlantic States Marine Fisheries Commission). 2013. Fisheries Management Report of the Atlantic States Marine Fisheries Commission: Interstate Fishery Management Plan for Black Drum. Washington, DC. June 2013. 72p.

ASMFC (Atlantic States Marine Fisheries Commission). 2015. Fisheries Management Report of the Atlantic States Marine Fisheries Commission: Black Drum Stock Assessment and Peer Review Reports. Washington, DC. February 2015. 319p.

TABLES

Table 1. North Carolina commercial black drum landings (lbs), number of dealers and ex-vessel value, 2005-2014 (NCTTP).

Year	Dealers	Ex-Vessel Value	Pounds
2005	120	$12,192	44,989
2006	150	$38,076	125,214
2007	134	$50,320	148,231
2008	156	$104,937	301,998
2009	151	$64,875	148,994
2010	128	$32,805	69,194
2011	132	$26,432	56,083
2012	157	$54,133	94,352
2013	151	$79,480	127,170
2014	120	$32,178	51,023

Table 2. North Carolina recreational black drum harvest (lbs), harvest number (n) and number released (n) and PSE=Proportional Standard Error, 2005-2014 (MRIP).

	Harvest Weight		Harvest Number		Released Alive	
Year	Pounds	PSE	Number	PSE	Number	PSE
2005	63,161	32.7	75,924	27.0	95,255	25.6
2006	162,932	22.4	92,956	21.5	93,229	25.4
2007	220,454	19.1	209,372	22.3	226,463	27.0
2008	524,138	27.4	359,702	20.6	188,680	24.8
2009	121,038	19.5	92,058	22.8	69,484	28.5
2010	305,517	34.9	122,709	20.5	102,348	20.6
2011	151,407	18.3	211,396	18.0	104,286	20.8
2012	243,965	18.0	139,363	15.9	91,895	20.0
2013	713,047	26.9	363,466	20.7	121,306	28.1
2014	60,552	25.7	24,118	28.3	361,621	26.4

Table 3. Commercial black drum length data from NCDMF fisheries dependent sampling programs (P400s), 2005-2014.

Year	Mean TL (inches)	Minimum TL (inches)	Maximum TL (inches)	Total Measured (number
2005	14	5	44	479
2006	14	6	48	2,033
2007	15	7	50	1,973
2008	15	7	50	3,074
2009	16	6	48	1,166

Table 3 (continued).

Year	Mean TL (inches)	Minimum TL (inches)	Maximum TL (inches)	Total Measured (number
2010	17	8	49	669
2011	14	7	33	1,478
2012	15	6	39	1,462
2013	16	5	36	1,213
2014	16	5	47	788

Table 4. Recreational black drum length data from Marine Recreational Intercept Program (MRIP), 2005-2014.

Year	Mean TL (inches)	Minimum TL (inches)	Maximum TL (inches)	Total Measured (number)
2005	10	7	34	89
2006	14	9	33	104
2007	11	7	20	191
2008	13	7	48	363
2009	12	8	25	191
2010	14	7	29	258
2011	10	7	24	567
2012	13	7	26	237
2013	13	7	26	154
2014	16	13	23	33

Table 5. Annual weighted black drum CPUE (ages combined) from the North Carolina Pamlico Sound Independent Gill Net Survey. N=number of samples; CPUE=Catch per unit effort; SE=Standard Error; PSE=Proportional Standard Error.

Year	N	CPUE	SE	PSE
2001	237	1.91	0.41	21
2002	320	3.52	0.46	13
2003	320	1.16	0.30	26
2004	320	0.46	0.09	20
2005	304	0.49	0.13	27
2006	320	0.78	0.09	12
2007	320	0.76	0.16	21
2008	320	0.87	0.16	18
2009	320	0.79	0.16	20
2010	320	0.54	0.18	33
2011	298	0.84	0.15	18
2012	308	0.38	0.07	18

Table 5 (continued).

Year	N	CPUE	SE	PSE
2013	308	0.42	0.07	17
2014	308	0.76	0.17	22

Table 6. Summary of black drum age samples collected from both dependent (commercial and recreational fisheries) and independent (surveys) sources from 2011-2014.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2011	0	0	60	140
2012	1	0	3	327
2013	2	0	4	187
2014	1	0	31	409

Table 7. Summary of ASMFC management strategies and their implementation status for Black Drum Fishery Management Plan.

Management Strategy	**Implementation Status**
HARVEST MANAGEMENT	
Implement a maximum possession limit and size limit (of no less than 12 inches) by January 1, 2014	Accomplished (other states)
Implement a maximum possession limit and size limit (of no less than 14 inches) by January 1, 2016	Proclamation FF-73-2013
DATA AND RESEARCH NEEDS	
Age otoliths that have been collected and archived.	Ongoing
Collect information to characterize the size composition of fish discarded in recreational fisheries.	Ongoing
Collect information on the magnitude and sizes of commercial discards. Obtain better estimates of bycatch of black drum in other fisheries, especially juvenile fish in south Atlantic states	Ongoing
Increase biological sampling in commercial fisheries to better characterize the size and age composition of commercial fisheries by state and gear	Ongoing
Increase biological sampling in recreational fisheries to better characterize the size and age composition by state and wave	Ongoing
Obtain estimates of selectivity-at-age for commercial fisheries by gear, recreational harvest, and recreational discards	Ongoing
Continue all current fishery-independent surveys and collect biological samples for black drum on all surveys	Ongoing

Table 7 (continued).

Management Strategy	Implementation Status
Develop fishery-independent adult surveys. Consider long line and purse seine surveys. Collect age samples, especially in states where maximum size regulations preclude the collection of adequate adult ages	Ongoing
Conduct reproductive studies, including: age and size-specific fecundity, spawning frequency, spawning behaviors by region, and movement and site fidelity of spawning adults	Needed
Conduct a high reward tagging program to obtain improved return rate estimates. Continue and expand current tagging programs to obtain mortality and growth information and movement at size data	Needed
Improve sampling of night time fisheries	Needed
Conduct studies to estimate catch and release mortality rates in recreational fisheries	Needed

FIGURES

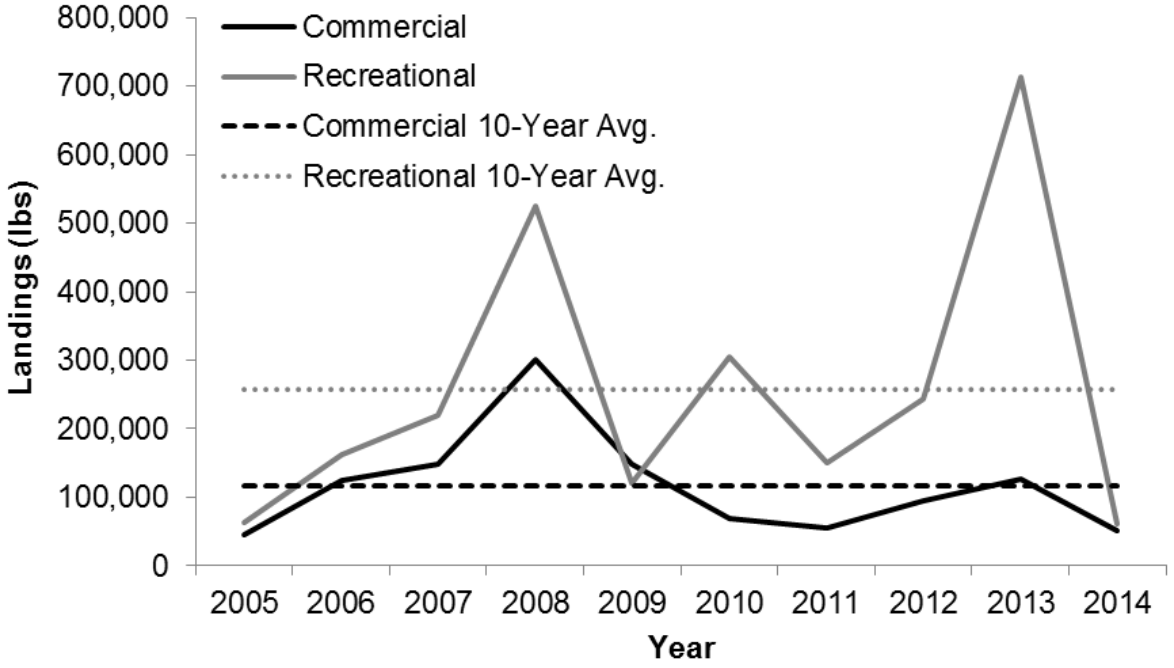


Figure 1. North Carolina commercial (NCTTP) and recreational (MRIP) black drum landings (lbs), 2005-2014.

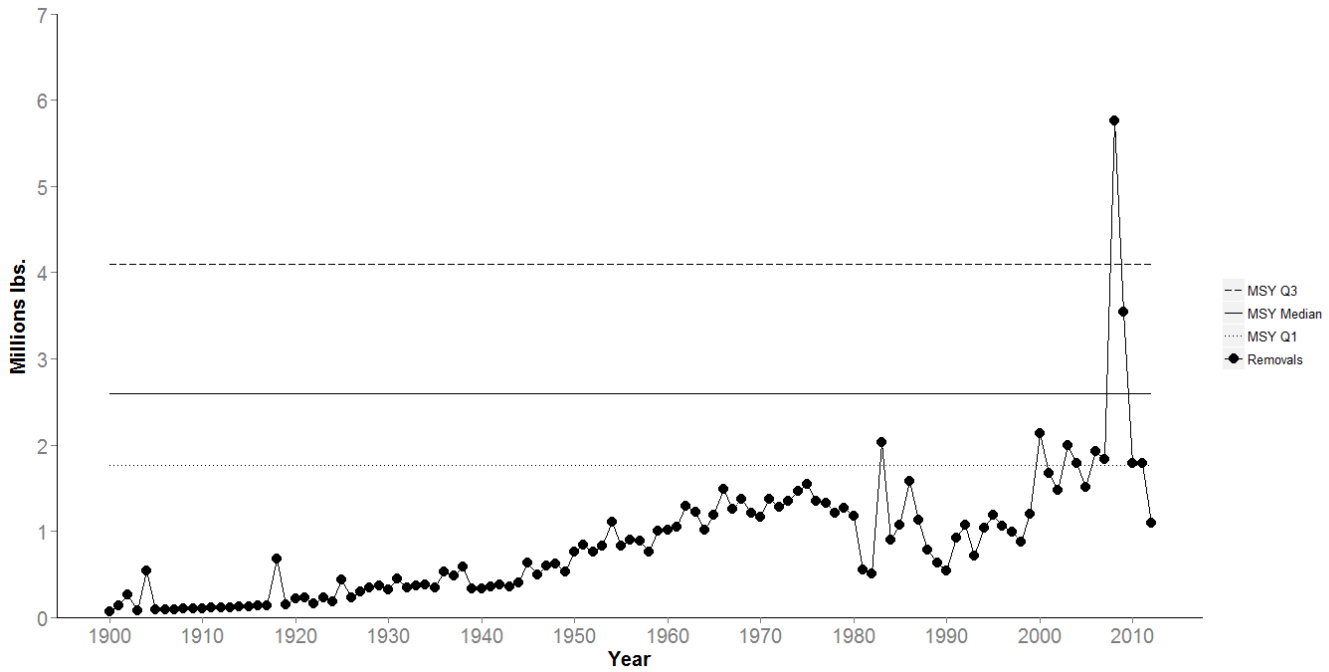


Figure 2. Observed removals and the median (2.60 million pounds) and interquartile range (1.76 – 4.10 million pounds) of the MSY estimate from the DB-SRA base configuration (ASMFC 2015).

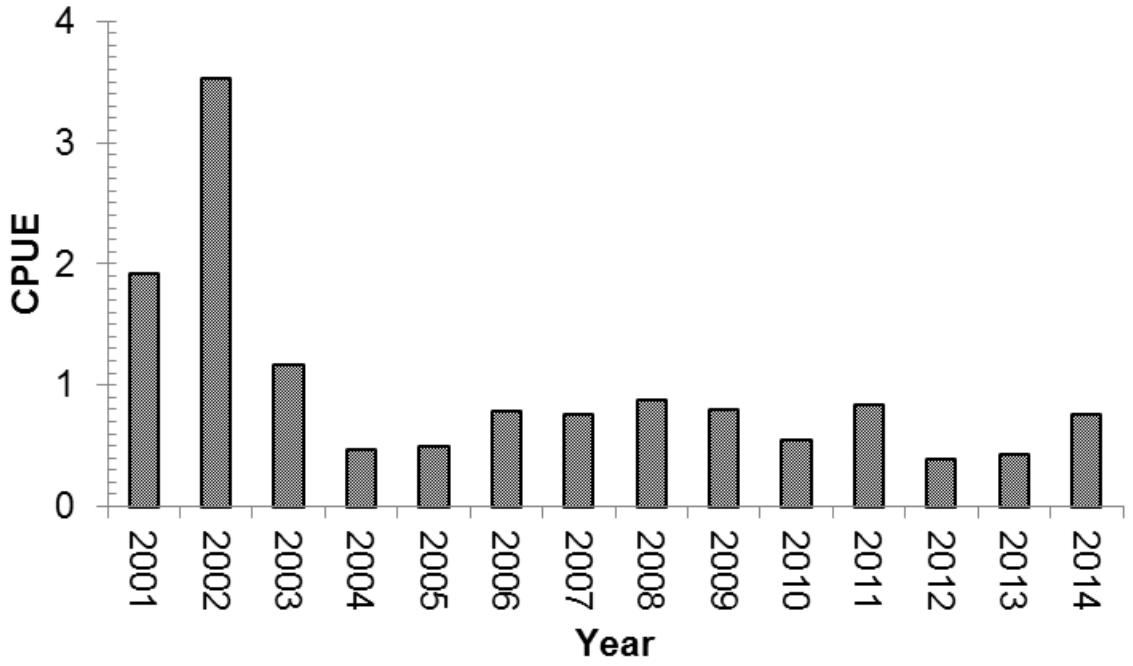


Figure 3. Annual weighted black drum CPUE (ages combined) from the North Carolina Pamlico Sound Independent Gill Net Survey, 2001-2014.

FISHERY MANAGEMENT PLAN UPDATE
BLACK SEA BASS NORTH OF CAPE HATTERAS
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	Incorporated into Summer Flounder FMP through Amendment 9 in 1996
Amendments:	Amendment 11 in 1998 Amendment 12 in 1999 Amendment 13 in 2003 Amendment 15 in 2011 Amendment 16 in 2007
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	Stock assessment to begin in 2016

Because of their presence in, and movement between, state waters (0-3 miles) and federal waters (3-200 miles), the Mid Atlantic Fisheries Management Council manages black sea bass north of Cape Hatteras cooperatively with the Atlantic States Marine Fisheries Commission (ASMFC). The two management entities work in conjunction with the National Marine Fisheries Service (NMFS) as the federal implementation and enforcement entity. The Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP) and amendments use output controls (catch and landings limits) as the primary management tool, with landings divided between the commercial and recreational fisheries. The FMP also includes minimum fish sizes, bag limits, seasons, gear restrictions, permit requirements, and other provisions to prevent overfishing and ensure sustainability of the fisheries. Recreational bag/size limits and seasons are determined on a state-by-state basis using conservation equivalency. The commercial quota is divided into state-by-state quotas based on historical landings. Specific details for each Amendment include:

Amendments 1-8 to the FMP were completed prior to black sea bass being incorporated in the Summer Flounder, Black Sea Bass and Scup FMP

Amendment 9 - Incorporated Black Sea Bass into Summer Flounder FMP; established black sea bass measures, including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements.

Amendment 11 - Modified certain provisions related to vessel replacement and upgrading, permit history transfer, splitting, and permit renewal regulations.

Amendment 12 - Revised FMP to comply with the Sustainable Fisheries Act and established framework adjustment process; established quota set-aside for research for summer flounder, scup, and black sea bass; established state-specific conservation equivalency measures; allowed the rollover of winter scup quota; revised the start date for summer quota period for scup fishery; established a system to transfer scup at sea.

Amendment 13 - Revised black sea bass commercial quota system; addressed other black sea bass mgmt. measures; Established multi-year specification setting of quota for all three species; Established region-specific conservation equivalency measures for summer flounder; built flexibility into process to define and update status determination criteria for each plan species.

Amendment 15 - Established Annual Catch Limits (ACLs) and Accountability Measures

Amendment 16 - Standardized bycatch reporting methodology.

Management Unit

U.S. waters in the western Atlantic Ocean from Cape Hatteras northward to the U.S.-Canadian border.

Goal and Objectives

The objectives of the Summer Flounder, Black Sea Bass and Scup FMP are to:

1. Reduce fishing mortality in the summer flounder, scup and black sea bass fisheries to assure that overfishing does not occur;

2. Reduce fishing mortality on immature summer flounder, scup and black sea bass to increase spawning stock biomass (SSB);

3. Improve the yield from these fisheries;

4. Promote compatible management regulations between state and federal jurisdictions;

5. Promote uniform and effective enforcement of regulations;

6. Minimize regulations to achieve the management objectives stated above.

The 2011 Omnibus Amendment contains Amendment 15 to the Summer Flounder, Black Sea Bass and Scup FMP (the most recent Amendment that impacts the black sea bass fishery). The amendment is intended to formalize the process of addressing scientific and management uncertainty when setting catch limits for the upcoming fishing year(s) and to establish a comprehensive system of accountability for catch (including both landings and discards) relative to those limits, for each of the managed resources subject to this requirement. Specifically: (1) Establish Allowable Biological Catch (ABC) control rules, (2) Establish a Council risk policy, which is one variable needed for the ABC control rules, (3) Establish ACL(s), (4) Establish a system of comprehensive accountability, which addresses all components of the catch, (5) Describe the process by which the performance of the annual catch limit and comprehensive

accountability system will be reviewed, (6) Describe the process to modify the measures above in 1-5 in the future.

Addendum XXV to the Summer Flounder, Black Sea Bass and Scup Fishery Management Plan, established regional management of the summer flounder and black sea bass recreational fisheries for the 2014 fishing year.

STATUS OF THE STOCK

Stock Status

The NCDMF considers the stock status to be 'concern' due to uncertainty in recent stock assessments and low catches in North Carolina waters. Although the ASMFC considers the stock to be rebuilt/sustainable based on the National Marine Fisheries Service's Northeast Fisheries Science Center (NEFSC) 2008 stock assessment, which found that the stock was not overfished and overfishing was not occurring. Subsequent assessments did not pass peer-review due to high uncertainty.

Stock Assessment

The NEFSC 2008 stock assessment used a length based model (SCALE model) due to lack of age data. Although it passed peer-review there was considerable uncertainty about results. The 2011 NEFSC benchmark assessment included a statistical catch at age model calculated using the Age Structured Assessment Program. The 2011 assessment did not pass review for use in management. In 2012 an update of the 2008 SCALE model was completed. However, results from the 2012 assessment are considered too uncertain to provide a reliable stock status determination. A new stock assessment is scheduled for 2016.

STATUS OF THE FISHERY

Current Regulations

Commercial: 11 inches total length (TL) minimum size limit. Landings windows are set by proclamation with variable harvest limits by gear and time-period (see most recent NCDMF proclamation).

Recreational: 12 ½ inches TL minimum size limit, 15-fish bag limit. The 2015 season is May 15 through September 21 and October 22 through December 31.

Commercial Landings

Most black sea bass landings from north of Cape Hatteras were from trawls although flynets, fish pots and rod and reel gears caught small numbers. Landings are constrained by the coastwide quota. Landings generally declined since 2005 but increased notably in 2014 (Figure 1). The low landings in 2012-2013 were partly due to the closure of Oregon Inlet to large vessels (such as trawlers) and the consequent transfer of most of North Carolina's quota allocation to Virginia and other states. In 2014, more winter trawl vessels returned to North Carolina to land catches rather than transferring quota to Virginia and other states. Trends in commercial trips have generally followed landings trends (Figure 1). Trips include the number

of trip ticket records with landings reported. Trips typically represent more than one day of fishing, especially for trawling.

Recreational Landings

Recreational harvest of black sea bass from north of Cape Hatteras generally declined since 2005 with the exception of a peak in 2011 (Figure 2). Recreational trips generally followed harvest trends but with a more clearly declining trend (Figure 2).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Three NCDMF sampling programs collect biological data on commercial and recreational fisheries that catch black sea bass north of Cape Hatteras. Program 433 (Winter Trawl Fishery) and Program 438 (Offshore Live Bottom Fishery) are the primary programs that collect harvest length data. Other commercial sampling programs focusing on fisheries that do not target black sea bass collect biological data rarely. NCDMF sampling of the recreational fishery through the Marine Recreational Information Program (MRIP) collects harvest length data.

There were no clear trends in commercial length data in 2005 to 2014 (Table 1). Annual mean lengths were fairly consistent for the time-series and 2014 was typical. There was a slight decrease in the annual maximum length in recent years compared to earlier years in the time-series. The number of fish measured in 2014 was the highest in the time-series. Age data were not collected for black sea bass north of Cape Hatteras until 2014.

There were some potential trends in length data but sample size was low throughout 2005-2014 (Table 2). Mean lengths were fairly consistent, although higher earliest in the time-series. The maximum annual length may be declining slightly. The number of measurements clearly declined – following the harvest decline with the exception of 2012 (very high harvest). Age data were not collected for black sea bass north of Cape Hatteras from recreational fisheries.

Fishery-Independent Monitoring

NCDMF independent sampling programs rarely encounter black sea bass north of Cape Hatteras (Table 3). Most of the small number of samples came from Program 120 (Estuarine Trawl Survey), which typically collects a few samples of black sea bass juveniles from inshore waters each year. However, it is not clear that samples collected inshore north of Cape Hatteras are from the northern stock of black sea bass; this combined with the small sample numbers means that these data cannot be used in an abundance index. NCDMF currently does not have independent sampling programs in ocean waters north of Cape Hatteras.

MANAGEMENT STRATEGY

Management of black sea bass has been based on results from stock assessments. Despite concerns about data uncertainty etc., results from the 2012 stock assessment update are being used to guide management in combination with a constant catch-based strategy (based on landings in recent years). A new stock assessment is scheduled for 2016.

MANAGEMENT AND RESEARCH NEEDS

At the 2013 Black Sea Bass Data Workshop, a series of research recommendations were developed to address concerns of the MAFMC and SSC had about the 2011 stock assessment. Text in parenthesis for each number indicates known progress made to address needs.

Research to address uncertainty in the spatial structure of the stock:

- Explore the impact of spatial heterogeneity on the stock assessment results. Conduct sensitivity analyses on this topic. Specifically, if you break the stock north-south do you get qualitatively different stock status results than coastwide stock? (progress unknown)
- Explore the use of time-varying catchability to account for changes in density dependent surveys catchability. This was a criticism of use of trawl surveys for a “structure-obligate” species. This will need to be added to the current assessment model (SCALE) code. (progress unknown)
- Use paired trawl experiments coefficient/data as prior's when estimating survey selectivities and estimate the change in selectivity instead of specifying it. This will need to be added to the assessment model code. (progress unknown)
- Build a simulation model that incorporates spatial structure for black sea bass as well as other necessary features (e.g. protogynous life history, sex-specific, etc.). Use existing data to simulate/ determine the scale at which management could be implemented. This simulation exercises should be developed at a complex level, but then be used to determine how simple your models need to be to provide management advice. The simulation can be used to identify critical model features (e.g., plasticity of the size/age at transition from female to male, etc.) and data gaps. (progress unknown)
- Evaluate the ability of the existing data to support a spatially-explicit assessment for management (if needed based on the simulation study above) and implement any necessary data collection protocols to support this approach. (progress unknown)
- If needed, build a spatially-structured, sex-specific assessment model for management. (progress unknown)
- Characterize ageing uncertainty: a) Conduct ageing validation study. b) Conduct formal ageing comparison of NEAMAP & NMFS ageing. c) Conduct formal ageing comparison between south and north Atlantic and borrow their ALKs. Conduct aging exchanges for otoliths (no scales). d) Develop ageing error matrices using this comparison study data for informing model inputs. (progress unknown)
- Explore cohort tracking in surveys (formally check that all surveys with multiple age classes show coherence). Determine if the surveys are tracking strong year classes such that age or length structure in the data could inform the assessment model. (progress unknown)
- Compare the temporal and spatial trends among surveys and report on the evidence of spatial structure of stock among surveys or lack thereof (e.g., spatial autocorrelation of catch and LF, cluster analysis). (progress unknown)
- Explore the catchability of surveys relative to black sea bass migration (e.g., correlation with temperature cues, etc.). Conduct a comprehensive spatio-temporal comparison of availability (side-by-side mapping and analysis of catch in each survey by date and location). (progress unknown)
- Conduct paired scup/BSB pot survey and VAS data with NJ trawl comparison using nearby locations. Explore if BSB are truly structure obligate and if trawls are valid for BSB. Compare catch and length frequency on/off structure. (progress unknown)
- Build an index of relative abundance using Jon Hare’s larval survey data (status unknown).
- Look at the implication of pooling samples in the age-length keys (ALK) versus filling parts of the annual keys that are low on samples. (progress unknown)

- Collect additional biological data on all FI surveys. (progress unknown)
- The collection of nearshore commercial trawl and pot fishery biosamples (i.e., lengths and sex) are needed (data collection has begun in NC, other states progress unknown)
- Sex ratio data should be collected from commercial and recreational port/intercept sampling to explore importance of sex information in assessment modeling (data collection has begun in NC, other states progress unknown)
- Ages should be collected from nearshore surveys (MA, RI, CT, NJ) for use in development of regional/local age length keys. (progress unknown)
- Tagging study (natural or artificial) should be conducted to determine mixing/migration. (progress unknown)

Research to address unusual life history:

- Studies should be conducted to understand the general reproductive behavior of black sea bass. What is the role of non-dominant males (e.g., sneaker males) in reproductive stock dynamics? Do black sea bass develop spawning harems or leks? (progress unknown)
- Studies should be conducted to determine the relationship between fertilization rates and sex ratio so this can be included into population dynamics models. A parentage analysis could be used to determine fecundity. (progress unknown)
- Work should be conducted to determine the natural mortality by sex; life stage research is needed. (progress unknown)

LITERATURE CITED

NEFSC. 2011. 53rd Northeast Regional Stock Assessment Workshop (53rd SAW) Assessment Report. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

TABLES

Table 1. Summary of harvest length (TL, mm) and age data for black sea bass north of Cape Hatteras from NCDMF commercial fishery sampling programs.

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	394	226	650	4,681	ND	ND	ND	ND
2006	389	135	620	4,166	ND	ND	ND	ND
2007	386	235	670	2,476	ND	ND	ND	ND
2008	375	234	656	4,206	ND	ND	ND	ND
2009	381	233	662	2,506	ND	ND	ND	ND
2010	378	226	635	3,415	ND	ND	ND	ND
2011	377	228	631	2,353	ND	ND	ND	ND
2012	373	260	586	858	ND	ND	ND	ND
2013	378	229	611	1,346	ND	ND	ND	ND
2014	381	214	622	5,609	ND*	ND*	ND*	ND*

*2014 age data were collected but are not yet complete

Table 2. Summary of length (TL, mm) and age data for black seas bass north of Cape Hatteras from NCDMF recreational fishery sampling

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	460	266	612	42	ND	ND	ND	ND
2006	342	203	582	64	ND	ND	ND	ND
2007	429	280	553	26	ND	ND	ND	ND
2008	358	273	501	48	ND	ND	ND	ND
2009	379	293	611	48	ND	ND	ND	ND
2010	356	276	529	29	ND	ND	ND	ND
2011	361	273	568	36	ND	ND	ND	ND
2012	384	304	511	14	ND	ND	ND	ND
2013	350	238	518	15	ND	ND	ND	ND
2014	378	314	523	8	ND	ND	ND	ND

Table 3. Summary of length (TL, mm) and age data for black sea bass f north of Cape Hatteras from NCDMF fishery-independent sampling programs

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	79	52	121	7	ND	ND	ND	ND
2006	153	153	153	1	ND	ND	ND	ND
2007	198	194	202	2	ND	ND	ND	ND
2008	123	110	133	5	ND	ND	ND	ND
2009	94	40	111	11	ND	ND	ND	ND
2010	60	42	71	4	ND	ND	ND	ND
2011	76	69	88	3	ND	ND	ND	ND
2012	127	127	127	1	ND	ND	ND	ND
2013	63	32	123	3	ND	ND	ND	ND
2014	ND	ND	ND	0	ND	ND	ND	ND

FIGURES

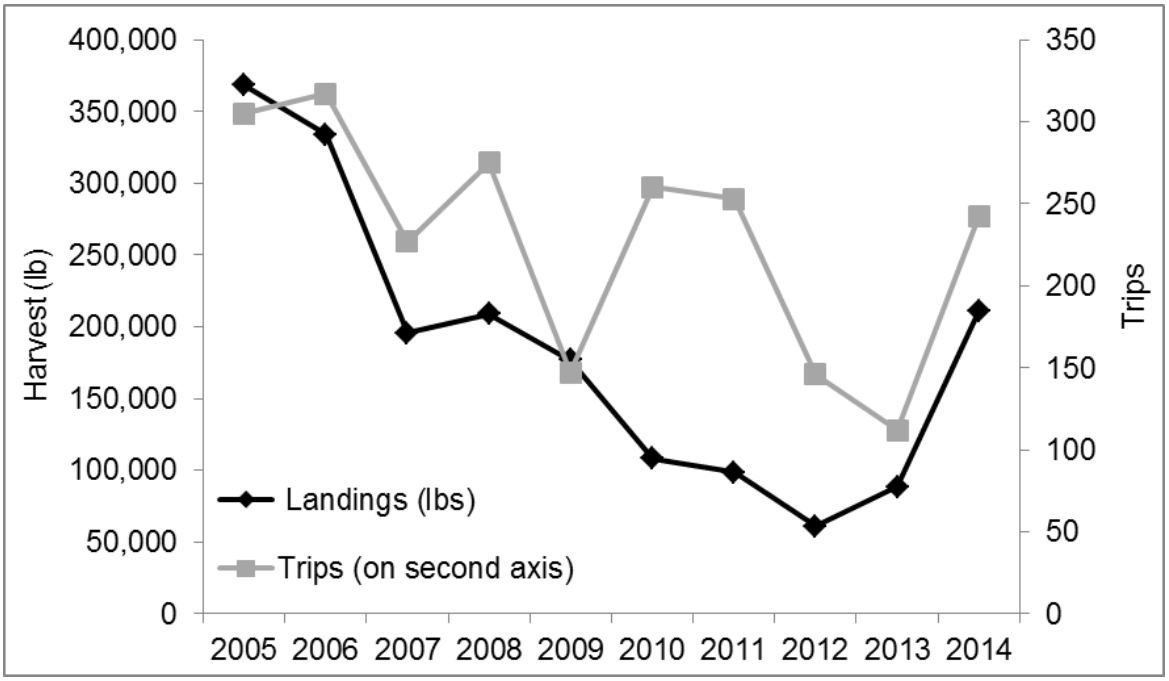


Figure 1. North Carolina commercial landings (lb) and trips for black sea bass north of Cape Hatteras 2005-2014.

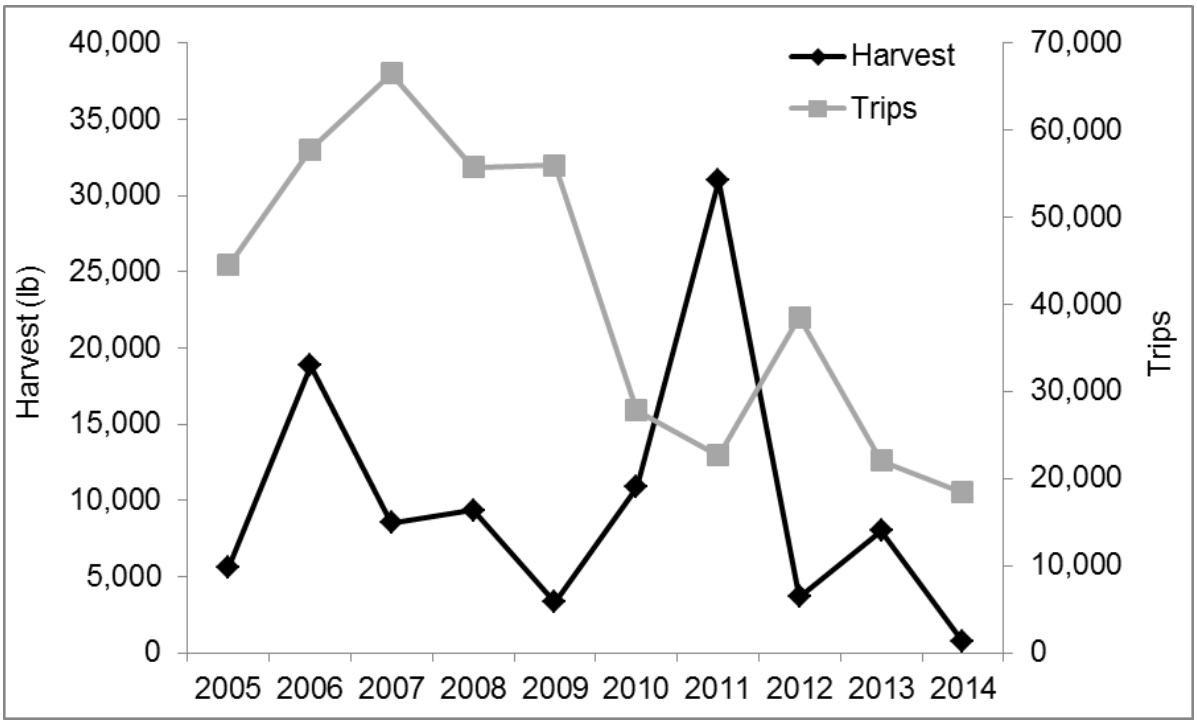


Figure 2. Recreational hook and line harvest of black sea bass in numbers of fish from MRIP data north of Cape Hatteras 2005-2014.

FISHERY MANAGEMENT PLAN UPDATE
BLUEFISH
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	October 1989
Amendments:	Amendment 1 – January 1998 Addendum I – February 2012
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	July 2015

The Bluefish Fishery Management Plan (FMP) is the first plan developed jointly by an interstate commission (Atlantic States Marine Fisheries Commission or ASMFC) and a federal fishery management council (Mid-Atlantic Fishery Management Council or MAFMC). The ASMFC and the MAFMC jointly manage bluefish under Amendment 1 to the Bluefish FMP. After it was implemented in July 2000, Amendment 1 initiated a ten-year rebuilding schedule to eliminate overfishing and allow for stock rebuilding to a level which would support harvest at or near maximum sustainable yield (MSY) by the year 2010 or earlier. The stock was declared rebuilt in 2009.

The FMP allows a state-by-state commercial quota system and a recreational harvest limit to reduce fishing mortality. The ASMFC and MAFMC adjust harvest limits for both sectors annually by the specification setting process that is detailed in Amendment1. Amendment 1 outlines a series of permitting and reporting requirements such as the requirement of operator permits for commercial, party, and charter boats; vessel permits for commercial, party and charter boats, as well as, dealer permits. The Bluefish Monitoring Committee is responsible for reviewing the best available data on an annual basis and recommending commercial and recreational management measures designed to ensure that the resource does not exceed the target fishing mortality rate.

In North Carolina, bluefish is currently included in the Interjurisdictional FMP, which defers to the ASMFC/MAFMC FMP compliance requirements. The FMP allows annually adjusted, state-by-state commercial quota system and recreational harvest limits to reduce fishing mortality.

In 2005, the Stock Assessment Review Committee (SARC) approved the use of an age structured assessment program (ASAP) for bluefish. The bluefish stock successfully rebuilt under the management program in Amendment 1, but the MAFMC and ASMFC were exploring ways to address uncertainties involved in the stock assessment. More specifically, the most

recent benchmark assessment revealed gaps in age length keys used in the ASAP model, and therefore, the assessment results should be used with caution (NEFSC 2005). The purpose of Addendum I was increase the number of aging samples available for the stock assessment and extend the geographic range of age samples to develop a coastwide age-length key.
States that account for more than 5% of total coastwide bluefish harvest (recreational and commercial combined) are required to collect a minimum of 100 bluefish ages (50 from January through June, 50 from July through December). These states are: Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and North Carolina.

Management issues are addressed through the ASMFC Bluefish Management Board and the MAFMC Coastal Migratory Species Committee. The ASMFC Bluefish Technical Committee provides technical advice. A joint ASMFC/MAFMC Technical Monitoring Committee conducts annual plan monitoring and provides framework adjustment recommendations. The ASMFC Stock Assessment Subcommittee addresses stock assessment matters.

Management Unit

The FMP defines the management unit as bluefish occurring in U.S. waters of the western Atlantic Ocean and is considered a single stock of fish. States with a declared interest in the bluefish FMP include all member states, with the exception of Pennsylvania and the District of Columbia.

Goal and Objectives

On July 26, 2000, the National Marine Fisheries Service published the final rule to implement the measures contained in Amendment 1 of the ASMFC/MAFMC Bluefish FMP. The goal of Amendment 1 is to conserve the bluefish resource along the Atlantic coast, specifically to:

1. Increase understanding of the stock and fishery.

2. Provide highest availability of bluefish to U.S. fishermen; while maintaining, within limits, traditional uses of bluefish.

3. Provide for cooperation among the coastal states, the various regional marine fishery management councils, and federal agencies involved along the coast to enhance the management of bluefish throughout its range.

4. Prevent recruitment overfishing.

5. Reduce the waste in both the commercial and recreational fisheries.

STATUS OF THE STOCK

Stock Status

The stock is listed as viable. Bluefish are not experiencing overfishing, and are not overfished. Fishing mortality has steadily declined since 1991, with biomass estimates increasing from 1997 to 2006, followed by a decline from 2007 to 2014. A new benchmark stock assessment is scheduled for completion in July 2015.

Stock Assessment

The original ASMFC benchmark bluefish stock assessment was completed in 2005. The assessment passed peer review (SARC 41) and was approved by the ASMFC Bluefish management Board and the MAFMC Coastal Migratory Species Committee. The assessment developed reference points for both bluefish biomass and fishing mortality. The Age Structured Assessment Program (ASAP) model used to calculate population abundance in this assessment is updated annually each spring with landings and survey indices, and the output from the model is used to set the annual Total Allowable Catch (TAC).

The 2014 stock assessment update (utilizing 2013 catch data) indicates that bluefish are not overfished and overfishing is not occurring. Estimates from the Age Structured Assessment Program (ASAP) model using state and federal indices show a decreasing trend in fishing mortality, an increasing trend in population biomass, and an increasing trend in population numbers from 1997 to 2007 followed by a decline from 2007 (86 million fish) to 2014 (59 million fish; Figure 1).

STATUS OF THE FISHERY

Current Regulations

There is a recreational bag limit of 15 fish per day. Only five of the 15 fish bag limit can be greater than 24 inches total length.

Amendment 1 establishes a state-by-state quota system where state quotas are based on the historic proportion of commercial and recreational landings for the period 1981-1989: 17% of the total allowable landings will be allocated to the commercial fishery, and 83% of the total allowable landings would be allocated to the recreational fishery. Each state is required to close its waters to fishing when its share of the commercial quota is landed. The commercial quota can be increased if it is anticipated that the recreational fishery will not land their entire allocation for the upcoming year.

The recreational fishery is managed through an annual framework of possession limits, size limits, and seasonal closures. Since recreational landings decreased in recent years, the Mid-Atlantic Council recommended an increase in the recreational possession limit from 10 to 15 fish in 2001. North Carolina increased the bluefish bag limit to 15 fish (proclamation effective 6/19/2001), and the NC Marine Fisheries Commission adopted a rule whereby only 5 of the 15 fish bag limit can be >24" TL (effective 4/01/2003). The possession limits will remain at 15 fish for 2014.

Commercial Landings

Bluefish landings have fluctuated annually (Figure 2). Landings have been on a relatively stable trend since 1994. Although bluefish landings reached the lowest point in the time series in 2012, landings in the last two years have increased. The vast majority of bluefish are harvested from the ocean gillnet fishery, followed by the estuarine gillnet fishery.

Recreational Landings

Recreational landings for bluefish have been relatively stable since the 1990's (Figure 3). Most of bluefish are harvested from the ocean by anglers fishing from the beach or man-made structures such as piers, jetties, and bridges. Bluefish are one of the most frequently harvested fish in NC.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Bluefish are sampled from a variety of commercial fishery surveys, including the estuarine long haul, ocean trawl, pound net, ocean gill net, estuarine gillnet and ocean beach seine fisheries in North Carolina. A total of 61,566 were measured from 2005 to 2014 (Table 1). Mean fork length (mm) has ranged from 348 mm to 486 mm with a minimum of 122 mm and 886 mm seen in the measurements.

Fishery-Independent Monitoring

The Division's Pamlico Sound Independent Gill Net Survey (PSIGNS) was initiated in May of 2001 and has sampled continuously since. This survey catches more bluefish than any other independent surveys in North Carolina. This survey provides fishery independent indices of relative abundance by size class, which when applied to the appropriate age-length keys can produce annual catch-at-age (CAA) estimates. These estimates provide essential data input for stock assessments. The Catch per Unit of Effort (CPUE) or number of bluefish per set has ranged from 3.6 in 2012 to 7.8 in 2007 during the last 10 years (Figure 4).

The vast majority of bluefish age samples are obtained from the Pamlico Sound Independent Gillnet survey but also come from various fisheries dependent sources. Bluefish ages range from 0 to 11 years old, with modal ages ranging from 1 to 3 years old (Table 2).

MANAGEMENT STRATEGY

The ASMFC uses biological reference points in an Age Structured Assessment Program (ASAP) stock assessment model. These biological reference points include Fishing Mortality at Maximum Sustainable Yield (FMSY) and Biomass at Maximum Sustainable Yield (BMSY). The current biological reference points are FMSY (0.19) and BMSY [147,052 metric tons (MT)]. If the total biomass drops below ½ BMSY of 73,526 MT, then the stock is overfished. If the FMSY rises above 0.19, then overfishing is occurring.

The basis for the reference points was the Sissenwine-Shepherd method using the Beverton-Holt stock recruitment parameters and Spawning Stock Biomass (SSB) per recruit results generated by the ASAP model results. BMSY was calculated using mean weights at age and is therefore comparable to mean biomass in year *t*. The 2013 estimate of mean total biomass is 123,716 MT, which is below BMSY but well above ½ BMSY of 73,526 MT. The 2013 estimate of fishing mortality (0.118) remains well below FMSY (Figure 1).

Bluefish is managed under Amendment 1 to the Fishery Management Plan for the Bluefish Fishery and Addendum I. The Commission and Council approved Amendment 1 to the FMP in

1998. Amendment 1 allocates 83% of the resource to recreational fisheries and 17% to commercial fisheries. However, the commercial quota can be increased up to 10.5 million pounds if the recreational fishery is projected to not land its entire allocation for the upcoming year. The commercial fishery is controlled through state-by-state quotas based on historic landings from 1981-1989. The recreational fishery is managed using a 15 fish bag limit.

A coastwide biological sampling program to improve the quantity and quality of information used in future bluefish stock assessments was approved and implemented in 2012 through Addendum I. A 2013 review the inaugural biological sampling program found the geographic range, distribution of sampling times, and program design are effectively capturing age data and it can be used in the next benchmark assessment, currently scheduled to be completed in July 2015.

The ASMFC FMP allocates 32% of the Atlantic coast total bluefish quota to North Carolina. The FMP for bluefish welcomes individual states to implement management measures in addition to those required by the FMP or FMP amendments. The scope of North Carolina's bluefish proclamation authority is limited to actions which "comply with or utilize conservation equivalency to comply with the management requirements incorporated in the plan" (15A NCAC 2M.0511). North Carolina continues to maintain a 15 fish bag limit on bluefish that has been in place since June 19, 2001. An additional restriction that only 5 of the 15 fish can be >24" TL, did not fall within the proclamation authority of the NCDMF Director, and required a NC rule change. This management measure had full support of recreational anglers and advisory committees, was passed unanimously by the NC Marine Fisheries Commission (4/23/2002), and the rule went into effect 4/01/2003.

MANAGEMENT AND RESEARCH NEEDS

- Collect size, otoliths and age composition of the fisheries by gear type and statistical area. Focus age sampling on as wide a range of sizes as possible
- Target commercial and recreational landings for biological data collection when possible
- Initiate fisheries-dependent and independent sampling of offshore populations of bluefish during the winter months
- Age any archived age data for bluefish and use the data to supplement age keys**
- Test the sensitivity of the bluefish assessment to assumptions concerning age-varying M, level of age-0 discard, and selection patterns
- Evaluate amount and length frequency of discards from the commercial and recreational fisheries
- Continue work on catch and release mortality
- Increase intensity of biological sampling of the NER commercial and coastwide recreational fisheries
- Conduct research to determine the timing of sexual maturity and fecundity of bluefish
- Study tag mortality and retention rates for ALS dorsal loop and other tags used for bluefish
- Initiate research on species interactions and predator-prey relationships
- Initiate a coastal surf-zone seine study to provide more complete indices of juvenile abundance
- Investigate the long term, synergistic effects of combinations of environmental variables on various biological and sociological parameters such as reproductive capability, genetic changes, and suitability for human consumption

- Conduct studies on the interactive effects of pH, contaminants, and other environmental variables on survival of bluefish.

LITERATURE CITED

Northeast Fisheries Science Center. 2005. 41st Northeast Regional Stock Assessment Workshop (41st SAW): 41st SAW Assessment Report. Northeast Fisheries Science Center Reference Document 05-14.

Wood, A. D. 2014. Bluefish 2014 Stock Assessment Update: Data and Model Update Through 2013. Coastal Pelagic Working Group, Northeast Fisheries Science Center, NOAA Fisheries. 37 pp.

TABLES

Table 1. Summary of length data sampled from the kingfish commercial fishery.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	486	138	840	7,507
2006	450	122	840	7,751
2007	387	142	833	7,089
2008	416	131	826	6,359
2009	461	145	860	5,784
2010	422	146	886	5,388
2011	406	155	843	4,653
2012	348	134	862	5,731
2013	359	158	830	5,819
2014	371	192	858	5,485

Table 2. Bluefish age data collected from all sources combined, 2006-2014.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2006	3	0	10	532
2007	2	0	11	432
2008	1	0	10	656
2009	3	0	10	489
2010	3	0	8	527
2011	3	0	9	552
2012	1	0	9	811
2013	0	0	9	741
2014	1	0	9	792

FIGURES

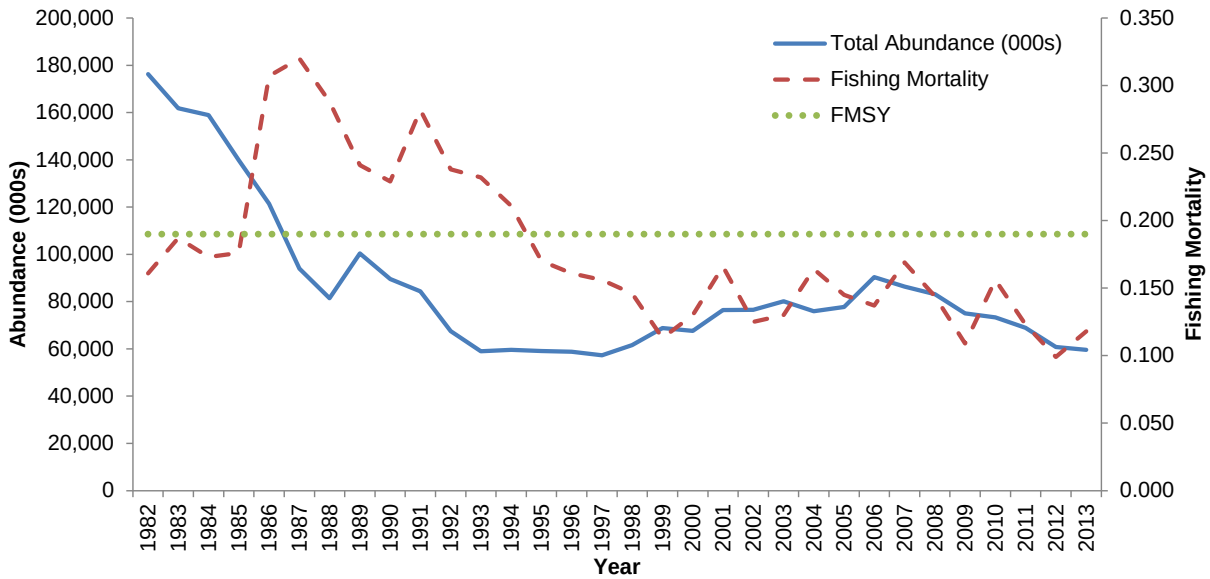


Figure 1. Total bluefish abundance and fishing mortality as estimated in ASAP model updated through 2013. F_{MSY} (fishing mortality at maximum sustainable yield) indicated by dotted horizontal line (cited from Wood (2014)).

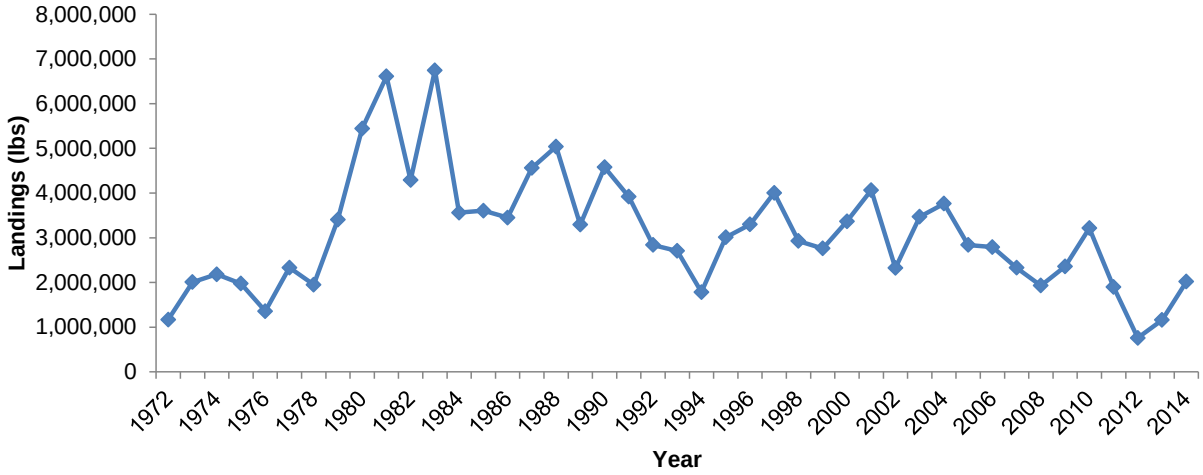


Figure 2. Commercial landings of bluefish from 1972 to 2014.

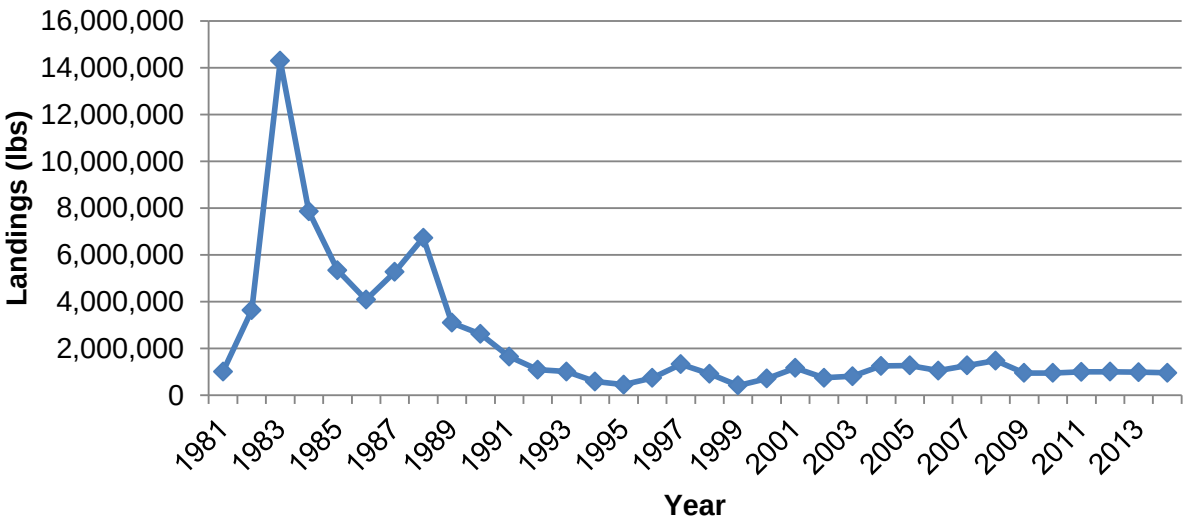


Figure 3. Recreational landings of bluefish from 1981 to 2014.

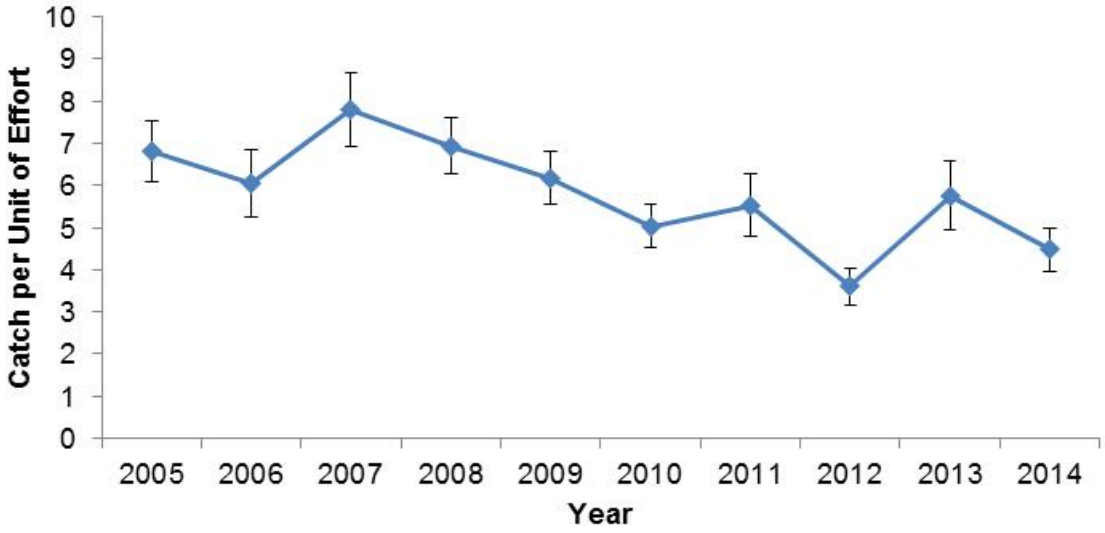


Figure 4. Catch per Unit of Effort of bluefish, from the Pamlico Sound Independent Gillnet Survey from 2005 to 2014.

FISHERY MANAGEMENT PLAN UPDATE
SPOT
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	ASMFC October 1987
Amendments:	ASMFC Omnibus Implementation Plan - October 2011 ASMFC Omnibus Amendment to the Interstate Fishery Management Plans for Spanish mackerel, Spot, and Spotted Seatrout - August 2012 Addendum I - August 2014
Revisions:	N/A
Supplements:	N/A
Information Updates:	N/A
Schedule Changes:	N/A
Next Benchmark Review:	ASMFC benchmark stock assessment scheduled for 2016.

The original interstate Fishery Management Plan (FMP) for spot was adopted in 1987 with recommendations to improve data collection to produce a stock assessment and improve information for management (ASMFC 1987). The original FMP for spot was adopted prior to passage of the Atlantic Coastal Fisheries Cooperative Management Act (1993) and the Atlantic States Marine Fisheries Commission (ASMFC) Interstate Fishery Management Program (ISFMP) Charter (1995). After the passage of the Act, the ASMFC adopted the Charter in order to establish standards and procedures for the preparation and adoption of the FMPs. Once an FMP is amended to incorporate the standards and procedures in the ISFMP Charter, the Commission can also adopt management requirements that can be enforced through the Act. The Omnibus Amendment updates the spot FMP with the Act and Charter requirements and initiated annual trigger exercises to monitor the status of spot resource while also directing the Board to consider management action depending on the results of the trigger exercise (ASMFC 2012). Without coastwide minimum management measures, the trigger exercises did little to provide effective management in between stock assessments and so Addendum 1 to the Amendment was developed. Addendum I establishes the use of the Traffic Light Approach (Caddy and Mahon, 1995; Caddy, 1998, 1999) with precautionary management framework in the management of spot. The management framework utilizing the Traffic Light Approach replaces the management triggers as stipulated in the Omnibus Amendment.

Management Unit

The ASMFC management area extends from Delaware to the east coast of Florida.

Goal and Objectives

The primary goal of the Omnibus Amendment is to bring the FMPs for Spanish mackerel, spot, and spotted seatrout under the authority of the Act, providing for more efficient and effective management and changes to management for the future. The objectives for spot under this amendment include:

1. Increase the level of research and monitoring on spot bycatch in other fisheries, in order to complete a coastwide stock assessment.

2. Manage the spot fishery to encourage reduced mortality on spot stocks until age 1.

3. Develop research priorities that will further refine the spot management program to maximize the biological, social and economic benefits derived from the spot population. The Omnibus Amendment does not require specific fishery management measures in either the recreational or commercial fisheries for states within the management unit range.

STATUS OF THE STOCK

Stock Status

No coastwide assessment has been performed for spot; however spot are a target or component of several state surveys using trawls, gill nets, or seine nets. Abundance indices have been highly variable throughout the survey time series. The status of spot has been considered concerned due the generally declining trends in commercial and recreational landings.

Stock Assessment

An ASMFC benchmark stock assessment is scheduled for 2016.

STATUS OF THE FISHERY

Current Regulations

None.

Commercial Landings

Commercial landings since 1994 have averaged 1.7 million pounds. Three major fisheries accounted for an average of 90% of landings, inshore gill net, ocean gill net, and long haul since 1994, and 94% for 2014. Spot commercial landings in North Carolina's major fisheries (long haul, ocean gill net and inshore gill net) have declined significantly since 2004, reaching a historic low in 2012 but rebounded in 2013 and 2014. Effort measured by trips increased in the ocean gill net and inshore gill net fishery (20% and 45% respectively) and decreased in the long haul fishery (22%) in 2014. Trips in the ocean and inshore gill net fisheries are defined as trips that landed more than 100 pounds of spot. All trips that landed spot in the long haul fishery are included (Figure 1 and 2).

Recreational Landings

Recreational landings of spot have been generally decreasing and reached a historical low in 2012, rebounding in 2013 and 2014. Recreational landings have averaged 893,427 pounds from 2005 to 2014 and were 704,445 pounds in 2014 (Figure 3).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Since 1994, the North Carolina Trip Ticket Program (NCTTP) has collected data on the commercial harvest of spot (Table 1). Commercial fishing activity is also monitored through fishery dependent sampling conducted by the division since 1982. Data collected in this program allow the size and age distribution of spot to be characterized by gear/fishery. Several NCDMF sampling programs collect biological data on commercial fisheries that catch spot. The primary programs that collect length and age data for harvested spot include: 461 (gill net and seine), and 437 (long haul seine). Other commercial sampling programs focusing on fisheries that do not target spot collect biological data rarely.

The average length was longer and more fish were measured in the commercial fisheries in the earlier part of the time series, 2005-2014 (Table 1).

Recreational angler harvest data is collected by the Marine Recreational Information Program (MRIP). There were no clear trends in recreational length data in 2005-2014. Annual mean and minimum lengths were fairly consistent and 2014 was similar to previous years. The maximum lengths have generally been decreasing over the time period (Table 2).

Harvest data from the Recreational Commercial Gear License was collected from 2002 to 2009. This program was discontinued to lack of funding. Spot landings averaged 203,833 pounds. Landings increased 7.8% from 2007 to 2008, while trips increased 3.6%. CPUE (pounds/trip) also increased slightly in 2008, from the lowest on record in 2007. CPUEs (pounds/trip) were consistent 2002 to 2005 but significantly decreased in 2006 and 2007 (Figure 4).
North Carolina awards a citation to applicants for any spot caught by hook and line if the weight exceeds one pound. Low citation years, 1994-1999, year with the highest number of citations was 1999 with ten. Beginning in 2000, many more citation sized fish applications were received, 19 in 2000, 249 in 2001, and 81 in 2005 but there were only two citations received in 2007, none from 2008 to 2013, and one in 2014 (Figure 5).

Fishery-Independent Monitoring

The Pamlico Sound Survey (program 195) samples fifty-two randomly selected stations (grids) in June and again in September. Stations are randomly selected from strata based upon depth and geographic location. Randomly selected stations are optimally allocated among the strata based upon all previous sampling in order to provide the most accurate abundance estimates (PSE <20). Tow duration is 20 minutes; using double rigged demersal mongoose trawls (9.1m headrope, 1.0m X 0.6m doors, 2.2-cm bar mesh body, 1.9-cm bar mesh cod end and a 100-mesh tailbag extension. Data from this survey were used to produce juvenile abundance indices for spot from 1994 to 2014. Catch per Unit Effort (CPUE; Number of spot per tow) have been extremely variable with no clear trend, however since 2006 the trend has been increasing (Figure 6).

The estuarine trawl survey (program 120) samples 105 estuarine core stations along the coast each year without deviation. A two-seam 10.5 foot headrope trawl with a ¼ inch mesh in the body and 1/8 inch mesh in the tailbag is used. Tow duration is calibrated for 1 minute and a span of 75 yards. The data show wide fluctuations with no clear trend (Figure 7).

MANAGEMENT STRATEGY

Addendum I established use of a Traffic Light Analysis (TLA) to evaluate fisheries trends and develop state-specified management actions (e.g. bag limits, size restrictions, time and area closures, and gear restrictions) when harvest and abundance thresholds are exceeded for two consecutive years. The name comes from assigning a color (red, yellow, green) to categorize relative levels of indicators on the condition of the fish population (abundance metric) or fishery (harvest metric). For example, as harvest or abundance decrease, the amount of red in that year becomes more predominant. The TLA improves the management approach as it illustrates long-term trends in the stock and includes specific management recommendations in response to declines in the stock or fishery. The 'harvest' characteristic is comprised of composite commercial and recreational harvest data. Similarly, a composite of fishery-independent survey indices will be used to derive the adult abundance characteristic (Figure 8).

MANAGEMENT AND RESEARCH NEEDS

High Priority

- State monitoring and reporting on the extent of unutilized bycatch and fishing mortality on fish less that age-1 in fisheries that take significant numbers of spot.
- Evaluate the effects of mandated bycatch reduction devices on spot catch in those states with significant commercial harvests.
- Develop fishery-dependent and fishery-independent size and sex specific relative abundance estimates.
- Cooperative coastwide spot juvenile indices should be developed to clarify stock status.
- Continue monitoring long-term changes in spot abundance, growth rates, and age structure.
- Continue monitoring of juvenile spot populations in major nursery areas.
- Improve spot catch and effort statistics from the commercial and recreational fisheries, along with size and age structure of the catch, in order to develop production models.
- Conduct age validation studies.
- Cooperatively develop criteria for aging spot otoliths and scales.
- Develop catch-at-age matrices for recreational and commercial fisheries.
- Determine the effect that anthropogenic perturbations may be having on growth, survival, and recruitment.

Medium Priority

- Develop stock assessment analyses appropriate to current data.
- Cooperatively develop a yield-per-recruit analysis.
- Develop stock identification methods and investigate the degree of mixing between state stocks during the annual fall migration.
- Determine migratory patterns through tagging studies.
- Determine the onshore vs. offshore components of the spot fishery.

LITERATURE CITED

ASMFC. 2014. Addendum I to the Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout.. 7.pp

ASMFC, 2012. Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout.. 131pp.

ASMFC. 1987. Fishery Management Plan for Spot. Washington (DC): ASMFC. Fisheries Management Report #11. 90 p.

Caddy, J.F. 1998. A short review of the precautionary reference points and some proposals for their use in data-poor situations. FAO Fisheries Technical Paper No. 379, 30pp.

Caddy, J.F. 1999. Deciding on precautionary management measures for a stock based on a suite of Limit Reference Points (LRPs) as a basis for a multi-LRP harvest law. NAFO Sci. Council Studies, 32:55-68.

Caddy, J.F. 2002. Limit reference points, traffic lights, and holistic approaches to fisheries management with minimal stock assessment input. Fisheries Research 56:133-137.

TABLES

Table 1. Summary of length data sampled from the commercial fishery for spot, 2005-2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	232	79	370	9,326
2006	214	92	426	7,073
2007	201	100	306	5,311
2008	201	80	337	4,762
2009	207	100	324	4,427
2010	205	87	294	3,636
2011	207	100	334	3,587
2012	203	105	486	1,985
2013	212	107	340	2,725
2014	208	104	391	4,953

Table 2. Summary of length data sampled from the recreational fishery, 2005-2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	218	132	411	1286
2006	226	122	342	1216
2007	230	144	299	1243
2008	213	128	311	1344
2009	216	126	274	682
2010	209	147	306	1096
2011	209	149	283	1534
2012	200	141	298	611
2013	207	115	293	484
2014	210	121	258	344

Table 3. Summary of age data collected from all sources combined.

Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2005	1	0	6	529
2006	1	0	5	501
2007	1	0	3	284
2008	1	0	3	408
2009	1	0	3	365
2010	1	0	3	268
2011	1	0	3	413
2012	1	0	4	230
2013	1	0	3	360
2014	1	0	4	702

FIGURES

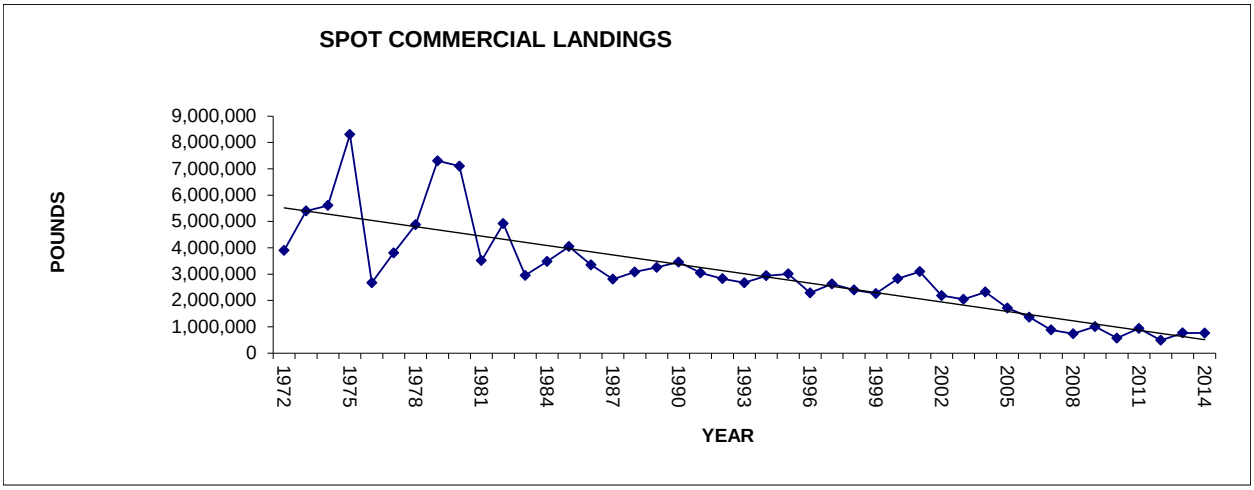


Figure 1. North Carolina commercial landings (pounds), 1972-2014.

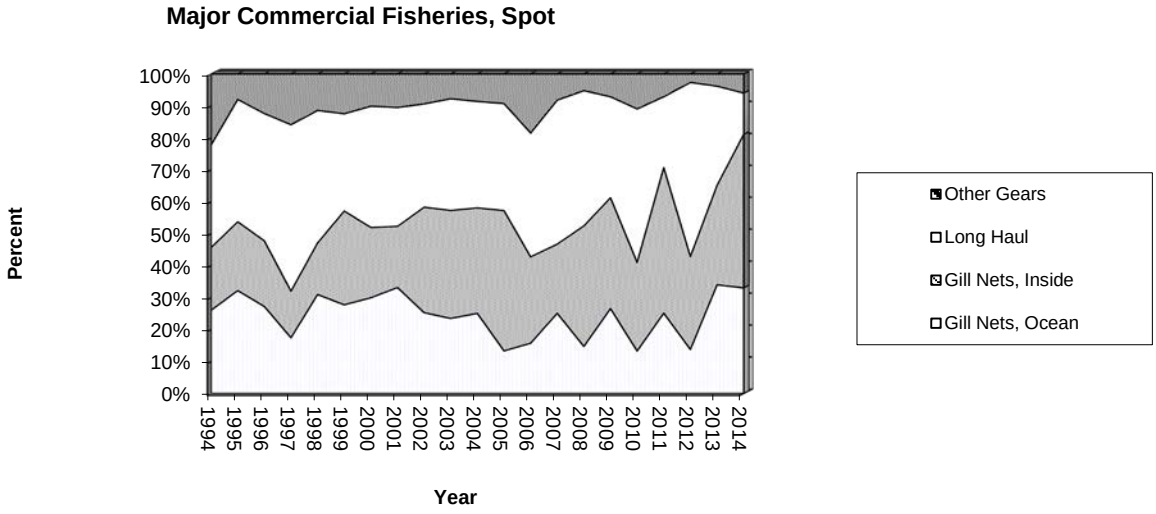


Figure 2. Major commercial gears capturing spot, 1994-2014.

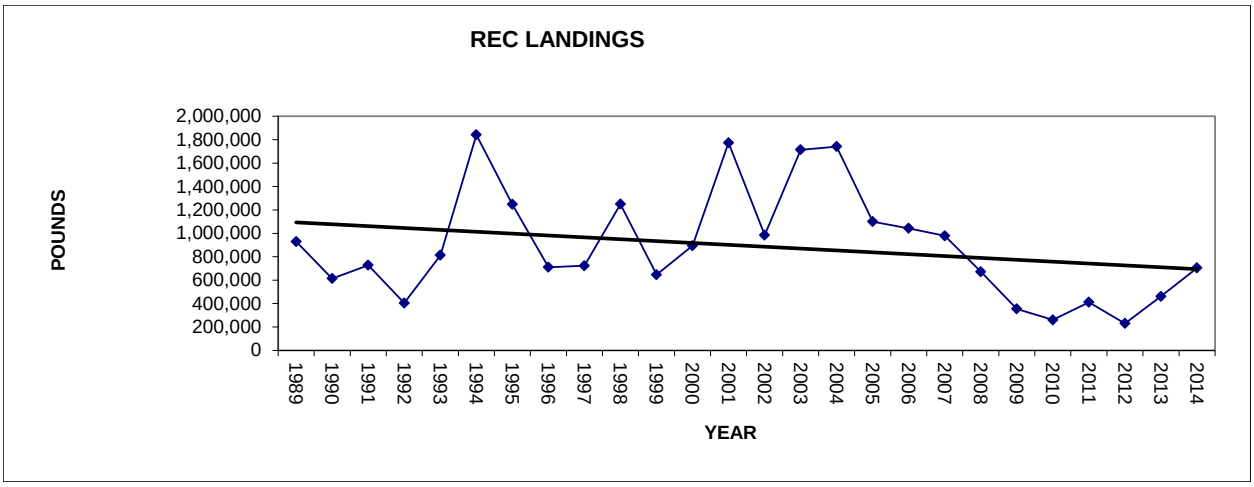


Figure 3. North Carolina recreational landings, 1989-2014.

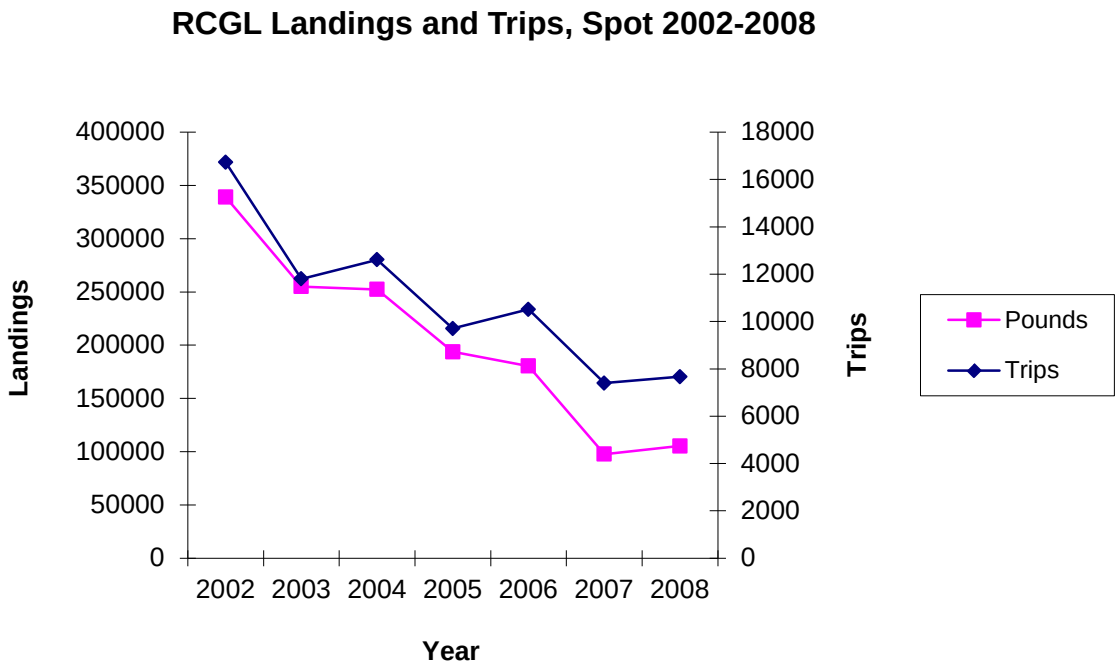


Figure 4. North Carolina spot landings from RCGL license holders, 2002-2008.

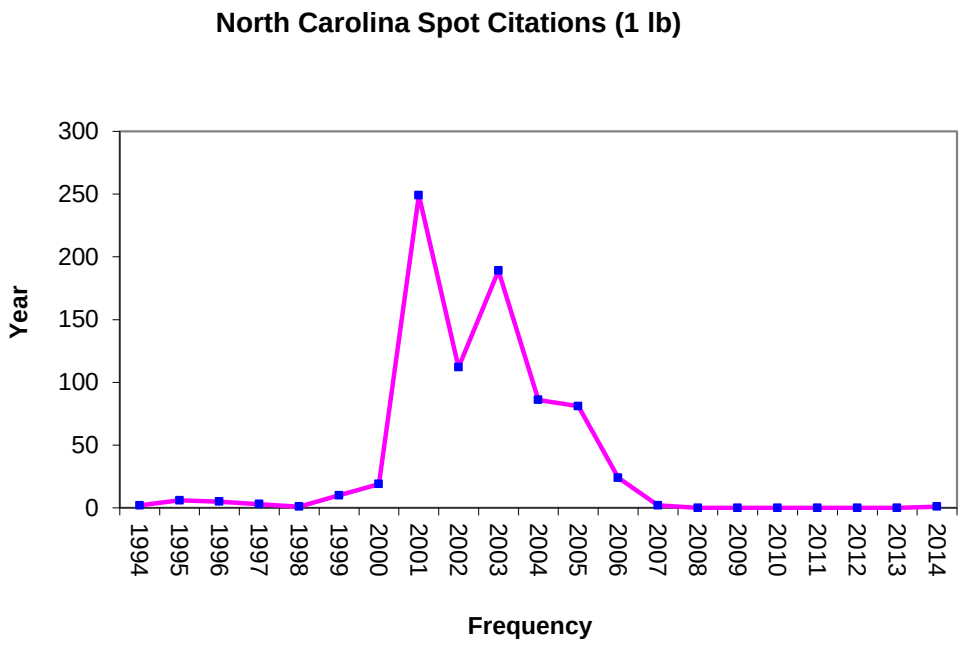


Figure 5. Number of spot citations (issued for hook and line catches >1 lb) issued 1994-2014.

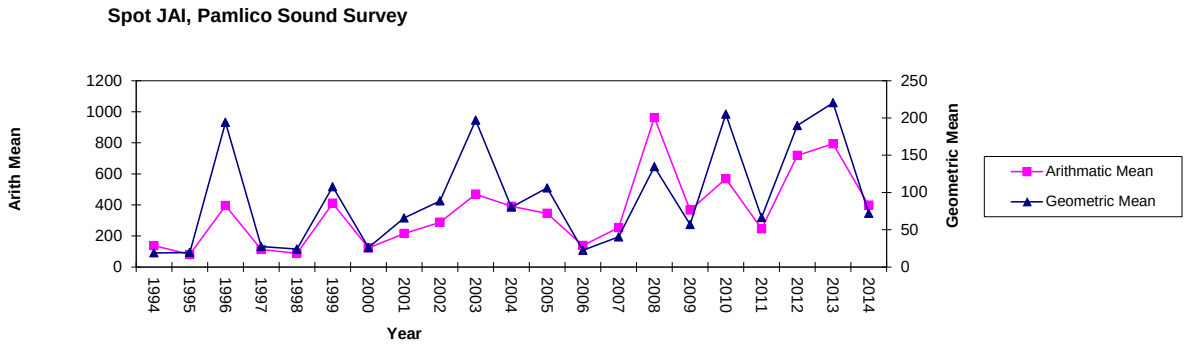


Figure 6. North Carolina Pamlico Sound Survey juvenile indices for spot, 1994-2014.

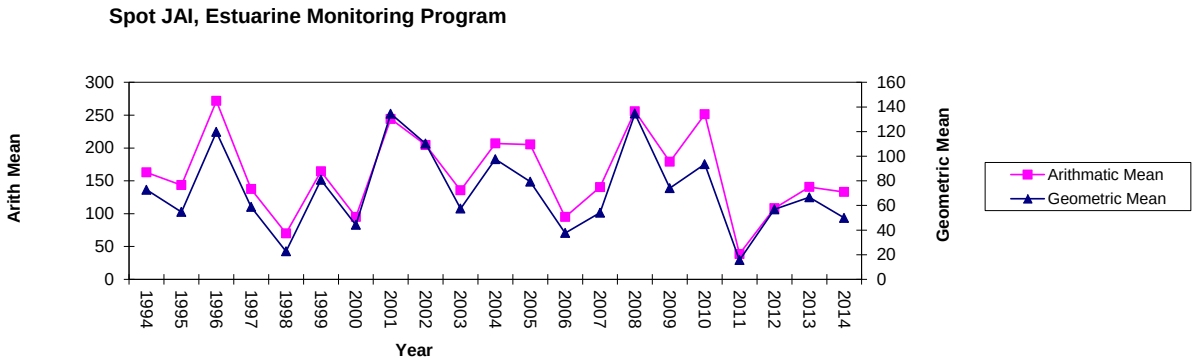
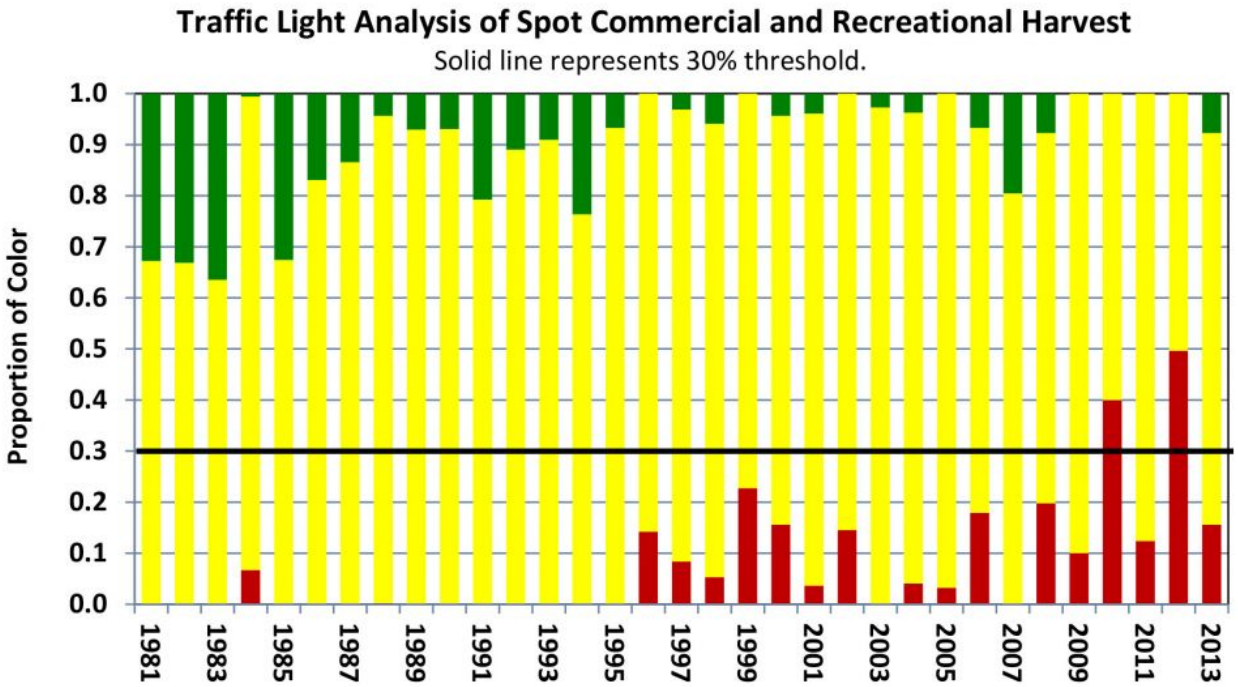
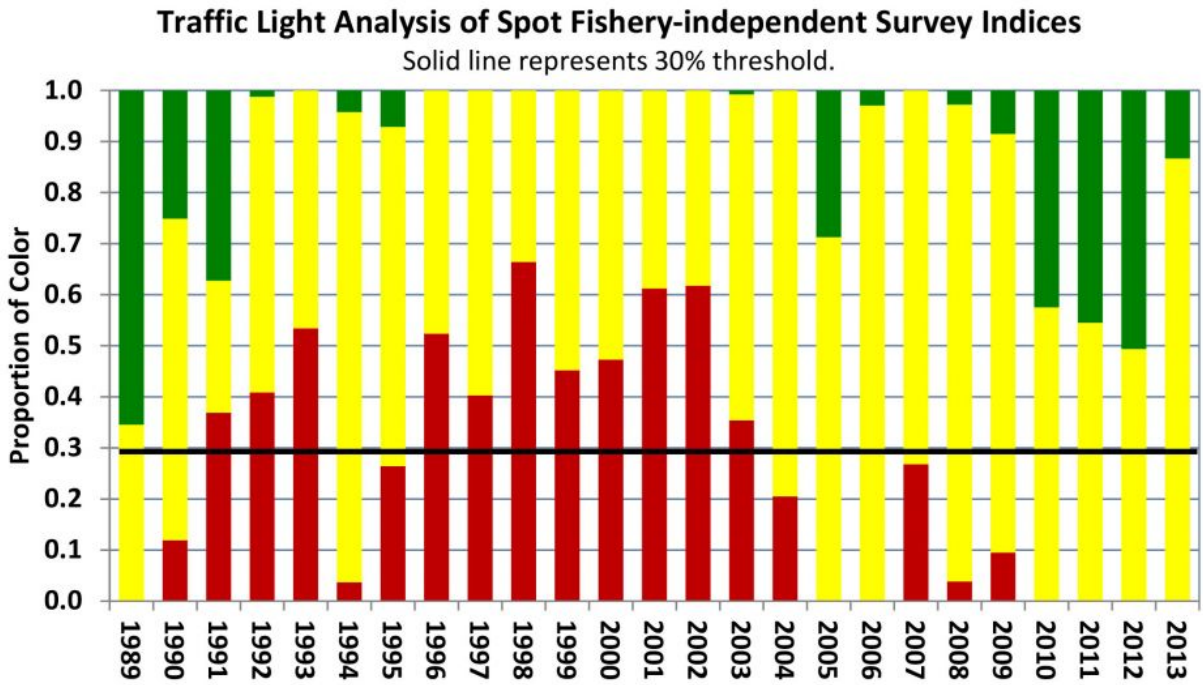


Figure 7. North Carolina Estuarine Trawl Survey juvenile indices for spot, 1994-2014.





Management response is triggered when proportion of red exceeds the 30% theshold level for two consequetive years in both fishery characteristics (landings and fishery-independent survey indices).

Figure 8**.** Traffic Light analysis of spot, 1989-2013.

FISHERY MANAGEMENT PLAN UPDATE
SUMMER FLOUNDER
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	Adopted by the ASMFC in 1982 and the MAFMC in 1988
Amendments:	Amendment 1 in 1991 Amendment 2 in 1993 Amendment 3 in 1993 Amendment 4 in 1993 Amendment 5 in 1993 Amendment 6 in 1994 Amendment 7 in 1995 Amendment 8 in 1996 Amendment 9 in 1996 Amendment 10 in 1997 Amendment 11 in 1998 Amendment 12 in 1999 Amendment 13 in 2003 Amendment 15 in 2011 Amendment 16 in 2007
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	A new comprehensive amendment is underway and scheduled to be completed in 2017.

Because of their presence in, and movement between, state waters (0-3 miles) and federal waters (3-200 miles), the Mid Atlantic Fisheries Management Council manages summer flounder cooperatively with the Atlantic States Marine Fisheries Commission (ASMFC). The two management entities work in conjunction with the National Marine Fisheries Service (NMFS) as the federal implementation and enforcement entity. The Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP) and amendments use output controls (catch and landings limits) as the primary management tool, with landings divided between the commercial and recreational fisheries. The FMP also includes minimum fish sizes, bag limits, seasons, gear restrictions, permit requirements, and other provisions to prevent overfishing and ensure sustainability of the fisheries. Recreational bag/size limits and seasons are determined on a state-by-state basis using conservation equivalency. The commercial quota is divided into state-by-state quotas based on historical landings. Specific details for each Amendment include:

Amendment 1 - Established an overfishing definition for summer flounder.

Amendment 2 - Established rebuilding schedule, commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements for summer flounder; created the Summer Flounder Monitoring Committee.

Amendment 3 - Revised the exempted fishery line for summer flounder; increased the large mesh net threshold for summer flounder; established otter trawl retention requirements for large mesh use in the summer flounder fishery.

Amendment 4 - Revised state-specific shares for summer flounder commercial quota allocation.

Amendment 5 - Allowed states to combine or transfer summer flounder commercial quota

Amendment 6 - Set criteria for allowance of multiple nets on board commercial vessels for summer flounder; established deadline for publishing catch limits; established commercial management measures for summer flounder.

Amendment 7 - Revised the fishing mortality rate reduction schedule for summer flounder.

Amendment 8 - Incorporated Scup FMP into Summer Flounder FMP; established scup management measures, including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements.

Amendment 9 - Incorporated Black Sea Bass into Summer Flounder FMP; established black sea bass measures, including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements.

Amendment 10 - Modified commercial minimum mesh requirements; continued commercial vessel moratorium; prohibited transfer of summer flounder at sea; established special permit for party/charter sector for summer flounder.

Amendment 11 - Modified certain provisions related to vessel replacement and upgrading, permit history transfer, splitting, and permit renewal regulations.

Amendment 12 - Revised FMP to comply with the Sustainable Fisheries Act and established framework adjustment process; established quota set-aside for research for summer flounder, scup, and black sea bass; established state-specific conservation equivalency measures; allowed the rollover of winter scup quota; revised the start date for summer quota period for scup fishery; established a system to transfer scup at sea.

Amendment 13 - Revised black sea bass commercial quota system; addressed other black sea bass mgmt. measures; Established multi-year specification setting of quota for all three species; Established region-specific conservation equivalency measures for summer flounder; built flexibility into process to define and update status determination criteria for each plan species.

Amendment 15 - Established Annual Catch Limits (ACLs) and Accountability Measures

Amendment 16 - Standardized bycatch reporting methodology.

Management Unit

U.S. waters in the western Atlantic Ocean from the southern border of North Carolina northward to the U.S.-Canadian border.

Goal and Objectives

The objectives of the Summer Flounder, Black Sea Bass and Scup FMP are to:

1. Reduce fishing mortality in the summer flounder, scup and black sea bass fisheries to assure that overfishing does not occur;

2. Reduce fishing mortality on immature summer flounder, scup and black sea bass to increase spawning stock biomass (SSB);

3. Improve the yield from these fisheries;

4. Promote compatible management regulations between state and federal jurisdictions;

5. Promote uniform and effective enforcement of regulations;

6. Minimize regulations to achieve the management objectives stated above.

The 2011 Omnibus Amendment contains Amendment 15 to the Summer Flounder, Black Sea Bass and Scup FMP (the most recent Amendment that impacts the summer flounder fishery). The amendment is intended to formalize the process of addressing scientific and management uncertainty when setting catch limits for the upcoming fishing year(s) and to establish a comprehensive system of accountability for catch (including both landings and discards) relative to those limits, for each of the managed resources subject to this requirement. Specifically: (1) Establish Allowable Biological Catch (ABC) control rules, (2) Establish a Council risk policy, which is one variable needed for the ABC control rules, (3) Establish ACL(s), (4) Establish a system of comprehensive accountability, which addresses all components of the catch, (5) Describe the process by which the performance of the annual catch limit and comprehensive accountability system will be reviewed, (6) Describe the process to modify the measures above in 1-5 in the future.

Addendum XXVI to the Summer Flounder, Black Sea Bass and Scup Fishery Management Plan, established regional management of the summer flounder and black sea bass recreational fisheries for the 2015 fishing year.

STATUS OF THE STOCK

Stock Status

The stock is considered viable. The 2013 National Marine Fisheries Service's Northeast Fisheries Science Center benchmark stock assessment for U.S. waters north of Cape Hatteras indicated the stock was not overfished and overfishing was not occurring. The 2015 Stock Assessment Update (released in July 2015) found the stock was not overfished but overfishing was occurring in 2014.

Stock Assessment

In the 2013 benchmark assessment, fishing mortality rates and stock sizes were estimated using a statistical catch at age model calculated using the Age Structured Assessment Program (ASAP). Fishing mortality was below the threshold fishing mortality reference point (F35%) and spawning stock biomass (SSB) was above the threshold biomass reference point (one-half SSB_{MSY}) so the stock was not overfished and overfishing was not occurring (although SSB was below the SSB target in 2012). The 2015 Stock Assessment Update included data through 2014 and indicated overfishing was occurring in 2014 relative to the biological reference points established in 2013. Fishing mortality estimates were higher in recent years than previously projected and poor recruitment persisted from 2010 to 2013. However, SSB was above the threshold biomass reference point so the stock was not overfished in 2014.

STATUS OF THE FISHERY

Current Regulations

Commercial: There is a 14-inch total length (TL) minimum size limit as well as harvest seasons and minimum mesh size for the flounder trawl fishery. Trip limits are set for landings windows established by proclamation to constrain harvest to the quota allocation (see most recent NCDMF proclamation on commercial summer flounder fishery). A bycatch trip limit of 100 lb. is in place during the closed trawl season. A license to land flounder from the Atlantic Ocean is required to land more than 100 lb. per trip.

Recreational: There is a 15-inch TL minimum size limit and 6-fish creel limit for all joint and coastal waters.

Commercial Landings

Any landings reported as caught in the ocean are considered to be summer flounder by North Carolina Trip Ticket Program. Most summer flounder landings were from trawls although gill nets and other gears (e.g. spears, gigs, hook and line) catch small numbers of flounder in the ocean. Landings are constrained by the coastwide quota and North Carolina's allocation of the total quota (27.4%). Landings peaked in 2004 and have been generally stable since 2007 aside from the lowest landings in the time-series in 2012 and 2013 (Figure 1). The low landings in 2012-2013 were primarily due to closure of Oregon Inlet to large vessels (such as trawlers) and the consequent transfer of most of North Carolina's quota allocation to Virginia and other states. In 2014, more winter trawl vessels returned to North Carolina to land catches rather than transferring quota to Virginia and other states. Trends in commercial trips have generally followed landings trends (Figure 1). Trips include the number of trip ticket records with landings reported. Trips typically represent more than one day of fishing, especially for trawling.

Recreational Landings

Recreational harvest of summer flounder varied annually but remained relatively high 1992-2002 (Figure 2). After that time harvest declined and remained consistently low. Trends in recreational trips are somewhat difficult to interpret because they represent all paralichthid flounder species commonly caught in North Carolina (southern, summer and Gulf). This is because anglers simply report targeting 'flounder' rather than a particular species of flounder. Trips can be defined in several ways but in this document all trips that harvested or released

paralichthid flounder were included. Trends in trips and harvest are roughly similar in 1992-2007 but in 2008-2014 harvest remained consistently low while trips were variable but remained relatively high (Figure 2).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Several NCDMF sampling programs collect biological data on commercial and recreational fisheries that catch summer flounder. Program 433 (winter trawl fishery) is the primary program that collects length and age data for harvested summer flounder. Other programs that collect information include: 461 (estuarine gill net and seine), 476 (gig and spear), 432 (flounder pound net), 434 (ocean gill net) and 437 (long haul seine). Programs 466 (sea turtle bycatch monitoring) and 570 (commercial shrimp trawl fishery characterization**)**collect length data on harvested and discarded flounder. Other commercial sampling programs focusing on fisheries that do not target summer flounder rarely collect biological data. NCDMF sampling of the recreational fishery through the Marine Recreational Information Program (MRIP) collects length data on summer flounder. The NCDMF mail-based gigging survey collects harvest data for the recreational gig fishery but does not collect length or age data or identify flounder species (and summer flounder are rarely caught by this fishery). Age data from the recreational fishery are collected mainly via voluntary angler donations.

There were no clear trends in commercial length data but some trends in the age data were evident in 2005 to 2014 (Table 1). Annual mean lengths were fairly consistent, but 2014 was the greatest mean length for the time-series. The 2014 maximum length was also the second largest in the time-series. The number of fish measured in 2014 was considerably higher than in 2012 and 2013 (due to low landings 2012-2013) but similar to prior years. The modal age in 2014 was fairly high relative to previous years. The maximum age in 2014 was the oldest in the time-series. Maximum ages since 2010 were higher than previous years, suggesting expansion of the stock age structure. The number of age samples collected and aged in 2014 was the highest in the time-series.

There were no clear trends in recreational length data in 2005 to 2014 (Table 2). The mean length in 2014 was lower than 2011 to 2013 but similar to prior years. The 2014 maximum length was smallest in the time-series. A relatively low number of fish were measured in 2014 but more than in 2013. There were no recreational ages in 2005-2013 so no trends can be discussed.

Fishery-Independent Monitoring

Several NCDMF independent sampling programs collect biological data on southern flounder. However, most surveys do not catch summer flounder regularly enough to provide consistent length, age or abundance data. The main exception is Program 195 (the Pamlico Sound Survey), which conducts trawls using a random stratified survey design in waters of Pamlico Sound and major river tributaries. Stations are randomly selected from strata based upon depth and geographic location. Randomly selected stations are optimally allocated among the strata based upon all previous sampling in order to provide the most accurate abundance estimates (PSE <20). Tow duration is 20 minutes; using double rigged demersal mongoose trawls (9.1m headrope, 1.0m X 0.6m doors, 2.2-cm bar mesh body, 1.9-cm bar mesh cod end and a 100-mesh tailbag extension. The survey takes place in June and September with the samples

collected in June serving as a juvenile abundance index (JAI) for summer flounder in North Carolina. A total of 596 summer flounder were caught in the survey in 2014 and the JAI value was 6.6 fish per tow. The 1987-2014 average JAI value was 9.5, so the 2014 value was relatively low but is similar to recent years (Table 4, Figure 3). The summer flounder JAI from the Pamlico Sound Survey is one of the recruitment indices provided for the annual coastwide stock assessment of summer flounder, although it was not used in the 2013 benchmark stock assessment. It is unclear whether the JAI includes only summer flounder from the stock unit north of Cape Hatteras or if it also includes fish from the population south of Cape Hatteras. Until this question is answered it will be difficult to use the JAI in an assessment. Genetic research on this topic is underway.

MANAGEMENT STRATEGY

An update of the summer flounder stock assessment is completed each year by the Northeast Fishery Science Center (NEFSC). Data are analyzed from the previous year based on decisions made for the previous benchmark assessment. Projections based on stock assessments are used to set the coastwide quota level each year. Amendments to the FMP are undertaken as issues arise that require action. North Carolina has several specific management strategies for summer flounder (Table 5).

MANAGEMENT AND RESEARCH NEEDS

The following research needs were reviewed (existing needs) or developed (new) during the 2013 Stock Assessment Workshop (SAW) by the Southern Demersal Working Group (SDWG) and the Scientific and Statistical Committee (SSC). Text in parenthesis for each number indicates known progress made to address needs.

- Develop a program to annually sample the length and age frequency of summer flounder discards from the recreational fishery (progress has been made in some states outside NC, but more synoptic data and potentially less biased data are needed including the length, age, and sex-frequency of discards).
- A comprehensive collection of otoliths, for all components of the catch-at-age matrix, needs to be collected on a continuing basis for fish larger than 60 cm (~7 years). The collection of otoliths and the proportion at sex for all of the catch components could provide a better indicator of stock productivity (ongoing through NEFSC, NCDMF and other organizations).
- A reference collection of summer flounder scales and otoliths should be developed to facilitate future quality control of summer flounder production aging. In addition, a comparison study between scales and otoliths as aging structures for summer flounder should be completed (an ageing workshop was held in 2014 to compare scales and otoliths, research in ongoing).
- Collect information on overall fecundity for the stock, as both egg condition and production may be a better indicator of stock productivity than weight (ongoing research by NEFSC Sandy Hook Laboratory to address, may require additional data collection).
- Investigate trends in sex ratios and mean lengths and weights of summer flounder in state agency and federal surveys catches (analyzed for the federal survey, state agency data may still need to be analyzed).
- Use NEFSC fishery observer age-length keys for 1994 and later years (as they become

available) to supplement NEFSC survey data in aging the commercial fishery discard (progress unknown - age data may not yet be available).

- Consider use of management strategy evaluation techniques to address the implications of harvest policies that incorporate consideration of retrospective patterns (retrospective pattern has changed since this recommendation was developed - i.e., smaller and less problematic – so this recommendation is no longer considered relevant).
- Consider treating scallop closed areas as separate strata in calculations of summer flounder discards in the commercial fisheries (has not been addressed but may not be an issue in the current discard estimation methods).
- Examine the sensitivity of the summer flounder assessment to the various unit stock hypotheses and evaluate spatial aspects of the stock to facilitate sex and spatially-explicit modeling of summer flounder (progress has been made on aspects of this recommendation, detailed in working papers for 2013 stock assessment).
- Conduct further research to examine the predator-prey interactions of summer flounder and other species, including food habitat studies, to better understand the influence of these other factors on the summer flounder population (research needed).
- Collect and evaluate information on the reporting accuracy of recreational discards estimates in the recreational fishery (Some research has been conducted in the recreational for-hire fishery, but comprehensive work across all fishing modes has not been completed).
- Examine male female ratio at age-0 and potential factors (e.g., environmental) that may influence determination of that ratio (sex ratio was updated, some research completed but more may be needed).
- Evaluate potential changes in fishery selectivity relative to the spawning potential of the stock; analysis should consider the potential influence of the recreational and commercial fisheries (some progress has been made on this topic in a report prepared for the MAFMC SSC describing a MSE for the recreational fishery).
- Collect data to determine the sex ratio for all of the catch components (through a PMAFS study, 2 years of data collection has occurred to determine sex ratios in the commercial and recreational landings).
- Determine the appropriate level for the steepness of the S-R relationship and investigate how that influences the biological reference points (some research completed)
- 16.) Evaluate uncertainties in biomass to determine potential modifications to default OFL CV (progress unknown).
- Evaluate the size distribution of landed and discarded fish, by sex, in the summer flounder fisheries (progress unknown).
- Evaluate past and possible future changes to size regulations on retention and selectivity in stock assessments and projections (progress unknown).
- Incorporate sex -specific differences in size at age into the stock assessment (progress unknown).
- Evaluate range expansion and change in distribution and their implications for stock assessment and management (research ongoing).
- Continued evaluation of natural mortality and the differences between males and females. This should include efforts to estimate natural mortality, such as through mark-recapture programs, telemetry (tagging studies ongoing).
- Further work examining aspects that create greater realism to the summer flounder assessment (e.g., sexually dimorphic growth, sex-specific F, differences in spatial structure [or distribution by size?] should be conducted (progress unknown)
  This could include:
  - Simulation studies to determine the critical data and model components that are necessary to provide reliable advice, and need to determine how simple a model

can be while still providing reliable advice on stock status for management use, and should evaluate both simple and most complex model configurations.
  - Development of models incorporating these factors that would create greater realism.
  - These first steps (a or b) can be used to prioritize data collection, and determine if additional investment in data streams (e.g., collection of sex at age and sex at length and maturity data from the catch, additional information on spatial structure and movement, etc.) are worthwhile in terms of providing more reliable assessment results.
  - The modeling infrastructure should be simultaneously developed to support these types of modeling approaches (flexibility in model framework, MCMC/bootstrap framework, projection framework).
- Develop comprehensive study to determine the contribution of summer flounder nursery area to the overall summer flounder population, based off approaches similar to those developed in WPA12 (otolith microchemistry research ongoing)
- Develop an ongoing sampling program for the recreational fishery landings and discards (i.e., collect age, length, sex) to develop appropriate age-length keys for ageing the recreational catch (progress unknown).
- Apply standardization techniques to all of the state and academic-run surveys, to be evaluated for potential inclusion in the assessment (some progress made).
- Continue efforts to improve understanding of sexually dimorphic mortality and growth patterns. This should include monitoring sex ratios and associated biological information in the fisheries and all ongoing surveys to allow development of sex structured models in the future (progress unknown).
- Conduct sensitivity analyses to identify potential causes of the recent retrospective pattern. Efforts should focus on identifying factors in both survey and catch data that could contribute to the decrease in cohort abundance between initial estimates based largely on survey observations and subsequent estimates influenced by fishery dependent data as the cohort recruits to the fishery (progress unknown).
- Develop methods that more fully characterize uncertainty and ensure coherence between assessments, reference point calculation and projections (progress unknown)

LITERATURE CITED

NMFS NEFSC. 2013. 57th Northeast Regional Stock Assessment Workshop (57th SAW) Assessment Report. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

TABLES

Table 1. Summary of length (TL, mm) and age data for NCDMF commercial fishery sampling programs (includes harvest and some discard information)

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	492	95	818	20,754	3	1	11	620
2006	497	123	848	21,093	4	1	11	682
2007	492	110	766	26,488	3	1	11	697
2008	502	77	792	28,550	4	1	11	751
2009	488	83	788	20,311	5	1	11	723
2010	499	217	846	23,492	3	1	14	783
2011	491	87	1095	17,405	4	2	12	417
2012	494	113	846	7,909	3	1	13	541
2013	503	78	794	7,082	4	1	13	575
2014	505	85	900	21,318	5	1	16	1113

Table 2. Summary of length and age data for NCDMF recreational fishery sampling

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	393	328	575	193	ND	ND	ND	ND
2006	394	303	537	217	ND	ND	ND	ND
2007	403	338	538	286	ND	ND	ND	ND
2008	399	331	485	88	ND	ND	ND	ND
2009	400	330	518	136	ND	ND	ND	ND
2010	395	310	550	259	ND	ND	ND	ND
2011	412	336	608	213	ND	ND	ND	ND
2012	410	283	608	228	ND	ND	ND	ND
2013	408	345	584	114	ND	ND	ND	ND
2014	398	338	476	137	2	2	5	8

Table 3. Summary of length (TL, mm) and age data for NCDMF fishery-independent sampling programs

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	134	27	430	799	ND	ND	ND	ND
2006	182	18	454	399	ND	ND	ND	ND
2007	167	40	418	449	ND	ND	ND	ND
2008	159	35	426	1,256	ND	ND	ND	ND
2009	179	37	490	716	ND	ND	ND	ND
2010	156	46	422	770	ND	ND	ND	ND
2011	163	39	431	789	ND	ND	ND	ND
2012	168	38	456	836	ND	ND	ND	ND
2013	153	30	405	1,412	1	0	1	35
2014	151	33	484	698	1	1	2	6

Table 4. Catch per unit effort (arithmetic mean) for summer flounder in Program 195 1987-2014.

Year	CPUE (number of fish per tow)	Standard error
1987	19.86	2.70
1988	2.61	0.89
1989	6.63	1.15
1990	4.27	0.77
1991	5.85	1.41
1992	9.14	1.71
1993	5.13	1.22
1994	8.17	1.94
1995	6.65	1.65
1996	30.67	5.61
1997	14.14	3.00
1998	10.44	4.32
1999*	3.24	0.58
2000	3.94	0.81
2001	22.03	3.31
2002	18.28	3.22
2003	7.23	1.73
2004	5.90	1.32
2005	9.79	1.76
2006	1.96	0.47
2007	3.62	0.67
2008	14.40	3.53
2009	4.53	1.22
2010	14.28	3.72
2011	6.64	1.11
2012	9.26	2.39
2013	9.80	1.92
2014	6.55	1.61
1987-2014 avg.	9.46	
2005-2014 avg.	8.08	

*Sampling occurred in July instead of June

Table 5. Summary of management strategies by North Carolina for summer flounder.

Management Strategy	Objectives	Outcome
14” minimum size limit for the commercial fishery	1,2,3,4,5,6	Size limit accomplished by rule 3M.0503(a)
Minimum trawl stretched mesh size of 5 ½” (diamond) or 6” (square) throughout the body, extensions and tailbag in order to possess more than 100 lb of flounder (exception for flynets)	1,2,3,4,5,6	Rules 3M.0503(b) 3M.0503(f) 3M.0503(g) 3M.0503(h)(1-3)
Licenses to land flounder in Atlantic Ocean and to purchase or offload flounder from the Atlantic Ocean required to possess >100 lb	1	Rules 3M.0503(c)(1,3,4) 3M.0503(c)(2)
Commercial seasons that allocate 80% of the quota to the winter season (starting January 1), a bycatch trip limit of 100 lb during the closed season and the remaining quota allocated to the fall season (starting no earlier than November 1)	1,2	Rules 3M.0503(i)(1-3). Rule suspended for 2013 and 2014 fishing seasons.
Trip limits established for the open seasons	1	Rule 3M.0503(j) Specific trip limits by Proclamation Authority
15” minimum size and 6 fish creel limit for recreational fishery in all joint and coastal waters	1,2,3	Proclamation FF-29-2011

FIGURES

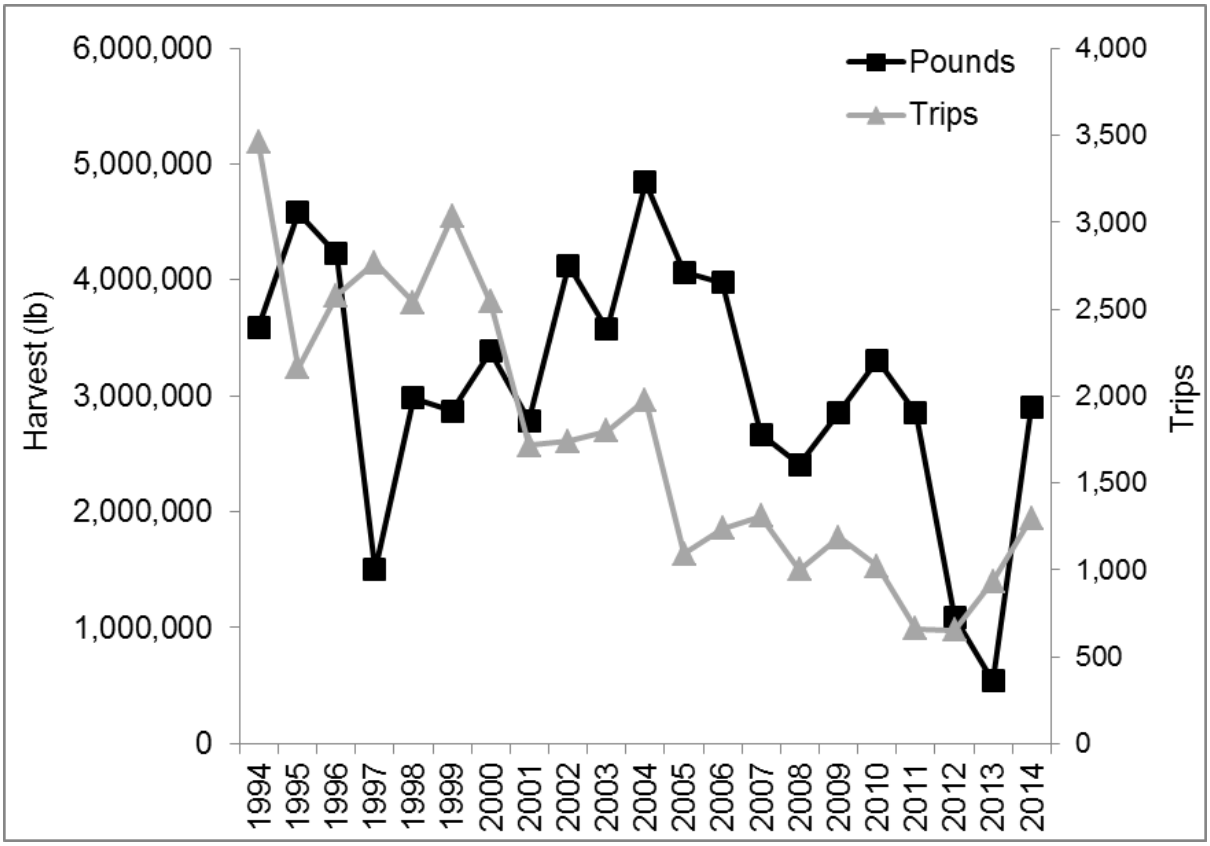


Figure 1. North Carolina commercial landings (lb) and trips for summer flounder 1994-2014.

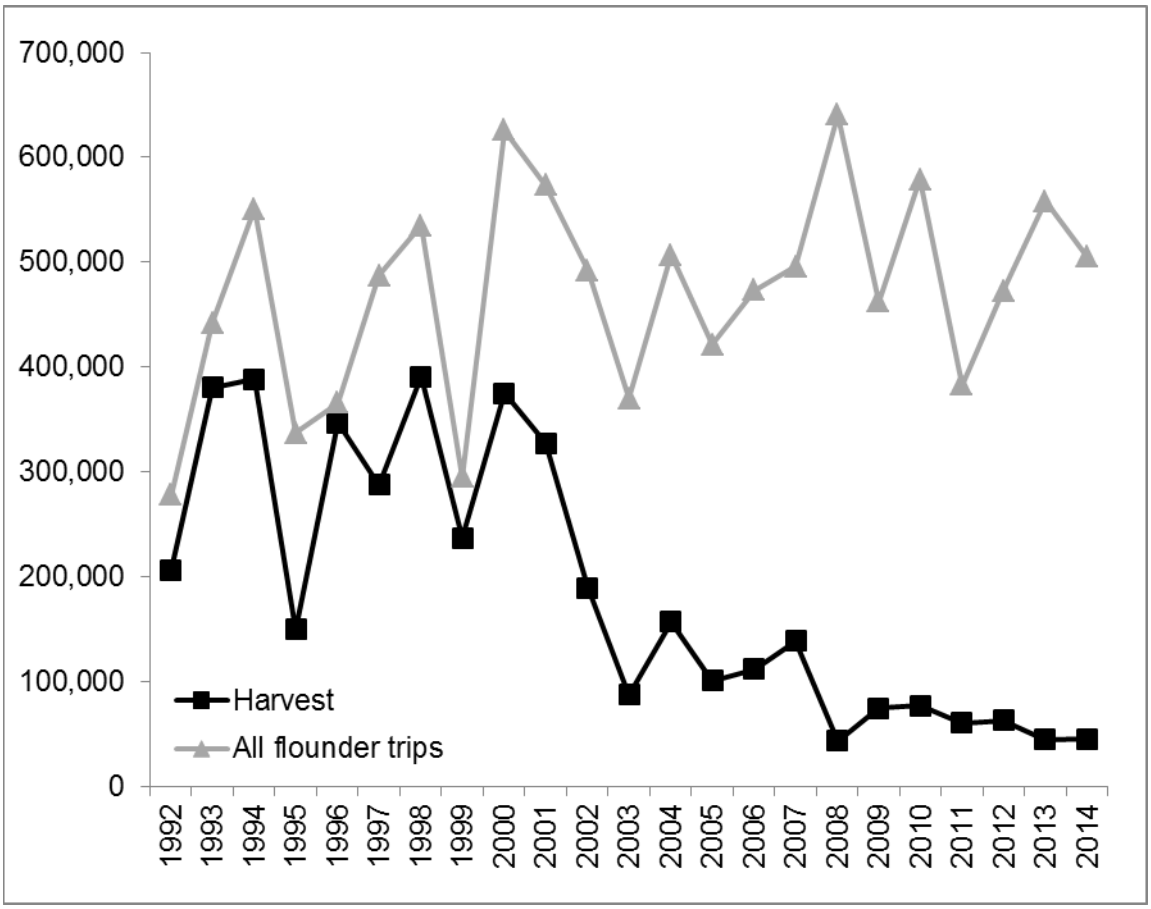


Figure 2. Recreational hook and line harvest (in numbers of fish) and all trips that harvested or released any paralichthid flounder species, from MRIP data 1992-2014.

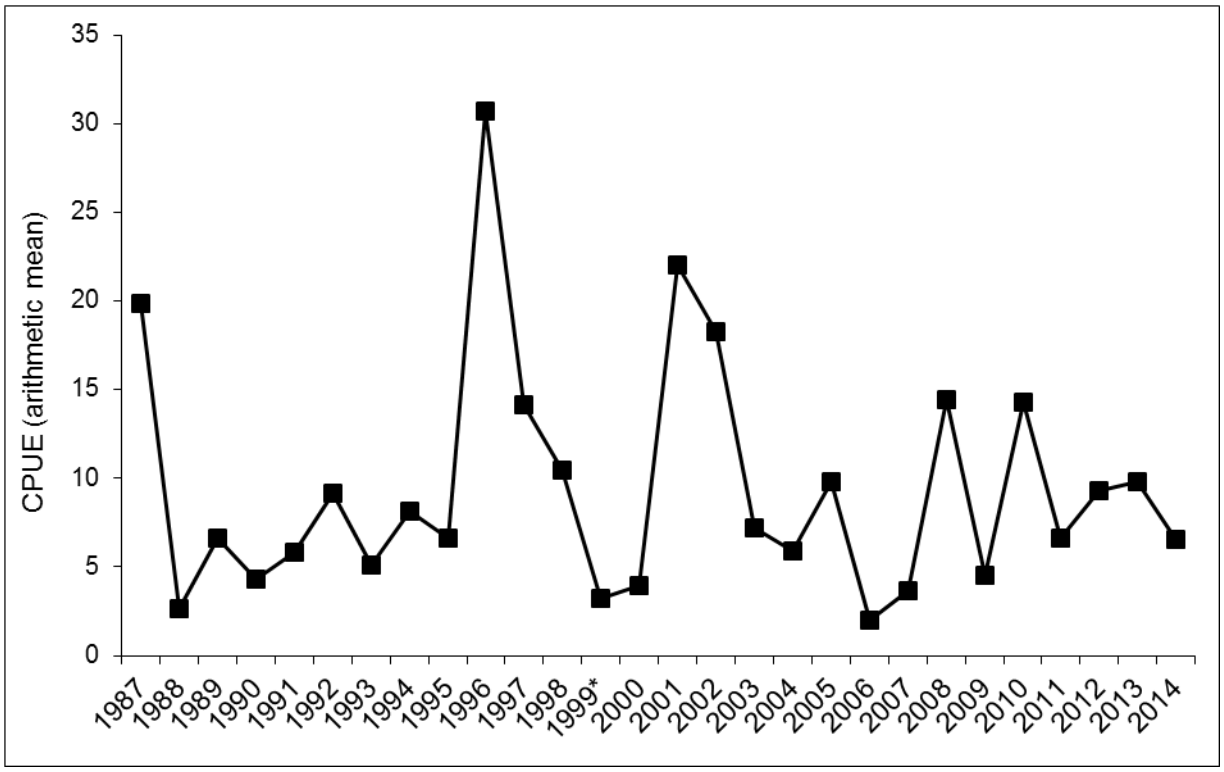


Figure 3. Catch per unit effort for juvenile summer flounder in Program 195 (Pamlico Sound Survey) 1987-2014.

FISHERY MANAGEMENT PLAN UPDATE
WEAKFISH
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	October 1985
Amendments:	Amendment 1 March 1992 Amendment 2 October 1994 Amendment 3 May 1996 Addendum I October 2000 Amendment 4 November 2002 Addendum I December 2005 Addendum II February 2007 Addendum III May 2007 Addendum IV November 2009
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	2016

The Atlantic States Marine Fisheries Commission (ASMFC) adopted its first Fishery Management Plan (FMP) for weakfish in 1985. Amendment 1 to the FMP (1992) unsuccessfully aimed to improve the status of weakfish. Amendment 2 (1994) resulted in some improvement to the stock, but several signs indicated that further improvement was necessary. Thus, Amendment 3 (1996) was implemented to increase the sustainability of the fishery. Addendum I to Amendment 3 was approved in 2000 in order to extend the existing management program until the Weakfish Management Board could approve Amendment 4.

Weakfish are currently managed under the guidelines contained in Amendment 4 (2002). The ASMFC adopted Addendum I to Amendment 4 (2005) to replace the biological sampling program in section 3.0 of Amendment 4. In response to a significant decline in stock abundance and increasing total mortality since 1999, the Board approved Addendum II to Amendment 4 (2007) to reduce the recreational creel limit and commercial bycatch limit, and set landings levels that when met, will trigger the Board to re-evaluate management measures. Addendum III to Amendment 4 (2007) altered the bycatch reduction device certification requirements in Section 4.2.8 of Amendment 4 for consistency with the South Atlantic Fishery Management Council's Shrimp FMP. A new stock assessment was conducted in 2009. The findings indicate that weakfish are currently in a severely depleted state. It is natural mortality, however, rather than fishing mortality (F) that is believed to be the primary culprit in the decline. In response to the continued decline in the weakfish population, the ASMFC Weakfish Management Board has

passed Addendum IV to Amendment 4 (2009). This Addendum requires all states along the east coast to implement severe harvest restrictions on weakfish. These include a one fish daily recreational bag limit and a 100 pound daily commercial trip limit. North Carolina requested and was approved by the Weakfish Management Board to implement a 10% bycatch allowance for weakfish in lieu of the 100 pound daily trip limit. This request was considered to be conservationally equivalent to the 100 pound daily trip limit. The alternate management action allowed weakfish to be landed provided they make up less than 10% of the weight of all finfish landed up to 1,000 pounds per trip or day, whichever is longer. This alternate management strategy was implemented in August of 2010. In November of 2012, based on the recommendation of the North Carolina Marine Fisheires Commission (NCMFC), the 100 pound daily trip limit consistent with Addendum IV was implemented and replaced the alternate management strategy. It was noted by the Weakfish Management Board, that reductions in harvest will not rebuild the depleted stocks until other factors (i.e. natural mortality) become more favorable for weakfish survival. The Board's actions are intended to reduce harvest and poise weakfish for a recovery.

Management Unit

Weakfish are managed under this plan as a single stock throughout their coastal range. All Atlantic coast states from Massachusetts through Florida and the Potomac River Fisheries Commission have a declared interest in weakfish. Responsibility for the FMP is assigned to the Weakfish Management Board, Plan Review Team, Technical Committee, Stock Assessment Sub-Committee, and Advisory Panel.

Goal and Objectives

The goal of Amendment 4 is to utilize interstate management so that Atlantic coastal weakfish recover to healthy levels that will maintain commercial and recreational harvest consistent with a self-sustaining spawning stock and to provide for restoration and maintenance of essential habitat (ASMFC 2002). The management objectives are to:

1. Establish and maintain an overfishing definition that includes target and threshold fishing mortality rates and a threshold spawning stock biomass to prevent overfishing and maintain a sustainable weakfish population;

2. Restore the weakfish age and size structure to that necessary for the restoration of the fishery;

3. Return weakfish to their previous geographic range;

4. Achieve compatible and equitable management measures among jurisdictions throughout the fishery management unit, including states' waters and the federal EEZ;

5. Promote cooperative interstate research, monitoring and law enforcement necessary to support management of weakfish;

6. Promote identification and conservation of habitat essential for the long term stability in the population of weakfish; and

7. Establish standards and procedures for both the implementation of Amendment 4 and for determination of states' compliance with provisions of the management plan.

Amendment 4 defines overfishing through the use of target and threshold F rates (F30%=F=0.31 and F20%=F=0.50, respectively) and a threshold spawning stock biomass (SSB) (SSB20%=31.8 million pounds). In order to achieve annual F targets, recreational harvest of weakfish is constrained by a combination of size limits and possession limits, and commercial harvest by size limits, gear restrictions, and possibly season and/or area closures. After approval, states may implement alternative management plans with conservation equivalency

STATUS OF THE STOCK

Stock Status

The most recent stock assessment indicates that the weakfish stock is depleted and overfishing is not occurring (NEFSC 2009a, NEFSC 2009b). In general, weakfish biomass has declined to an all time low, total mortality is currently high, and non-fishing mortality has increased in recent years. Given this situation, recent fishery removals (landings and dead discards combined) represent a significant proportion of the remaining biomass and further exacerbate the stock decline. While overfishing has not occurred in recent years, harvest was reduced by an estimated 60% in Addendum IV to reduce additional mortality from fishing and poise the stock for a quicker recovery should natural mortality decline.

Currently, the stock's spawning potential is considered to be at only 4% of an unfished stock, well below the 20% spawning potential threshold and 30% spawning potential target adopted in Addendum IV. Trends in F are stable and modest. Thus, while the stock biomass is depleted, overfishing is not occurring.

Stock Assessment

Between 1982 and 1990, age 1+ weakfish biomass declined drastically. Overfishing was the main cause of this decline, with F accounting for about 60-90% of total mortality (fishing plus natural mortality) during the period. Fishing mortality peaked at 1.01 in 1989, but with the implementation of management measures in the early to mid-1990s, F declined to 0.24 in 1995 and biomass responded favorably by increasing to a peak of 62.1 million pounds in 1996. While F remained relatively stable (between 0.26 and 0.58) after that time, the stock began another drastic decline in 2001 to the time-series low of 10.8 million pounds in 2008. However, the contribution of fishing mortality to total mortality was substantially reduced during this period; from 2004-2007 only 10-20% of total mortality is attributed to F. Conversely, natural mortality has risen substantially since 1995, and factors such as predation, competition, and changes in the environment are thus believed to be having a stronger influence on recent weakfish stock dynamics than F. Bycatch and under-reported catches would have to be much greater than those estimated, growing from about 3-4 times the estimates in 1996 to 15-20 times in the most recent years, to account for the biomass decline. Thus far, there is no evidence available of an Atlantic coast fishery capable of generating additional unreported weakfish discards of this magnitude.

These estimates of age 1+ biomass are roughly comparable to spawning stock biomass due to the biology of weakfish (most fish are mature at age one). The 2008 estimate of age 1+ biomass is below the Amendment 4 SSB threshold of 31.8 million pounds (and the stock's spawning potential – 4% of an unfished stock – is also below the 20% spawning potential threshold adopted in Addendum IV). While the F estimates above are not comparable to the target and threshold rates in Amendment 4, the trend indicates a stable and modest fishing mortality. Thus,

while the stock biomass is depleted, overfishing is not occurring. ASMFC is currently working through the process to complete an updated stock assessment with a completion date expected during the fall of 2015.

STATUS OF THE FISHERY

Current Regulations

Recreational - 12 inch minimum size limit with a one fish daily bag limit
Commercial - 12 inch minimum size limit with a 100 lbs daily limit.

exception – from April 1 through November 15, weakfish 10 inches total length or more may lawfully be taken in North Carolina internal waters by use of long haul seines or pound nets only

exception – commercial flounder trawl and flynet operations are allowed to land a tolerance of no more than 100 undersized (less than 12 in total length) weakfish per day or trip, whichever is longer. It is unlawful to sell undersized weakfish.

Commercial Landings

Commercial landings of weakfish peaked in 1980 at 20,343,952 pounds. Landings have since steadily dropped and reached their lowest point in 2011 65,897 pounds (Table 1; Figure 1). Recent years have shown little increase, due to low abundance and severe commercial harvest restrictions. The North Carolina commercial weakfish harvest was 105,115 pounds in 2014. This is a 12% decrease over landings in 2013, and is below the 10-year average of 177,502 pounds (Table1; Figure 1). Addendum IV reduced commercial harvest to 100 lbs per trip thus estimating a reduction of 61% from the 2005-2008 harvest levels.

Recreational Landings

Recreational landings have been variable since 1994 with a peak in 2004 at 244,023 pounds. Landings decreased to 25,961 pounds in 2014 and were below the 10-year average of 76,438 pounds (Table 2). The dramatic decrease in landings since 2009 can be attributed to the recreational creel limit being reduced to 1 fish per day as a result of continued stock decline. Addendum IV implemented a 1 fish bag limit at 12 inches minimum TL, and was estimated to reduce recreational harvest by 53% for North Carolina.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Commercial fish houses are sampled on a monthly basis to provide length, weight, and age data to describe the commercial fisheries. The number of weakfish samples has declined in the last 10 years following a similar trend to the commercial landings (Tables 1 and 3). Samples are collected from the ocean fisheries as well as the estuarine fisheries. Ocean commercial fisheries landed 33,322 pounds of weakfish in 2014 (32% of commercial total). The ocean gill net fishery (31,414 lbs) dominated the ocean catches accounting for 30% of the overall commercial catch and 94% of the ocean commercial catch. Estuarine fisheries landed 71,793 pounds of weakfish in 2014 (68% of the commercial total). Landings from estuarine gill nets

(61,720) accounted for 86% of the overall estuarine commercial landings followed by long haul seines (5,258 lbs) at 7%. Pound nets harvested 2,329 pounds. "Other" fisheries (crab trawl, hook and line, and shrimp trawl) accounted for 2,486 pounds. Average, minimum, and maximum lengths have been variable over the last 27 years. The maximum length recorded in 2014 was the second smallest in the entire time series and the minimum size in 2014 was the largest in the time series (Table 3).

Fishery-Independent Monitoring

Fishery independent data are collected through both the program 195 Sound Survey and program 915 Independent Gill Net Survey. The program 195 survey provides an age 0 index calculated from the September stations and an age 1+ index calculated from the June stations. Both program 195 indices have been used in the ASMFC stock assessments and show a variable trend over the years (Tables 4 and 5; Figures 2 and 3). Program 915 collects information in the Pamlico Sound, Pamlico, Pungo, and Neuse rivers, and the Cape Fear and New rivers. The Pamlico Sound portion is used in the ASMFC stock assessment and has shown a declining trend since 2001 (Table 6; Figure 4). The Pamlico, Pungo, and Neuse rivers survey is not used in the assessment as there are minimal catches of weakfish. The Cape Fear and New rivers survey has not been used to date as the survey only dates back to 2008 and does not provide a sufficient time series yet.

Age samples are collected through both dependent and independent sampling. Age samples are collected from all gears possible and during all months. Target sample numbers are set on a monthly basis and the number of samples collected has ranged from 263 to 1,695, however no age samples were collected during 1997. Ages have ranged from 0 to 15 years with an average modal age of 2 years (Table 7).

MANAGEMENT STRATEGY

Addendum IV removes the existing F target and threshold and replaces the existing SSB threshold with percentage-based SSB reference points. The SSB target and threshold are SSB30% and SSB20%, respectively. These reference points represent a level of SSB that is either 30% or 20% of an unfished stock, and reflect the stock's spawning potential. To determine stock status, estimates of spawning stock biomass are divided by estimates of unfished spawning stock biomass, multiplied by 100 to be in the form of a percent, and then compared to the 30% target and 20% threshold. Figure 5 illustrates this approach. A spawning stock biomass reduced to less than 20% of an unfished stock equals an overfished or depleted stock (overfished when fishing mortality is the primary cause of the biomass decline, and depleted when causes other than fishing mortality have resulted in the biomass decline). Under this definition, weakfish are currently considered depleted. As a consequence of this modification to the management plan, the F target and threshold triggers in Amendment 4, Section 2.1 Stock Rebuilding Program are no longer applicable; however, the spawning stock biomass threshold trigger remains relevant and in effect.

MANAGEMENT AND RESEARCH NEEDS

Biological

High

- Collect catch and effort data including size and age composition of the catch, determine stock mortality throughout the range, and define gear characteristics. In particular, increase length-frequency sampling in fisheries from Maryland north.
- Derive estimates of discard mortality rates and the magnitude of discards for all commercial gear types from both directed and non-directed fisheries. In particular, quantify trawl bycatch, refine estimates of mortality for below minimum size fish, and focus on factors such as distance from shore and geographical differences.
- Conduct an age validation study.
- Identify stocks and determine coastal movements and the extent of stock mixing, including characterization of stocks in over-wintering grounds (e.g., tagging).
- Conduct spatial and temporal analysis of the fishery independent survey data. The analysis should assess the impact of the variability of the surveys in regards to gear, time of year, and geographic coverage on their (survey) use as stock indicators.
- Analyze the spawner recruit relationship and examine the relationships between parental stock size and environmental factors on year-class strength.

Medium

- Biological studies should be conducted to better understand migratory aspects and how this relates to observed trends in weight at age. Test for individual growth difference and the geospatial pattern, as well as the geospatial pattern of the catch rate surveys.
- Define reproductive biology of weakfish, including size at sexual maturity, maturity
- schedules, fecundity, and spawning periodicity. Continue research on female spawning patterns: what is the seasonal and geographical extent of "batch" spawning; do females exhibit spawning site fidelity?
- Continue studies on mesh-size selectivity, particularly for trawl fisheries.
- Continue studies on recreational hook-and-release mortality rates, including factors such as depth, warmer water temperatures, and fish size in the analysis. Studies are needed in deep and warm water conditions. Further consideration of release mortality in both the recreational and commercial fisheries is needed, and methods investigated to improve survival among released fish.

Low

- Develop a coastwide tagging database.

Social/Economic

- Assemble socio-demographic-economic data as it becomes available from ACCSP.
- Detailed information on production activities (e.g., fishing effort and labor used by gear, vessel characteristics, areas fished, etc.) and costs and earnings for the harvesting and processing sectors.
- Information on retail sales and demand for weakfish in order to estimate the demand and economic benefits of at-home and away-from home consumption of weakfish.
- Development of bio-economic models that link the underlying population dynamics to the economic aspects of the commercial and recreational fisheries.
- Distribution of weakfish to the various markets and across states.

- Information on the margins of various stages of processing and marketing also need to be obtained; this information is necessary to construct mathematical models that can be used to estimate the economic impacts of management and regulation.
- A directed data collection program for weakfish including the same variables presently collected by NMFS in support of MRFSS and by the economic add-on. Data collected includes information on travel distance, mode of angling, expenditures, area fished, catch on previous trips, and other information.
- Development of commercial decision-making or behavioral models to explain how fishers might respond to various regulations.
- Estimation and assessment of consumer (net economic benefits to consumers) and producer (net economic benefits or profits to producers) surplus; the sum of consumer and producer surplus is a measure of the net economic value to society of a good or service.
- Development of input/output models for all states having commercial weakfish activity, or alternatively, full-blown economic impact models, which might consist of input/output models or General Equilibrium models.
- Determination of the economic value derived from recreational angling including the economic value of a catch and release fishery

Habitat

- Conduct hydrophonic studies to delineate weakfish spawning habitat locations and environmental preferences (temperature, depth, substrate, etc.) and enable quantification of spawning habitat.
- Compile existing data on larval and juvenile distribution from existing databases in order to obtain preliminary indications of spawning and nursery habitat location and extent.
- Document the impact of power plants and other water intakes on larval, post larval and juvenile weakfish mortality in spawning and nursery areas, and calculate the resulting impacts on adult stock size.
- Define restrictions necessary for implementation of projects in spawning and over-wintering areas and develop policies on limiting development projects seasonally or spatially.

LITERATURE CITED

Northeast Fisheries Science Center (NEFSC). 2009a. 48th Northeast Regional Stock Assessment Workshop (48th SAW) Assessment Summary Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-10; 50 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/saw/

Northeast Fisheries Science Center. 2009b. 48th Northeast Regional Stock Assessment Workshop (48th SAW) Assessment Report. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 09-15; 834 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at http://www.nefsc.noaa.gov/nefsc/saw/

TABLES

Table 1. Commercial landings of weakfish (all gears combined) collected through the North Carolina Trip Ticket Program, 1994-2014.

Year	Landings (lb)	Value	Number of Dealers	Number of Participants	Number of Trips
1994	3,489,929	$1,917,948	180	1,355	17,414
1995	4,113,260	$2,165,276	201	1,455	20,565
1996	3,977,633	$2,304,415	197	1,318	17,653
1997	3,561,060	$1,869,620	203	1,420	21,235
1998	3,354,008	$1,698,336	190	1,170	16,854
1999	2,617,580	$1,390,987	192	1,169	17,074
2000	1,869,042	$1,089,958	170	1,128	13,992
2001	1,960,324	$1,037,169	177	1,029	12,030
2002	1,828,150	$1,051,137	175	970	10,094
2003	848,822	$532,904	161	818	8,791
2004	685,463	$488,894	177	792	8,554
2005	421,779	$357,062	141	726	7,804
2006	363,078	$310,697	142	716	7,239
2007	175,589	$149,202	138	703	6,092
2008	162,516	$142,545	159	756	6,404
2009	163,146	$163,210	133	675	4,718
2010	106,328	$105,293	107	534	4,776
2011	65,897	$78,522	90	461	3,986
2012	91,383	$111,461	112	582	5,485
2013	120,188	$150,725	109	697	7,119
2014	105,115	$140,430	98	582	5,878

Table 2. Recreational landings of weakfish collected through the MRIP program in North Carolina from 1994 through 2014.

Year	Landings (lbs.)	PSE
1994	149,159	11.5
1995	72,413	21.0
1996	79,317	12.3
1997	165,032	9.9
1998	192,210	13.9
1999	161,290	15.0
2000	87,926	20.2
2001	158,423	18.2
2002	82,746	19.1
2003	161,474	16.4
2004	244,023	19.2
2005	142,140	23.8
2006	143,525	19.1
2007	111,754	22.3
2008	114,192	27.4
2009	89,652	34.6
2010	38,721	15.4
2011	17,621	25.0
2012	46,081	22.6
2013	34,731	26.6
2014	25,961	17.7

Table 3. Mean, Minimum, and Maximum lengths of weakfish measured from the commercial fisheries in North Carolina from 1987 through 2014.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
1987	316	112	869	18,710
1988	336	133	856	16,088
1989	368	118	895	11,530
1990	314	105	899	12,110
1991	273	106	662	14,761
1992	316	132	756	10,504
1993	308	102	742	11,797
1994	343	118	710	9,202
1995	330	111	750	11,007
1996	348	116	714	11,483
1997	342	105	755	11,694
1998	352	166	695	9,173
1999	346	130	738	10,112
2000	341	103	758	11,884
2001	379	165	801	8,238
2002	354	154	800	8,155
2003	334	107	847	6,190
2004	346	147	852	6,101
2005	342	143	875	6,544
2006	326	162	826	5,940
2007	324	121	662	4,401
2008	319	127	668	2,745
2009	325	160	857	1,990
2010	320	130	692	1,898
2011	330	197	637	1,542
2012	349	128	575	2,091
2013	359	202	718	2,915
2014	356	204	620	2,608

Table 4. Catch Per Unit Effort from the Program 195 Pamlico Sound Survey Age 0 weakfish collected during September with a total length less than 200 mm from 1987 through 2014.

Year	Number of Trawls	CPUE	SE	Geometric Mean
1987	48	12.14	5.84	1.01
1988	48	101.5	20.17	23.8
1989	46	14.2	3.14	4.04
1990	48	50.2	10.75	9.23
1991	50	36.96	11.74	3.77
1992	49	42.71	8	14.34
1993	50	9.12	3.17	1.71
1994	46	68.34	12.42	20.6
1995	49	38.21	5.73	14.3
1996	50	72.07	12.17	38.01
1997	50	32.79	4.22	16.57
1998	51	70.44	12.81	31.41
1999	49	99.9	10.43	59.65
2000	50	63.19	9.81	35.37
2001	50	30.3	5.82	5.17
2002	49	22	5.28	4
2003	50	24.52	5.77	10.98
2004	50	29.36	6.18	9.55
2005	49	28.76	6.1	9.05
2006	51	40.07	9.11	7.49
2007	51	56.77	11.14	12.93
2008	51	50.26	11.05	12.73
2009	51	58.89	12.72	10.06
2010	51	32.45	6.19	7.87
2011	51	33.69	11.17	5.12
2012	51	40.66	10.79	5.17
2013	51	58.53	12.81	9.72
2014	51	32.82	8.98	3.7

Table 5. Catch Per Unit Effort from the Program 195 Pamlico Sound Survey Age 1+ weakfish collected during June with a total length greater than 140 mm from 1987 through 2014.

Year	Number of Trawls	CPUE	SE	Geometric Mean
1987	48	53.14	9.97	14.07
1988	48	35.55	6.07	12.3
1989	46	13.81	2.89	3.43
1990	48	17.18	3	5.98
1991	50	14.74	2.41	4.67
1992	49	19.92	3.98	6.3
1993	50	70.94	12.69	20.92
1994	46	72.93	20.27	16.77
1995	49	42.28	7.04	14.32
1996	50	32.62	6.12	9.69
1997	50	55.7	9.08	19.05
1998	51	27.31	12.22	3.06
1999	49	48.36	8.3	15.91
2000	50	123.66	16.24	51.52
2001	50	52.75	9.42	9.9
2002	49	20.64	5.4	3.78
2003	50	17.39	5.15	3.22
2004	50	31.24	9.1	4.35
2005	49	29	8.65	4.31
2006	51	90.6	13.78	30.51
2007	51	23.56	6.15	4.38
2008	51	13.34	3.46	2.19
2009	51	10.83	2.79	2.26
2010	51	100.5	20.74	21.42
2011	51	38.09	11.51	4.15
2012	51	23.84	6.61	4.84
2013	51	24.48	8.14	5.17
2014	51	50.26	10.27	11.09

Table 6. Catch Per Unit Effort from the Pamlico Sound portion of Program 915 Independent Gill Net Survey from 2001 through 2014.

Year	Effort	Collection Number	CPUE	SE
2001	237	386	1.4208	0.1355
2002	320	491	1.39984	0.2453
2003	320	396	1.22039	0.1683
2004	320	445	1.32283	0.2404
2005	304	396	1.24107	0.1449
2006	320	347	0.92206	0.1333
2007	320	159	0.43236	0.0516
2008	320	190	0.48958	0.0797
2009	320	124	0.3068	0.0518
2010	320	177	0.48459	0.069
2011	300	133	0.36085	0.0659
2012	308	302	0.92235	0.1556
2013	308	247	0.69078	0.0947
2014	309	180	0.50249	0.0686

Table 7. Modal age, minimum age, maximum age, and number aged for weakfish collected through NCDMF sampling programs from 1988 through 2014.

Year	Modal Age	Min Age	Max Age	Number Aged
1988	2	0	6	419
1989	2	0	7	356
1990	2	1	11	272
1991	2	0	5	481
1992	2	0	6	597
1993	2	0	6	710
1994	2	0	7	689
1995	3	0	6	1,408
1996	4	0	6	1,695
1997				
1998	3	0	7	703
1999	3	0	8	659
2000	1	0	9	616
2001	2	0	10	630
2002	3	0	10	512
2003	4	0	8	491
2004	2	0	11	589
2005	2	0	12	561
2006	3	0	7	752
2007	2	0	6	560
2008	1	0	5	480
2009	1	0	15	263
2010	2	0	5	507
2011	2	0	4	378
2012	3	0	4	497
2013	2	0	5	546
2014	1	0	4	508

FIGURES

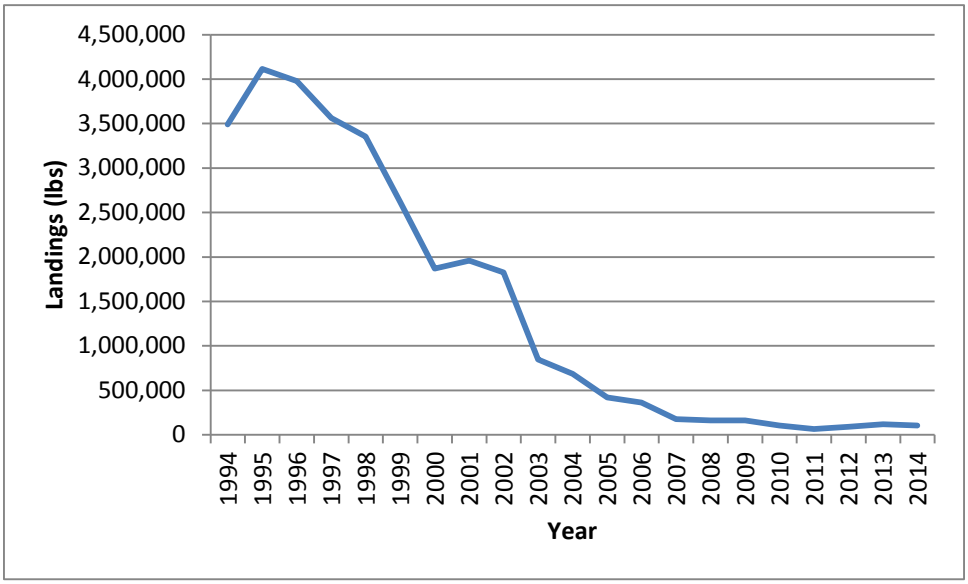


Figure 1. Commercial landings of weakfish (all gears combined) collected through the North Carolina Trip Ticket Program, 1994-2014.

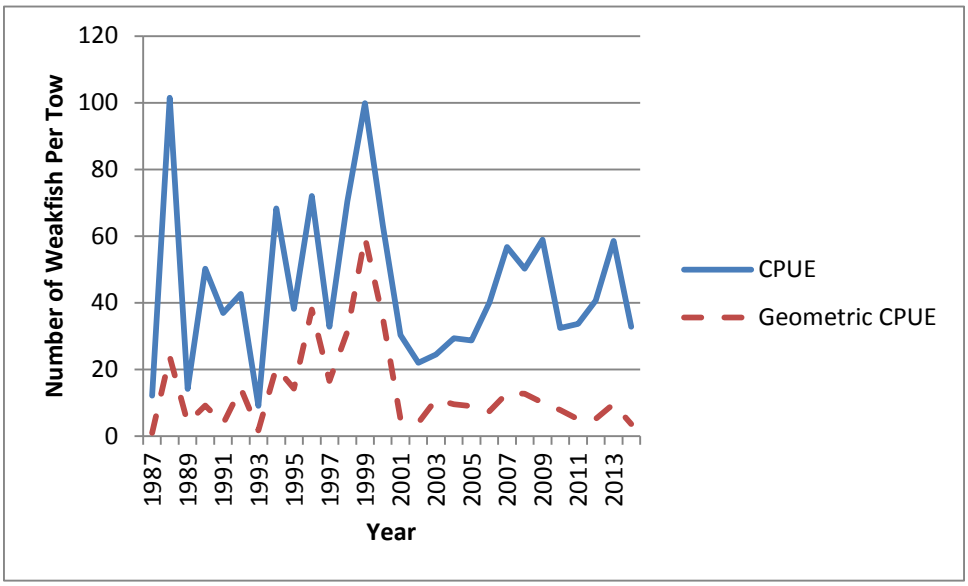


Figure 2. Catch Per Unit Effort from the Program 195 Pamlico Sound Survey Age 0 weakfish collected during September with a total length less than 200 mm from 1987 through 2014.

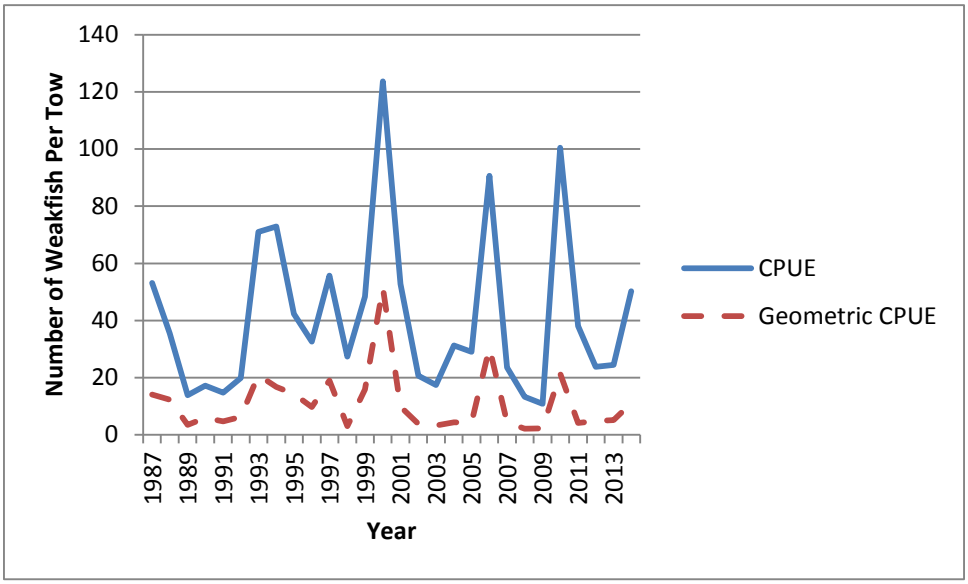


Figure 3. Catch Per Unit Effort from the Program 195 Pamlico Sound Survey Age 1+ weakfish collected during June with a total length greater than 140 mm from 1987 through 2014.

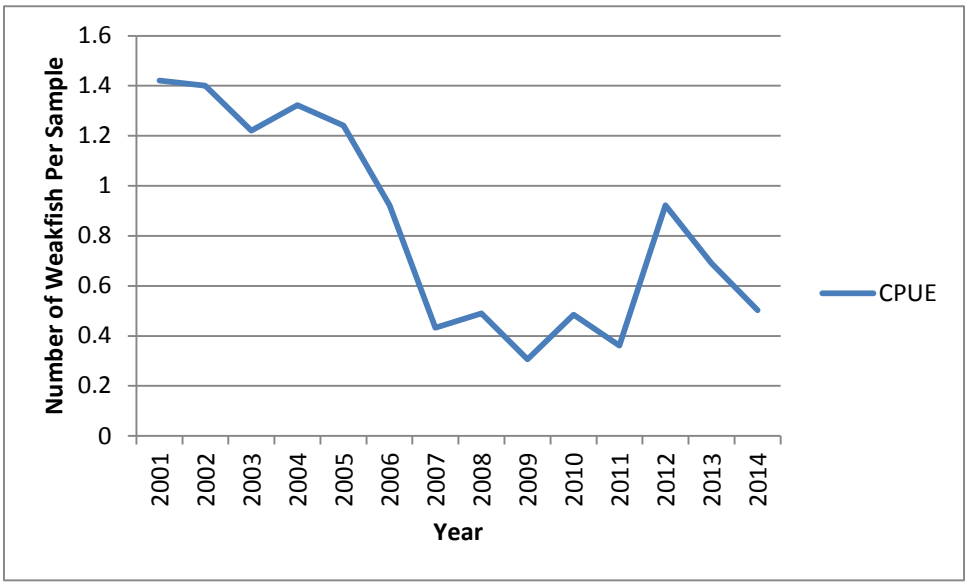


Figure 4. Catch Per Unit Effort from the Pamlico Sound portion of Program 915 Independent Gill Net Survey from 2001 through 2014.

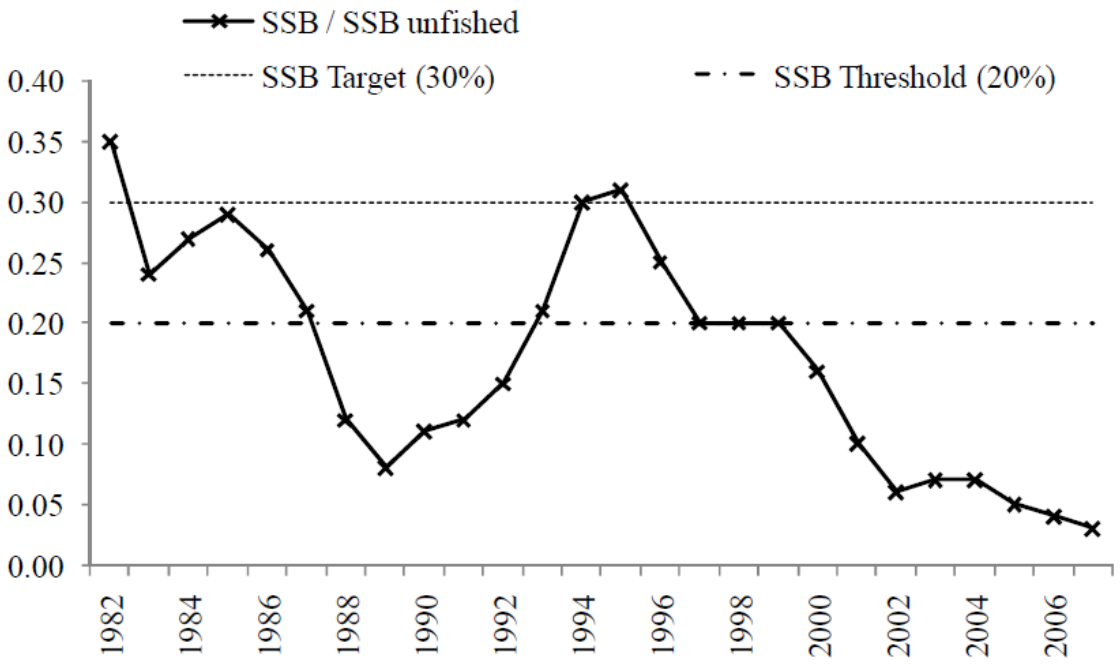


Figure 5. Changes in weakfish percent spawning potential ([spawner biomass (mid-year) /unfished biomass] * 100) during 1982-2007 (NMFS 2009b). Estimates are compared to theSSB20% threshold and SSB30% target.

FISHERY MANAGEMENT PLAN UPDATE
AMERICAN EEL
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 1999 Addendum I (February 2006) Addendum II (October 2008) Addendum III (August 2013) Addendum IV (October 2014)
Amendments:	None
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	Assessment last completed in May 2012, the next benchmark review would be at a minimum 5 years from the 2012 benchmark.

American eel is included in the Interjurisdictional Fisheries Management Plan (FMP), which defers to Atlantic States Marine Fisheries Commission (ASMFC) Interstate FMP for American Eel. The initial FMP was approved in 1999, reviewed and updated in 2006 and 2008. In May 2012, the benchmark American eel stock assessment was completed and accepted for use in management. In 2013 and again in 2014, the FMP was reviewed and updated. The FMP implements management measures to protect and enhance the abundance of American eel, while allowing commercial and recreational fisheries to continue. Addendum I, approved November 2006, required states to establish a mandatory trip-level catch and effort monitoring program, including the documentation of the amount of gear fished and soak time (ASMFC 2006). Addendum II, approved in October 2008, maintained status quo on state management measures and placed increased emphasis on improving the upstream and downstream passage of American eel (ASMFC 2008). In August 2013, Addendum III to the ASMFC Interstate FMP for American Eel was approved for management. This addendum predominately focused on the commercial yellow eel and recreational fishery management measures. Addendum III implemented new size and possession limits as well as new pot mesh size requirements and seasonal gear closures (Table 1). Following approval of Addendum III, the ASMFC American eel Management Board initiated the development of Addendum IV which was approved and adopted in October 2014. This addendum addresses concerns and issues in the commercial glass and silver eel fisheries, domestic eel aquaculture, and established a coastwide catch cap that also set up an automatic implementation of a state-by-state commercial yellow eel quota if the catch cap is exceeded. As the second phase of management in response to the 2012 stock assessment, the goal of Addendum IV is to continue

to reduce overall mortality and increase overall conservation of American eel stocks. Information about abundance and status at all life stages, as well as habitat requirements, is very limited. The life history of the species, such as late age of maturity and a tendency for certain life stages to aggregate, can make this species particularly vulnerable to overharvest.

Management Unit

The American eel is managed as a coast wide stock under the ASMFC Interstate FMP for American Eel (ASMFC 2000). The American eel's range extends beyond U.S. borders and more specifically ASMFC member states territorial waters. However, the management unit is limited to ASMFC member states territorial waters.

Goal and Objectives

The goal of the ASMFC American Eel FMP is to protect and enhance the abundance of American eel in inland and territorial waters of the Atlantic states and jurisdictions, and contribute to the viability of the American eel spawning population; and provide for sustainable commercial, subsistence, and recreational fisheries by preventing over-harvest of any eel life stage. The following objectives will be used to achieve this goal:

1. Improve knowledge of eel utilization at all life stages through mandatory reporting of harvest and effort by commercial fishers and dealers, and enhanced recreational fisheries monitoring.

2. Increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring.

3. Protect and enhance American eel abundance in all watersheds where eel now occur.

4. Where practical, restore American eel to those waters where they had historical abundance but may now be absent by providing access to inland waters for glass eel, elvers, and yellow eel and adequate escapement to the ocean for pre-spawning adult eel.

5. Investigate the abundance level of eel at the various life stages necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure.

STATUS OF THE STOCK

Stock Status

The 2012 ASMFC benchmark stock assessment found the stock status of the American eel population to be depleted in U.S. waters. Although no determination of overfishing could be made, the assessment found the stock is at or near historically low levels due to a combination of historical overfishing, habitat loss and alteration, productivity and food web alterations, predation, turbine mortality, changing climatic and oceanic conditions, toxins and contaminants, and disease (ASMFC 2013).

In 2010, the Center for Environmental Science, Accuracy, and Reliability (CESAR) petitioned the US Fish and Wildlife Service (USFWS) to list American eel under the Endangered Species

Act (ESA). In September 2011, USFWS concluded the petition may be warranted and initiated a status review to assess the health of the population and the magnitude of threats facing the species. However, in August 2012, CESAR filed a lawsuit against USFWS for failure to publish a proposed rule within the timeframe specified by the ESA. A Settlement Agreement was approved in April 2013, which requires USFWS to publish its proposed rule by September 30, 2015.

Stock Assessment

A depletion-based stock reduction analysis (DB-SRA) was conducted by the Stock Assessment Subcommittee; results suggested overfishing has been occurring since the 1980s. However, while it is highly likely the American eel stock is depleted; the overfishing and overfished status in relation to the biomass and fishing mortality reference points cannot be stated with confidence.

STATUS OF THE FISHERY

Current Regulations

New management measures dealing with yellow eels went into effect on January 1, 2014 under North Carolina Marine Fisheries Commission (NCMFC) Rule 15A NCAC 03M .0510. These measures included a 9-inch total length (TL) minimum size limit for both the commercial and recreational fishery, a new bag limit for the recreational fishery (25 eels / person / day), and crew members involved in for-hire employment are allowed to maintain the current 50 eels / day bag limit for bait purposes. The rule also made the possession of American eels illegal from September1 through December 31 except when taken by baited pots. NCMFC Rule 15A NCAC 03J .0301 established a ½ by ½ inch minimum mesh requirement for the commercial fishery. Eel pots with an escape panel consisting of a 1 by ½ inch mesh are allowed until January 1, 2017.

Commercial Landings

The average commercial landings and value over a ten year period (2005 – 2014) was 55,115 pounds / $134,342, in 2014 the commercial landings and value was 58,886 pounds / $159.727. Commercial American eel landings have fluctuated over the years; in 1979 and 1980 over 900,000 pounds of eels were landed, however, since the late 1980's American eel landings have averaged less than 100,000 pounds (Figure 1).

Recreational Landings

There are no recreational landings data available for American eels which are not typically a targeted species. Due to the fact that eels are caught incidentally in the estuarine environment by recreational fishermen by hook and line, the Marine Recreational Information Program (MRIP) does not provide reliable harvest data. Also, the survey design of MRIP does not provide information on the recreational harvest of American eel in inland waters. North Carolina does not require a permit or mandatory reporting for recreational fishermen that catch American eels.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Not Available

Fishery-Independent Monitoring

The N.C. Division of Marine Fisheries young-of-year (YOY) American eel sampling was eliminated in 2009 due to budget cuts. Currently, the National Marine Fisheries Service conducts a year round ichthyoplankton survey at Beaufort Inlet which will be used to develop a new North Carolina juvenile abundance index for American eel; a CRFL grant was received to process the backlog of samples. In the future, other resources will be needed to ensure that the YOY eel samples can be processed.

MANAGEMENT STRATEGY

The commercial yellow eel fishery is regulated through an annual coast wide catch cap set at 907,671 pounds (1998 – 2010 harvest level; ASMFC 2014). Contained within Addendum IV are two management triggers (see below), which, if either triggers were tripped, there would be automatic implementation of a state-by-state commercial yellow eel quota. The annual coast wide quota is set at 907,669 pounds, with allocations to each state. North Carolina would receive an 11.8% allocation (107,054 lbs.).

Management Triggers:

1. The coast wide catch cap is exceeded by more than 10% in a given year (998,438 lbs.)

2. The coast wide catch cap is exceeded for two consecutive years, regardless of percent over.

MANAGEMENT AND RESEARCH NEEDS

At this time there are no critical data or management needs from North Carolina Division of Marine Fisheries or the ASMFC. Table 2 identifies research needs as identified in Addendum III to the American Eel FMP and lists progress made towards accomplishing those objectives.

LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 2000. Atlantic States Marine Fisheries Commission Interstate Fishery Management Plan for American Eel. Atlantic States Marine Fisheries Commission. Arlington, VA. 93 pp.

ASMFC. 2006. Atlantic States Marine Fisheries Commission Addendum I to the Interstate Fishery Management Plan for American Eel. Atlantic States Marine Fisheries Commission. Arlington, VA. 8 pp.

ASMFC. 2008. Atlantic States Marine Fisheries Commission Addendum II to the Interstate Fishery Management Plan for American Eel. Atlantic States Marine Fisheries Commission. Arlington, VA. 8 pp.

ASMFC. 2013. Atlantic States Marine Fisheries Commission Addendum III to the Interstate Fishery Management Plan for American Eel. Atlantic States Marine Fisheries Commission. Arlington, VA. 22 pp.

ASMFC. 2014. Atlantic States Marine Fisheries Commission Addendum IV to the Interstate Fishery Management Plan for American Eel. Atlantic States Marine Fisheries Commission. Arlington, VA. 26 pp.

TABLES

Table 1. Summary of management strategies and outcomes from Addendum IV and previous Addendums.

Issue	Management Strategy	Objectives	Outcome
Maintain commercial harvest level	Establish a Coastwide cap (907,671lbs.)	3	Accomplished with Addendum IV
Increased protection for small yellow eels	Nine (9) inch minimum size limit for both commercial and recreational fisheries.	3	Accomplished by Marine Fisheries Commission Rule 15A NCAC 03M .0510
	Minimum eel pot mesh size of one-half by one-half inch.	3	Accomplished by Marine Fisheries Commission Rule 15A NCAC 03J .0301
Reduce the recreational harvest	Recreational possession limit of 25 eels / person / day.	3	Accomplished by Marine Fisheries Commission Rule 15A NCAC 03M .0510
Protect out-migrating silver eels	No possession of American eels from September 1 to December 31 unless they are taken with baited pots	3	Accomplished by Marine Fisheries Commission Rule 15A NCAC 03M .0510
Collect commercial catch and effort information	Mandatory trip level reporting by life stage, including number of units fished and unit soak time.	1, 2, 5	Accomplished by G.S. 113-170.3 and the American eel log book reporting program where fishermen are notified by letter of the monthly reporting requirement

Table 2. Summary of research needs and outcomes from Addendum IV and monitoring requirements from previous plans Addendums.

Management Strategy	Objectives	Outcome
Mandatory trip level reporting by life stage, including number or units fished and unit soak time	1, 2	Ongoing through the American eel

Management Strategy	Objectives	Outcome
		Logbook Reporting Program
Mandatory young-of-year survey in two river systems over a six week period	1, 2	In 2008, funding was cut for the young-of year survey; however, the Beaufort bridge-net survey is proposed to be used for the young-of-year survey, as approved by the ASMFC American Eel Management Board
Mandatory cross-referencing between dealer and fishery reported harvest	1	Ongoing through the NC Trip Ticket Program and the American Eel Logbook Reporting Program
Development of quantifiable eel habitat enhancement goals through the creation of a coast-wide eel habitat GIS database. The goal of the database would be the generation of coast-wide, regional, state, and watershed maps that would quantify the amount of available habitat relative to historical habitat and identify major barriers to eel migration. This information would allow the ASMFC to prioritize eel habitat enhancement programs at coast-wide, regional, and state scales. Efforts should be coordinated with existing GIS efforts already underway in Canada (see: http://www.dfompo.gc.ca/Library/345546.pdf). Potential funding and coordination with the Atlantic Fish Habitat Partnership should be considered. This project is considered a high priority item and should be completed either prior to the start of the next benchmark stock assessment or in conjunction with the stock assessment	2, 3, 4	No Action
Work with other appropriate ASMFC committees to develop materials to support states of jurisdictions interested in making recommendations to the Federal Energy Regulatory Commission (FERC) for upstream and downstream fish passage provisions for American eels in the hydropower licensing and relicensing process.	3, 4	No Action
Work with states and jurisdictions to develop a list of non-FERC licensed dams and other impoundments which impact eel movements and migration. The Nature Conservancy recently completed an online, interactive inventory of dams from Maine to Virginia (see: The Northeast Aquatic Connectivity and Assessment of Dams) which could be adapted to meet this goal. An evaluation	2, 3, 4	No Action

Management Strategy	Objectives	Outcome
should be conducted on each general type of impoundment to assess the potential for eel passage without assistance (i.e. no eel passage constructed) or determine what type of eel passage for each type of impoundment would be most beneficial for all, or specific, life stages. The recommendations from the workshop proceedings (in preparation) from the ASMFC American Eel Passage Workshop held in Gloucester, MA, (March 2011) should be a useful document to assist in the completion of this task.		
Develop a timeline and target for 1) the amount of habitat to open up through creation of fish passage or dam removal, where feasible and/or 2) the amount of habitat to enhance to increase survival for all, or specific, life stages.	2, 3, 4	No Action
Assess and provide recommendations related to other potential impacts caused by water supply and withdrawal operations, water diversions, and agricultural water use.	2, 3, 4	No Action
Increase coordination with the ASMFC Fish Passage, Habitat, and FERC Guidance Committees. The state marine fisheries agencies should also encourage increased communication and collaboration with their inland fisheries agencies counterparts where applicable. The Commission should also continue the development of a Memorandum of Understanding between the Great Lakes Fisheries Commission, U.S. Fish and Wildlife Service, and NOAA Fisheries in order to reduce mortality on eels throughout their range, as well as improving access to suitable habitat.	2, 3, 4	No Action
Collect biological information by life stage including length, weight, age, and sex of eels caught in fishery-independent sampling programs; at a minimum, length samples should be routinely collected from fishery-independent or fisheries-dependent surveys.	2, 4,	Collecting weight of eels caught in independent sampling programs as well as commercial eel pots
Implement surveys that directly target and measure abundance of yellow- and silver-stage American eels, especially in states where few targeted eel surveys are conducted.	2	No Action
Coast-wide sampling program for yellow and silver American eels should be developed using standardized and statistically robust methodologies.	1, 2	No Action
State marine agencies work with their state inland counterparts, where applicable, to standardize reporting of trip-level landings and effort data that occur in inland waters on diadromous populations of eels	1, 2	No Action

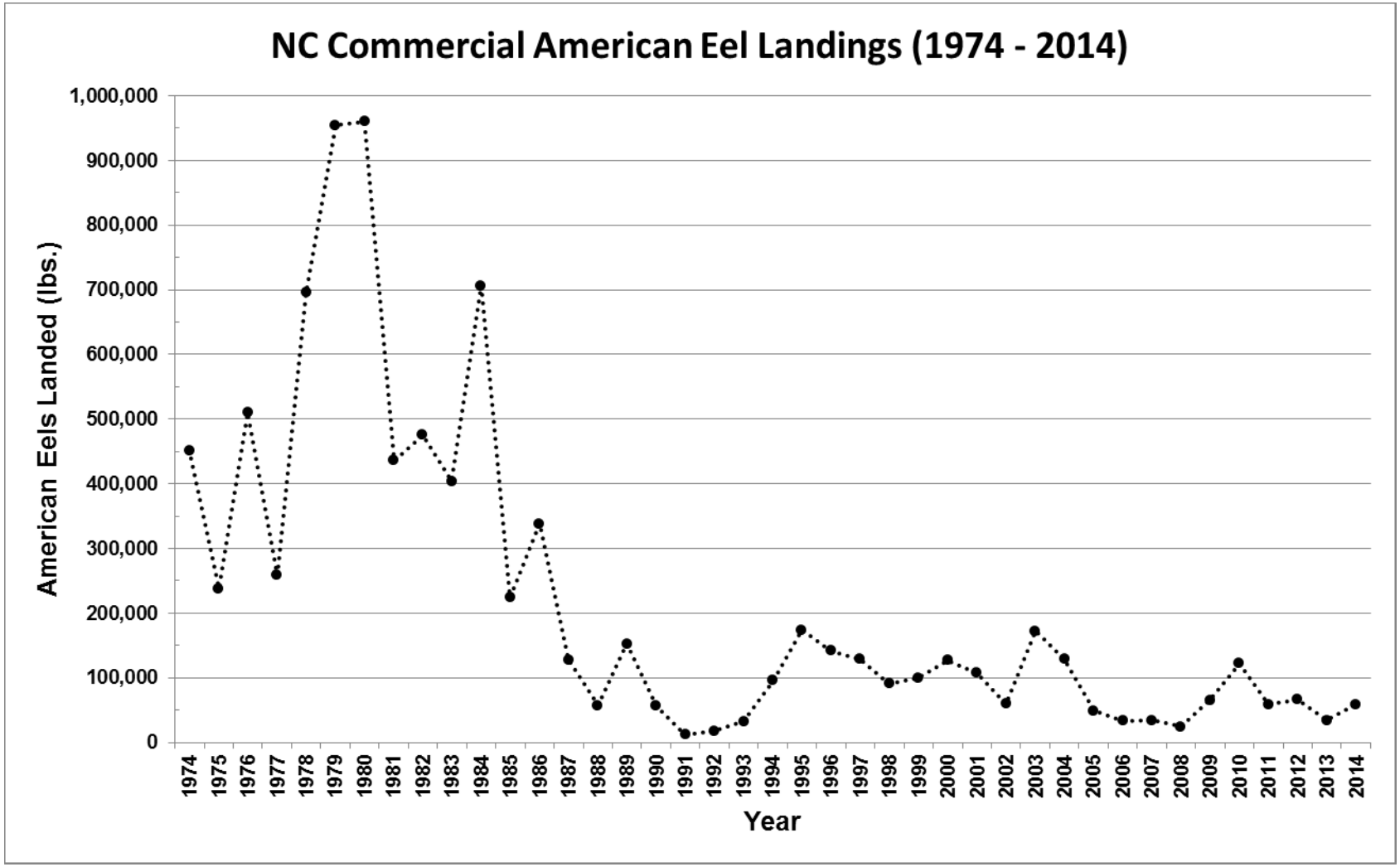


Figure 1. American eel landings in N.C. from 1974 to 2014.

FISHERY MANAGEMENT PLAN UPDATE
ATLANTIC STURGEON
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 1990
Amendments:	Amendment 1 July 1998 Technical Addendum #1 to Amendment 1 October 2000 Addendum I January 2001 Addendum II May 2005 Addendum III November 2006 Addendum IV September 2012
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	January 2017

Amendment 1 to the Interstate Fishery Management Plan (FMP) for Atlantic Sturgeon was developed by the Atlantic States Marine Fisheries Commission (ASMFC) with a goal to restore Atlantic sturgeon spawning stocks to a population level which will provide for sustainable fisheries, and ensure viable spawning populations. Addendum I was completed to allow importation on non-indigenous Atlantic sturgeon and permit the development of private aquaculture facilities. Addendum II required the compliance with ASMFC Terms, Limitations, Enforcement and Reporting Requirements for each exemption to the harvest and possession moratoria as outlined in Section 4 of the FMP. It also allowed for Lapaz Inc. to import Atlantic sturgeon fingerlings, produce fish, and sell the meat. Further exemption was provided to Acadian Sturgeon and Caviar to import fish to North Carolina. Addendum III compliments Addendum II and provides authority for LaPaz Inc. to import Atlantic sturgeon from Supreme Sturgeon and Caviar for commercial aquaculture. Addendum IV is the Atlantic Sturgeon Habitat Addendum.

Management Unit

Atlantic Ocean and adjacent estuaries and coastal rivers from Maine through Florida.

Goal and Objectives

The goal is to restore Atlantic sturgeon spawning stocks to population levels which will provide for sustainable fisheries, and ensure viable spawning populations (ASMFC 1998). Amendment

1 to the Atlantic Sturgeon FMP was approved in July 1998. In order to achieve this goal the plan sets forth the following objectives:

- Establish 20 protected year classes of females in each spawning stock;
- Close the fishery for a sufficient time period to reestablish spawning stocks and increase numbers in current spawning stocks;
- Reduce or eliminate bycatch mortality;
- Determine the spawning sites and provide protection of spawning habitats for each spawning stock;
- Where feasible, reestablish access to historical spawning habitats for Atlantic sturgeon; and
- Conduct appropriate research as needed.

STATUS OF THE STOCK

Stock Status

Reported landings peaked in 1890 at 3.4 million kg (7,495,717 pounds) and declined precipitously. Currently, populations of Atlantic sturgeon throughout their range are either extirpated or at historically low abundance. Recruitment is variable at low levels in all regions. The stock is considered overfished but overfishing is not occurring. The target fishing mortality (F) rate was defined as that level of F that generated an eggs-per-recruit (EPR) equal to 50% of the EPR at F = 0.0 (i.e., virgin stock). This rate (F 50) equals 0.03 (annual harvest rate of 3%) for a restored population. This target is far below recent estimates of F prior to enactment of fishing moratoria, which ranged from 0.01 - 0.12 for females and 0.15 - 0.24 for males in the Hudson River. These numbers may not apply to southern stocks, where more signs toward recovery are being seen.

Stock Assessment

The 1998 Atlantic sturgeon assessment relied on data from Maine, the Hudson River, Delaware Bay, South Carolina and Georgia. Egg-per-recruit (EPR) and yield-per-recruit (YPR) models were used to estimate a target F rate and potential yield in number of recent age-one abundance (recruitment) estimates. Mortality rates associated with targeted fisheries were estimated for the Hudson River population through a catch-at-age analysis. The spawning stock biomass (SSB) is undocumented for all river systems. The stock assessment report presented a comprehensive review of the current status of Atlantic sturgeon in the U.S. From this review it is obvious that fishing seriously depleted the Atlantic sturgeon by the early 1900s. Since that time, some stocks are believed to have been extirpated, while others have persisted at very low levels. Catches of juveniles suggest that sporadic spawning is occurring in some of the larger rivers throughout the historic range, but because of the migratory nature of juvenile Atlantic sturgeon, the origin of these juveniles older than age 2 is uncertain. Although time series are sparse for most river stocks, declines in abundance have been noted. The ASMFC has identified members to initiate a new benchmark stock assessment and has completed the initial

data workshops. The estimated completion for a peer reviewed stock assessment is early 2017.

STATUS OF THE FISHERY

Current Regulations

Coastwide commercial and recreational moratorium.

Commercial Landings

No landings recorded since 1991

Recreational Landings

No recreational fishery.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

The NCDMF provides at sea observer coverage for the fall flounder fishery as well as other large and small mesh fisheries throughout the state. Staff observed large mesh trips and small mesh trips throughout the estuaries of North Carolina.

Fishermen participating in the American shad fishery conducted in the Cape Fear (drift nets) and Brunswick rivers (anchored gill nets) were interviewed for interactions with Atlantic sturgeon during nine fishing trips. No Atlantic or shortnose sturgeon were reported during 2013.

North Carolina developed a Section 10 Incidental Take Permit for the estuarine waters of North Carolina relative to gill net fishing. Through this process North Carolina developed a zero inflated poisson general linear model that estimated bycatch in the gill net fisheries. This model divided the state estuarine waters into management units and estimated takes (live and dead) within each of these units, by season, and mesh size (large and small). Results from this model are available in the Application for an Incidental Take Permit submitted to the National Marine Fisheries Service in December 2012 by the NCDMF.

A total of 196 Atlantic sturgeon have been encountered in the North Carolina on board observer program since 2003. These sturgeon have ranged from 330 to 1,524 mm FL and averaged 635 mm FL (Table 1). One-hundred and fifty-three of the 196 sturgeon have been encountered in the Albemarle Sound Management Unit. An additional 15 Atlantic sturgeon were observed through the alternate platform observer program during 2013 and 2014. These fish ranged in size from 410 to 895 mm FL and averaged 668 mm TL. Thirteen of the 15 sturgeon encountered were observed in the Albemarle Sound Management Unit.

Fishery-Independent Monitoring

The North Carolina Division of Marine Fisheries (NCDMF) currently has three independent gill net programs that encounter and tag Atlantic sturgeon. The Albemarle Sound Independent Gill

Net Survey (IGNS) is a stratified random gill net survey that employs gill nets with mesh sizes that range from 2.5 inch stretch mesh (ISM) through 7 ISM (0.5 ISM increments) and 8 ISM and 10 ISM of floating and sinking nets. Gill nets are fished in 40 yard shots totaling 960 yards per set. Each set is fished for approximately 24 hours before retrieval. Nets were fished from January through May, November, and December each year From 1991 through 2014. Lengths of sturgeon collected have ranged from 230 mm FL to 1,498 and average 516 mm FL (Table 2). Six fish were collected with a fork length greater than 1,000 mm, and only 3 of 1,448 fish collected were adults. Catch per unit effort shows an increasing trend over the entire time series but annual CPUE are variable (Figure 1).

The Pamlico Sound Independent Gill Net Survey (PSIGNS) is conducted in Pamlico Sound, Pungo, Pamlico, and Neuse rivers, and consists of gill net sets, ranging in mesh size from 3.0 ISM through 6.5 ISM (0.5 ISM increments) and are fished for approximately 12 hours before retrieval. The Pamlico Sound portion has been conducted since 2001 and the rivers portion since 2003. Less than 50 fish have been collected though sampling in each region. Average lengths are larger than those seen in the Albemarle, indicating capture of more sub-adult fish than young of year fish (Tables 3, 4). Two adults have been collected in the Pamlico Sound Survey and one adult was collected in the Rivers Survey.

The Fisheries Independent Assessment Program (FIAP) is modeled after the PSIGNS. The areas fished include the New and Cape Fear rivers. Two-hundred and forty yards were fished per sample and 120 samples were completed. Trips conducted in the Atlantic Ocean include an additional 2.5 ISM net. The areas fished include the coastal ocean waters off the New and Cape Fear rivers. Two-hundred and seventy yards were fished per sample. Effort has been ongoing since 2008. Four fish have been collected in the Cape Fear River IGNS and they ranged from 569 to 8736 mm FL. No adult Atlantic sturgeon have been collected in this survey.

During 2010, The NCDMF joined a multi-state grant entitled “Research and Management of Endangered and Threatened Species in the Southeast: Riverine Movements of Shortnose and Atlantic Sturgeon” cooperating with South Carolina Department of Natural Resources, The University of Georgia, and North Carolina State University (NCSU). Funding was provided through the National Marine Fisheries Service (NMFS), Section 6. Ninety-four Atlantic sturgeon were tagged with acoustic transmitters from 2011 through 2013 in the Cape Fear River and Albemarle Sound. These fish ranged from 772 to 1,753 mm FL and averaged 928 mm FL (Table 5). Collections in the Albemarle Sound were low, however the Cape Fear River crew were very successful, contrary to the IGNS survey conducted within the same river but in different locations. The Cape Fear River tagging was also conducted using gill nets but were targeting Atlantic sturgeon with appropriate mesh and twine sizes for the species.

MANAGEMENT STRATEGY

Atlantic coastal states implemented a moratorium on harvest and possession of Atlantic sturgeon in 1998. Furthermore, harvest is not permitted in the exclusive economic zone (EEZ). The best available data indicate that river-specific populations are appropriate management units. It is recommended that the moratorium remain in place for each population until it can be documented that the spawning population includes at least 20 year classes of adult females (half the number of year classes that probably existed in unfished populations). Given that female Atlantic sturgeon do not mature until about 20 years of age, the moratorium can be expected to remain in place for several decades from when harvest of a given population ended. As populations increase during restoration, bycatch of sturgeon will increase; hence,

managers should ensure that mechanisms are in place to monitor the level of bycatch and make reductions if necessary.

The NMFS listed the Carolina Distinct Population Segment of Atlantic sturgeon as an endangered species under the 1973 Endangered Species Act (ESA). This listing determination drastically influences the management strategy in North Carolina. The largest influence was the requirement of the NCDMF to obtain a Section 10 Incidental Take Permit to allow the estuarine gill net fisheries to continue. Without the Section 10 Permit interactions in the fishery would have been illegal. Any future fishery for Atlantic sturgeon will only be possible if the NMFS removes Atlantic sturgeon from the ESA. However, additional protections provided through the ESA listing should increase the potential recovery.

MANAGEMENT AND RESEARCH NEEDS

Biological/Captive Propagation

- Standardize and obtain baseline data on population status for important sturgeon rivers. Data should include assessment of stock status in various rivers, size and composition of the spawning population, reproductive success and juvenile production;
- Develop long-term marking/tagging procedures to provide information on individual tagged Atlantic sturgeon for up to 20 years;
- Establish success criteria in order to evaluate the effectiveness of stocking programs;
- Determine size at maturity for Mid- and North Atlantic sturgeon;
- Monitor catch/effort and size/age composition of landings of any future authorized directed fisheries;
- Determine length at age by sex for North, Mid- and South Atlantic stocks;
- Determine maturity at age by sex for North, Mid- and South Atlantic stocks;
- Determine fecundity at age, length, and weight for North, Mid-, and South Atlantic stocks;
- Characterize size and condition of Atlantic sturgeon by gear and season taken as bycatch in various fisheries;
- Establish environmental tolerance levels (D.O., pH, temperature, etc.) for different life stages;
- Establish coastal tagging projects to delineate migratory patterns (This measure is being implemented by the USFWS and member states.);
- Expand tagging of juveniles in major spawning rivers to allow estimates of rates of loss to bycatch;
- Establish a tag recovery clearinghouse and database for consolidation and evaluation of tagging and tag return information including associated biological, geographic, and hydrographic data (This measure is being implemented by the USFWS through the Maryland Fisheries Resources Office located in Annapolis, Maryland.);
- Encourage shortnose sturgeon researchers to include Atlantic sturgeon research in their projects;
- Establish methods for the recovery of tags and associated information (This measure is being implemented through ASMFC/USFWS cooperative efforts.);
- Evaluate existing groundfish survey data to determine what can be learned about at-sea migratory behavior;
- Conduct basic culture experiments to provide information on: a) efficacy of alternative spawning techniques, b) egg incubation and fry production techniques, c) holding and

rearing densities, d) prophylactic treatments, e) nutritional requirements and feeding techniques, and f) optimal environmental rearing conditions and systems;
- Determine the extent to which Atlantic sturgeon are genetically differentiable among rivers;
- Conduct research to identify suitable fish sizes, and time of year for stocking cultured fish;
- Conduct and monitor pilot-scale stocking programs before conducting large-scale efforts over broad geographic areas;
- Determine effects of contaminants on early life stages;
- Develop methods to determine sex and maturity of captured sturgeon;
- Develop sperm cryopreservation techniques and refine to assure availability of male gametes;
- Refine induced spawning procedures;
- Develop the capability to capture wild broodstock and develop adequate holding and transport techniques for large broodstock;
- Conduct studies to identify tissue(s) suitable for genetic analyses and the techniques for their collection and storage. In those states which permit future harvest of Atlantic sturgeon, material for genetic analysis should be collected from up to 50 percent of the fish landed in the commercial fisheries. In states with no future directed fisheries, federal and state programs which encounter sturgeon should be encouraged to collect specified tissues for genetic analysis;
- Standardize collection procedures to obtain biological tissues, and identify a suitable repository to archive all materials;
- Conduct research to determine the susceptibility of Atlantic sturgeon to sturgeon adenovirus and white sturgeon iridovirus. Methods should be developed to isolate the sturgeon adenovirus and an Atlantic sturgeon cell line should be established for infection trials;
- Conduct research to identify the major pathogens of Atlantic sturgeon and a cell line for this species should be developed .

Social

- To evaluate the social impacts the needed data might include the following for consumptive and non-consumptive users: demographic information (e.g. age, gender, ethnicity/race, etc.), social structure information (e.g. historical participation, affiliation with NGOs, perceived conflicts, etc.), other cultural information (e.g. occupational motivation, cultural traditions related to resource's use), and community information.
- A cost and benefit analysis (CBA) of possible stocking protocols is needed.

Monitoring population status through juvenile indices and abundance, characterizing the incidence of bycatch in various fisheries and associated mortalities, conducting tag/recapture studies for estimates of bycatch loss are being addressed through current sampling. It should be noted that any sampling that encounters Atlantic sturgeon whether incidental or targeted now require Section 10 permits through NMFS or a Section 7 consultation if funded through a federal grant program. These permit requirements directly influence the data collection abilities of the NCDMF and the thus completing research recommendations.

LITERATURE CITED

Atlantic States Marine Fisheries Commission (ASMFC). 1998. Amendment 1 to the interstate fishery management plan for Atlantic Sturgeon. Atlantic States Marine Fisheries Commission, Atlantic Sturgeon Plan Development Team, Washington, D.C.

TABLES

Table 1. Mean, minimum, and maximum lengths of Atlantic sturgeon collected from the Albemarle Sound Independent Gill Net survey from 2005 through 2014.

Year	Mean	Minimum	Maximum	Collection Number
2003	N/A	N/A	N/A	1
2004	581	330	820	25
2005	631	467	814	28
2006	600	336	1,135	39
2007				
2008	639	480	845	18
2009				
2010				
2011	763	464	1,386	4
2012	651	464	900	10
2013	643	492	920	29
2014	684	405	1,524	42
Total	635	330	1,524	196

Table 2. Mean, minimum, and maximum lengths of Atlantic sturgeon collected from the Albemarle Sound Independent Gill Net survey from 2005 through 2014.

Year	Mean	Minimum	Maximum	Collection Number
2005	516	231	850	48
2006	570	230	1,473	62
2007	528	230	770	66
2008	543	257	840	124
2009	629	391	800	55
2010	579	395	812	32
2011	604	393	1,498	47
2012	574	296	1,060	64
2013	556	275	1,395	139
2014	609	355	1,180	69

Table 3. Mean, minimum, and maximum lengths of Atlantic sturgeon collected from the Pamlico Sound Independent Gill Net survey from 2005 through 2014.

Year	Mean	Minimum	Maximum	Collection Number
2005	657	574	795	20
2006	765	522	790	13
2007	531	654	1,495	5
2008	663	643	947	2
2009	967	967	967	1
2010	606	200	698	4
2011				0
2012	1,415	1,415	1,415	1
2013				0
2014				0

Table 4. Mean, minimum, and maximum lengths of Atlantic sturgeon collected from the Pamlico, Pungo, and Neuse Rivers Independent Gill Net survey from 2005 through 2014.

Year	Mean	Minimum	Maximum	Collection Number
2005	463	358	794	29
2006	627	480	735	4
2007	516	400	714	3
2008	532	532	532	1
2009	706	716	716	1
2010				0
2011	2,300	2,300	2,300	1
2012	625	625	625	1
2013				0
2014	N?A	N/A	N/A	1

Table 5. Mean, minimum, and maximum lengths of Atlantic sturgeon collected through section 6 funding in the Cape Fear River and Albemarle Sound, North Carolina, 2011-2013.

Year	Mean	Minimum	Maximum	Number
2011	960	630	1,620	45
2012	948	772	1,753	21
2013	862	605	1,162	28
Total	928	772	1,753	94

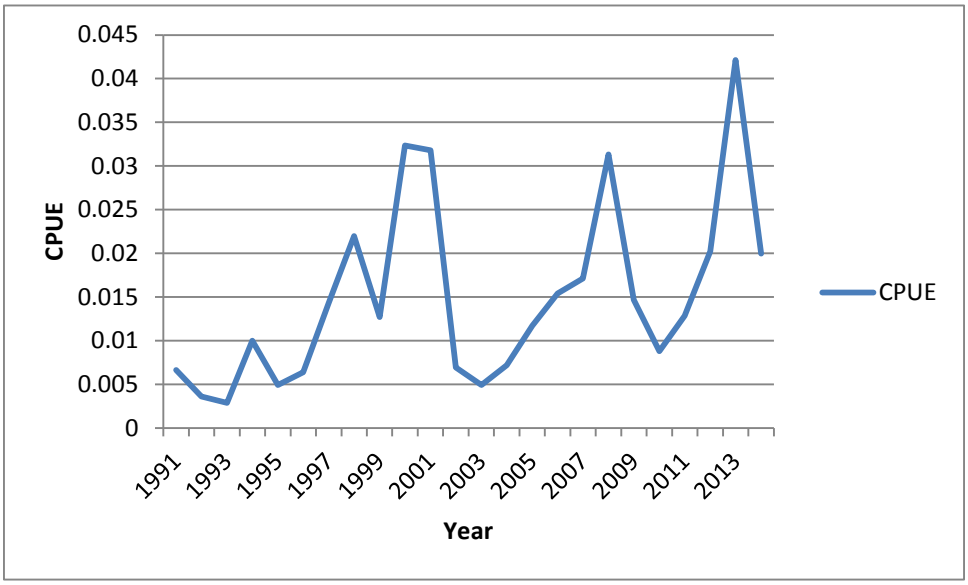


Figure 1. Catch per unit effort of Atlantic sturgeon collected from the Albemarle Sound Independent Gill Net Survey from 1991 through 2014.

FISHERY MANAGEMENT PLAN UPDATE
DOLPHIN
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	December 2003
Amendments:	Amendment 1 – July 2010 Amendment 2 – April 2012 Amendment 5 – July 2013
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	None

The South Atlantic Fisheries Management Council (SAFMC), in cooperation with the Mid-Atlantic and New England Councils, developed a Dolphin/Wahoo Fishery Management Plan (FMP) for the Atlantic in 2004. While dolphin was not overfished, the Council adopted a precautionary and risk-averse approach to management for this fishery and to maintain status quo over the years 1993 through 1997. In 2013, Amendment 5 was approved and adopted by the SAMFC and was the most comprehensive amendment to the Dolphin/Wahoo FMP, in terms of management measures and process updates. Amendment 5 updated the annual catch limits (ACLs) and accountability measures (AM) for both sectors as well as the acceptable biological catch (ABC) values and ACT for the recreational fishery in an effort to achieve optimum yield (OY) of the stock. This amendment also sets up an abbreviated framework procedure whereby modifications to the ACLs, ACTs, and AMs can be implemented by National Marine Fisheries Service (NMFS) without a full FMP supplement.

Management Unit

The management unit for dolphin encompasses all U.S. waters of the Atlantic in the 3 – 200 mile Exclusive Economic Zone (EEZ).

Goals and Objectives

1. Address localized reduction in fish abundance. The Councils remain concerned over the potential shift of effort by longline vessels to traditional recreational fishing grounds and the resulting reduction in local availability if commercial harvest intensifies.

2. Minimize market disruption. Commercial markets (mainly local) may be disrupted if large quantities of dolphin are landed from intense commercial harvest or unregulated catch and landing by charter or other components of the recreational sector.

3. Minimize conflict and/or competition between recreational and commercial user groups. If commercial longlining effort increases, either directing on dolphin and wahoo or targeting these species as a significant bycatch, conflict and/or competition may arise if effort shifts to areas traditionally used by recreational fishermen.

4. Optimize the social and economic benefits of the dolphin and wahoo fishery. Given the significant importance of dolphin and wahoo to the recreational sector throughout the range of these species and management unit, manage the resources to achieve optimum yield on a continuing basis.

5. Reduce bycatch of the dolphin fishery. Bycatch is a problem in the pelagic longline fishery for highly migratory species. Any increase in overall effort, and more specifically shifts of effort into nearer shore, non-traditional fishing grounds by swordfish and tuna vessels, may result in increased bycatch of non-target species. In addition, National Standard 9 requires that: “Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.” Therefore bycatch of the directed dolphin fishery must be addressed. Appendix C (FSEIS for HMS Regulatory Amendment 1) contains data on dolphin-wahoo pelagic longline fishery analysis. The data presented on page C-66 and in Table C-4 indicate that pelagic longlines targeting dolphin do in fact result in a bycatch of HMS species.

6. Direct research to evaluate the role of dolphin and wahoo as predator and prey in the pelagic ecosystem.

7. Direct research to enhance collection of biological, habitat, social, and economic data on dolphin and wahoo stocks and fisheries.

STATUS OF THE STOCK

Stock Status

A surplus production model was fit to abundance indices estimated from long line catches and total landings of the fisheries from years 1985 – 1997. It was concluded that the stock status, as of 1998, is above B_{MSY} and that the species is able to withstand a relatively high rate of exploitation.

Stock Assessment

No formal assessment has been conducted on dolphin in the Atlantic due to uncertainties in the extent of the North Atlantic stock and the jurisdictional cooperation necessary to characterize catch across the range of the species.

STATUS OF THE FISHERY

Current Regulations

There is a 10 fish/day bag limit with a 60 fish per boat/day trip limit (headboats excluded from daily trip limit) for recreationally harvested dolphin North Carolina. No trip limit exists for commercial harvest.

Commercial Landings

Commercial landings have fluctuated over the last 10 years with a high of 611,962 lbs valued at $1,030,145 in 2009 and a low of 94,210 lbs valued at $244,752 in 2011 (Fig. 1). Over 75% of dolphin landings were harvested using surface longlines with the remainder of the harvests coming from the pelagic troll and greenstick fisheries.

Recreational Landings

Recreational landings of dolphin have declined over the last 10 years with a high of 5,850,339 lbs in 2005 and a low of 1,388,209 lbs in 2014 (Figure. 2). This trend is likely due to a decline in effort within the recreational fishery related to the economic downturn in 2008, and likely not due to affects related to over harvest (Figure. 3).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Fishery dependent length-frequency information for the commercial dolphin fishery in North Carolina is collected by port agents through the trip ticket program, specifically programs 438 and 439. Size trends in landed fish appear to correspond with varying levels of commercial harvest (Table 1; Figure. 1).

Fishery-Independent Monitoring

Currently, the division does not have any fishery-independent sampling programs that target or catch dolphin in great numbers.

MANAGEMENT STRATEGY

Dolphin is currently included in the North Carolina Interjurisdictional Fishery Management Plan, which defers to South Atlantic Fishery Management Council Fishery Management Plan compliance requirements. The South Atlantic Fishery Management Council approved a Fishery Management Plan for dolphin in 2004 and is currently managed under recent Amendment 5 (2014). Current regulations for dolphin are as follows:

15A NCAC 03M .0515 DOLPHIN

(a) It is unlawful to possess more than 10 dolphin per person per day taken by hook and line for recreational purposes.

(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) It is unlawful to take or possess more than 10 dolphin per person per day, or sell 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.

MANAGEMENT AND RESEARCH NEEDS

Prioritized EFH Research Needs for Dolphin and Wahoo

1. What is the areal and seasonal abundance of pelagic *Sargassum* off the southeast U.S.?
2. Develop methodologies to assess remotely assess *Sargassum* using aerial or satellite technologies (e.g., Synthetic Aperture Radar)
4. What is the relative importance of pelagic *Sargassum* weedlines and oceanic fronts for early life stages of dolphin and wahoo?
5. Are there differences in abundance, growth rate, and mortality?
6. What is the age structure of all fishes that utilize pelagic *Sargassum* habitat as a nursery and how does it compare to the age structure of recruits to pelagic and benthic habitats?
7. Is pelagic *Sargassum* mariculture feasible?
8. Determine the species composition and age structure of species associated with pelagic *Sargassum* when it occurs deeper in the water column?
9. Additional research on the dependencies of pelagic *Sargassum* productivity on the marine species using it as habitat.
10. Quantify the contribution of nutrients to deepwater benthic habitat by pelagic *Sargassum*.
11. Studies should be performed on the abundance, seasonality, life cycle, and reproductive strategies of Sargassum and the role this species plays in the marine environment, not only as an essential fish habitat, but as a unique pelagic algae.
12. Research to determine impacts on the *Sargassum* community, as well as the individual species of this community that are associated with, and/or dependent on, pelagic *Sargassum*. Human induced (tanker oil discharge; trash) and natural threats (storm events) to *Sargassum* need to be researched for the purpose of protecting and conserving this natural resource.
13. Develop cooperative research partnerships between the Council, NMFS Protected Resources Division, and state agencies since many of the needs to a) research pelagic *Sargassum*, and b) protect and conserve pelagic *Sargassum* habitat, are the same for both managed fish species and listed sea turtles.
14. Direct specific research to further address the association between pelagic *Sargassum* habitat and post-hatchling sea turtles

Prioritized Biological Research Needs for Dolphin and Wahoo.

1. In the short-term effort should be directed at examining all existing seasonality (effort and landings), mean size, and life history data for dolphin from the northern area.
2. Additional data are needed to develop and/or improve estimates of growth, fecundity, etc. Research in this area is encouraged.
3. There are limited social and economic data available. Additional data need to be obtained and evaluated to better understand the implications of fishery management options.
4. Trophic data should be considered in support of an ecosystem management approach.
5. Essential fish habitats for dolphin and wahoo need to be identified.
6. An overall design should be developed for future tagging work. This could be done by the Working Group. In addition, existing tagging databases should be examined.

7. Long-term work should continue and expand on current research investigating genetic variability of dolphin populations in the western central Atlantic.
8. Observer programs should place observers on longline trips directed on dolphin. Catch and bycatch characterization, condition released (alive or dead), etc. should be collected. Observers could also be used to collect bioprofile data (size, sex, hard parts for aging, etc.).
9. High levels of uncertainty in inter-annual variation in abundance of dolphin should be investigated through an examination of oceanographic and other environmental factors.
10. Release mortality should be investigated as a part of the evaluation of the effectiveness of current minimum size limits in the dolphin fishery.
11. Establish a list serve for dolphin and wahoo which would facilitate research and the exchange of information.

LITERATURE CITED

SAFMC 2003. Fishery management plan for the dolphin and wahoo fishery of the Atlantic. South Atlantic Fishery Management Council. Charleston, SC. 308 pp.

SAFMC 2003. Amendment 5 to the fishery management plan for the dolphin and wahoo fishery of the Atlantic. South Atlantic Fishery Management Council. Charleston, SC. 106 pp.

TABLES

Table 1. Mean, minimum and maximum fork lengths (mm) and total number sampled of dolphin from commercial fish house sampling.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	689	420	1140	184
2006	707	426	1342	172
2007	758	348	1097	228
2008	665	413	1135	231
2009	815	140	1295	555
2010	628	345	1115	451
2011	665	410	1120	269
2012	756	430	1245	579
2013	700	478	1440	176
2014	788	390	1352	339

FIGURES

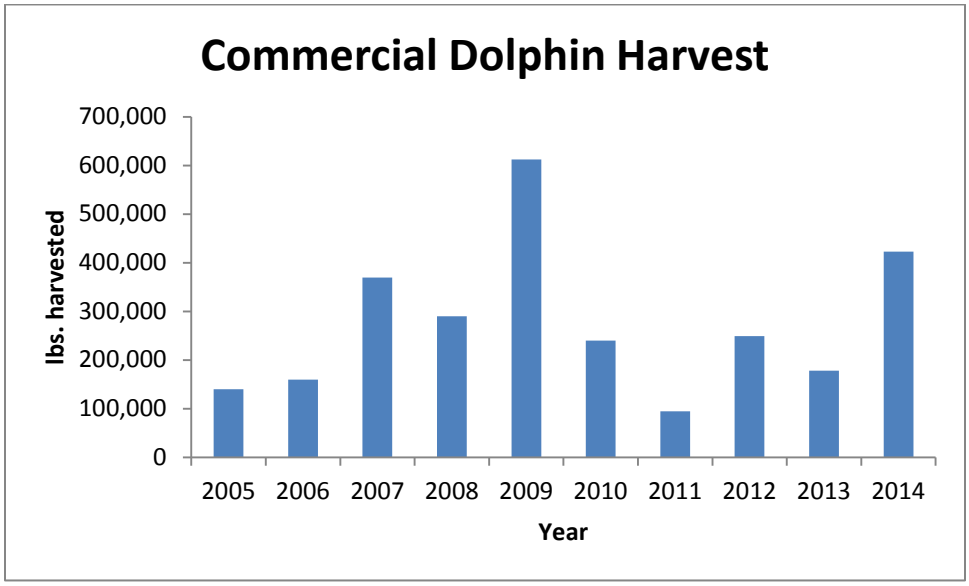


Figure 1. Commercial landings (lbs) of dolphin from 2005-2014.

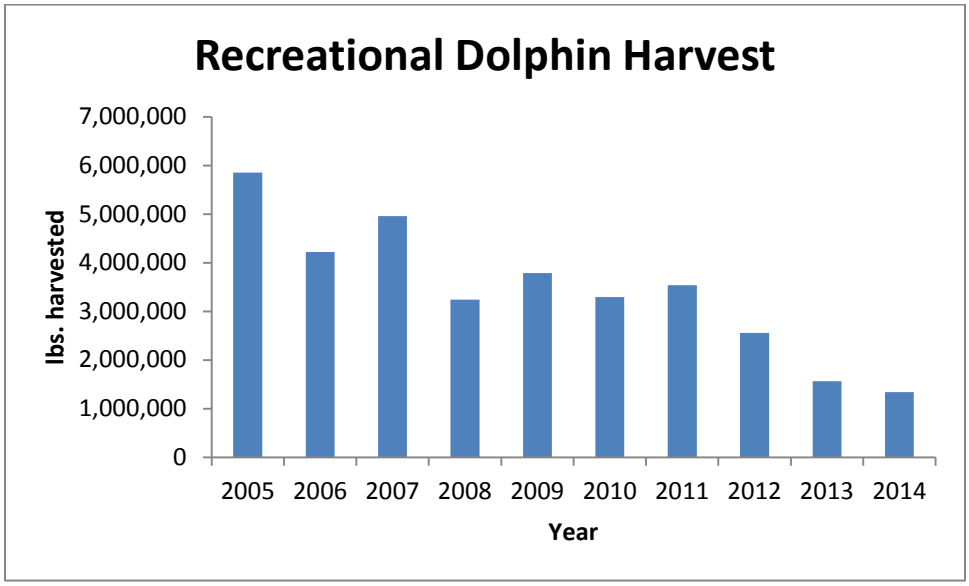


Figure 2. Recreational landings (lbs) of dolphin from 2005-2014.

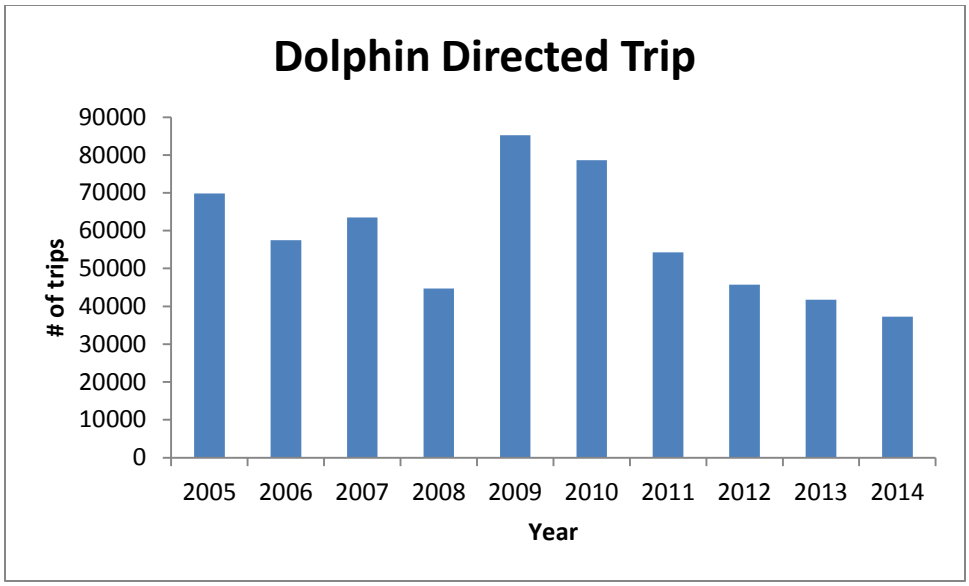


Figure 3. Number of directed recreational trips for dolphin by year.

FISHERY MANAGEMENT PLAN UPDATE
KING MACKEREL
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	February 1983
Amendments:	Amendment 1 – September 1985 Amendment 3 – August 1989 Amendment 5 – August 1990 Amendment 6 – November 1992 Amendment 7 – November 1994 Amendment 8 – March 1998 Amendment 9 – April 2000 Amendment 10 – June 1999 Amendment 11 – December 1999 Amendment 12 – October 2000 Amendment 13 – August 1992 Amendment 14 – July 2002 Amendment 15 – February 2004 Amendment 18 – December 2011 Amendment 20a – July 2014 Amendment 20b – March 2015 Framework action – December 2014 Framework Amendment 1 – December 2014
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	A benchmark stock assessment was completed for king mackerel in the South Atlantic in 2014. The next assessment has not been scheduled.

The original Gulf and South Atlantic Fisheries Management Councils (GSAFMCs) fishery management plan (FMP) for Coastal Migratory Pelagic Resources (mackerels) was approved in 1983. This plan treated king as one U.S. stock. Allocations were established for recreational and commercial fisheries, and the commercial allocation was divided between net and hook–and–line fishermen; Established procedures for the Secretary to take action by regulatory amendment to resolve possible future conflicts in the fishery, such as establish fishing zones and local quotas to each gear or user group. Numerous amendments have been implemented since the first FMP and are described below:

Amendment 1, established in 1985 provided a framework for pre–season adjustment of total allowable catch (TAC), revised king mackerel maximum sustainable yield (MSY) downward, recognized separate Atlantic and Gulf migratory groups of king mackerel, and established fishing permits and bag limits for king mackerel. Commercial allocations among gear users were eliminated.

Amendment 3 (1998) prohibited drift gill nets for coastal pelagics and purse seines and run-around gillnets for the overfished groups of mackerels. The habitat section of the FMP was updated and vessel safety considerations were included in the plan. A new objective to minimize waste and bycatch in the fishery was added to the plan.

Amendment 5 established in 1990 Extended the management area for the Atlantic groups of mackerels through Mid-Atlantic Fishery Management Council (MAFMC) jurisdiction. It revised problems in the fishery and plan objectives, revised the definition of "overfishing", added cobia to the annual stock assessment procedure, provided that the SAFMC will be responsible for pre–season adjustments of TACs and bag limits for the Atlantic migratory groups of mackerels, redefined recreational bag limits as daily limits; created a provision specifying that the bag limit catch of mackerel may be sold, provided guidelines for corporate commercial vessel permits, imposed a bag limit of two cobia per person per day for all fishermen, established a minimum size of 12–inch (30.5 cm.) fork length or 14–inch total length for king mackerel and included a definition of "conflict" to provide guidance to the Secretary.

Amendment 6 (1992) Identified additional problems and an objective in the fishery, provided for rebuilding overfished stocks of mackerels within specific periods, provided for biennial assessments and adjustments, provided for more seasonal adjustment actions, including size limits, vessel trip limits, closed seasons or areas, and gear restrictions, provided for commercial Atlantic Spanish mackerel possession limits, changed commercial permit requirements to allow qualification in one of three preceding years, discontinued the reversion of the bag limit to zero when the recreational quota is filled, modified the recreational fishing year to the calendar year; and changed minimum size limit for king mackerel to 20 inches fork length, and changed all size limit measures to fork length only.

Amendment 7 (1994) equally divided the Gulf commercial allocation in the Eastern Zone at the Dade–Monroe County line in Florida. The sub-allocation for the area from Monroe County through Western Florida is equally divided between commercial hook–and–line and net gear users.

Amendment 8 (1996) Identified additional problems in the fishery, specified allowable gear, established a moratorium on new commercial king mackerel permits and provided for transferability of permits during the moratorium, revised qualifications for a commercial permit, extended the management area of cobia through New York, allowed retention of up to 5 damaged king mackerel on vessels with commercial trip limits, revised the seasonal framework procedures to a). delete a procedure for subdividing the Gulf migratory group of king mackerel, b). request that the stock assessment panel provide additional information on spawning potential ratios and mixing of king mackerel migratory groups, c). provide for consideration of public comment, d). redefine overfishing and allow for adjustment by framework procedure, e). allow changes in allocation ratio of Atlantic Spanish mackerel, f). allow setting zero bag limits, g). allow gear regulation including prohibition.

Amendment 9 (2000) changed the percentage of the commercial allocation of TAC for the Florida east coast (North Area) and Florida west coast (South/West Area) of the Eastern Zone to 46.15 percent North and 53.85 percent South/West (previously, this allocation was

50%/50%); and allowed possession of cut-off (damaged) king or Spanish mackerel that comply with the minimum size limits and the trip limits in the Gulf, Mid-Atlantic, or South Atlantic EEZ (sale of such cut-off fish is allowed and is in addition to the existing allowance for possession and retention of a maximum of 5 cut-off (damaged) king mackerel that are not subject to the size limits or trip limits, but that cannot be sold or purchased, nor counted against the trip limit). (Note: Several other changes were made involving allocation and gear restrictions that affected the Florida west coast and Gulf fisheries).

Amendment 10 (1998) designated Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concerns for coastal migratory pelagics.

Amendment 11 (1998) amended the FMP as required to make definitions of MSY, optimal yield (OY), overfishing and overfished consistent with "National Standard Guidelines"; identified and defined fishing communities and addressed bycatch management measures.

Amendment 12 (1999) extended the commercial king mackerel permit moratorium from October 15, 2000 to October 15, 2005, or until replaced with a license limitation, limited access, and/or individual fishing quota or individual transferable quota system (ITQ), whichever occurs earlier.

Amendment 13 (2002) established two marine reserves in the exclusive economic zone (EEZ) of the Gulf of Mexico in the vicinity of the Dry Tortugas, Florida known as Tortugas North and Tortugas South, in which fishing for coastal migratory pelagic species is prohibited. This action complements previous actions taken under the National Marine Sanctuaries Act.

Amendment 14 (2002) established a 3-year moratorium on the issuance of charter vessel and headboat Gulf group king mackerel permits in the Gulf unless sooner replaced by a comprehensive effort limitation system. The control date for eligibility was established as March 29, 2001. The amendment also includes other provisions for eligibility, application, appeals, and transferability of permits.

Amendment 15 (2005) established an indefinite limited access program for king mackerel in the EEZ under the jurisdiction of the Gulf of Mexico, South Atlantic, and Mid-Atlantic Fishery Management Councils; Changed the fishing year to March 1 through February 28/29 for Atlantic group king and Spanish mackerels.

Amendment 18 establishes Annual Catch Limits and Accountability Measures for king and Spanish mackerel, as well as cobia.

Amendment 20a prohibits the sale of king mackerel caught under the bag limit unless the fish are caught as part of a state-permitted tournament and the proceeds from the sale are donated to charity. In addition, the rule removes the income qualification requirement for king mackerel commercial vessel permits.

Amendment 20b eliminates the 500-pound trip limit that is effective when 75 percent of the respective quotas are landed for king mackerel in the Florida west coast Northern and Southern Subzones, allows transit of commercial vessels with king mackerel through areas closed to king mackerel fishing, if gear is appropriately stowed, creates Northern and Southern Zones for Atlantic migratory group king and Spanish mackerel, each with separate quotas. NOAA Fisheries will close each zone when the respective quota is met or expected to be met. The dividing line between the zones is at the North Carolina/South Carolina state line.

A stock assessment was completed for king mackerel in the South Atlantic in 2014, concluding that the stock was not overfished and overfishing was not occurring.

Management Unit

King mackerel are managed under the jurisdiction of The Coastal Migratory Pelagic FMP jointly with the Gulf of Mexico Fishery Management Council. The management unit is defined as King mackerel within US waters of the South Atlantic and Gulf of Mexico. Current management defines two migratory units: Gulf Migratory Group and Atlantic Migratory Group.

Goals and Objectives

Amendment 12 to the Gulf and South Atlantic Fishery Management Councils FMP for Coastal Migratory Pelagics lists eight plan objectives:

1. The primary objective of the FMP is to stabilized yield at MSY, allow recovery of overfished populations, and maintain population levels sufficient to ensure adequate recruitment.

2. To provide a flexible management system for the resource which minimizes regulatory delay while retaining substantial Council and public input in management decisions and which can rapidly adapt to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups or by areas.

3. To provide necessary information for effective management and establish a mandatory reporting system.

4. To minimize gear and user group conflicts.

5. To distribute the TAC of Atlantic migratory group Spanish mackerel between recreational and commercial user groups based on the catches that occurred during the early to mid-1970s, which is prior to the development of the deep water run-around gill net fishery and when the resource was not overfished.

6. To minimize waste and bycatch in the fishery.

7. To provide appropriate management to address specific migratory groups of king mackerel.

8. To optimize the social and economic benefits of the coastal migratory pelagic fisheries.

STATUS OF THE STOCK

Stock Status

An integrated Stock Synthesis approach was used assess the stock (SEDAR 38) in a benchmark assessment in 2014 and predicts that Atlantic king mackerel are not overfished and overfishing is not occurring.

Stock Assessment

Fishery independent data from the SEAMAP Trawl Survey for the Atlantic and fishery dependent information collected from NMFS MRFSS, Headboat and Logbook survey as well as NCDMF Trip Ticket landings information was used in constructing the assessment model. A Stock Synthesis approach was used which integrated fishery and life history indices into a statistical catch-at-age model to produce observed catch, size and age composition and CPUE

indices. Overall, stock biomass and SSB show little depletion until the 1950s when a slow decline started and then accelerated around 1980 reaching its lowest level in the late 1990s from which it increased until 2010. Since 2010 there has been a slight decrease in SSB (Figure. 1). Key biological reference points and associated benchmarks (SSB_{MSY} and F_{MSY}) were successfully derived and the overall consensus derived from sensitivity analysis of the model predict that the Atlantic stock of king mackerel is not overfished and overfishing is not occurring.

STATUS OF THE FISHERY

Current Regulations

Commercial: 3,500 lb trip limit

Recreational: 24 inches FL minimum size; 3 fish/day

Commercial Landings

Since 2005, commercial landings of king mackerel have declined from a high of 1,246,088 lbs to < 500,000 lbs since 2012 (Figure 2.)

Recreational Landings

During the time series (2005 – 2014), estimated MRIP landings of king mackerel peaked in 2007 at 2,530,097 lbs and declined sharply over the next 4 years to a low of 180,014 lbs in 2011and stayed below 400,000 lbs for the remainder of the series (Figure 3.)

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Length-frequency information for the commercial king mackerel fishery in North Carolina is collected by port agents through the trip ticket program, specifically programs 438 and 439. Ageing structures are collected from king mackerel fishing tournaments statewide and sent to the Southeast Fisheries Science Center in Panama City, Florida for processing and aging (Table 1). Maximum sizes of king mackerel sampled over the last 10 years have remained steady at ~1400 mm while mean annual sizes varied from 730 mm in 2008 to 990 mm in 2013 (Table 2).

Fishery-Independent Monitoring

Currently, the division does not have any fishery-independent sampling programs that target or catch king mackerel in great numbers.

MANAGEMENT STRATEGY

In North Carolina, king mackerel are currently included in the Interjurisdictional Fishery Management Plan, which defers to the South Atlantic Fishery Management Council management measures compliance requirements and is currently managed under recent Amendments 20A (2014) and 20B (2015) to the Coastal Migratory Pelagics Fishery Management Plan. Amendment 20A prohibits the sale of all bag-limit-caught king mackerel,

except those harvested during a state-permitted tournament. Amendment 20B establishes separate commercial quotas of Atlantic king mackerel for a Northern Zone (north of North Carolina/South Carolina line) and Southern Zone (south of North Carolina/South Carolina line NC/SC line). The South Atlantic Fishery Management Council is currently developing Amendment 26 to update the Atlantic king mackerel annual catch limits and adjust the mixing zone based on the results of the 2014 stock assessment, and to provide an incidental catch allowance of Atlantic king mackerel in the small coastal shark gillnet fishery. Current management strategies for king mackerel in South Atlantic waters are summarized in Table 3.

MANAGEMENT AND RESEARCH NEEDS

From SEDAR 38 report:

Develop a survey to obtain reliable age/size composition data and relative abundance of adult fish. This could be done using gillnets or handlines. The review panel recommends that the design of a scientific survey be peer reviewed.

Determine most appropriate methods to deal with changing selectivity in fisheries over time, particularly changing selectivity related to management actions or targeting of specific cohorts. The review panel suggests that historical mark-recapture data available from NMFS SEFSC and FWRI could be used to compare size composition of recaptures for different fishing gears to evaluate selectivity for historic periods.

Determine stock mixing rates using otolith microchemistry and/or otolith shape analysis on a routine basis that would allow future stock assessments to capture the dynamic spatial and temporal nature of mixing of the Atlantic and Gulf of Mexico stocks, and consider evaluating stock mixing within integrated modeling approaches.

More accurately characterize juvenile growth by increasing samples of age-0 and 1 fish. Further investigate 2-phase growth models including different breakpoints and different growth models to better model size and age. Consider if there is temporal (annual and seasonal) variability in growth rates. Results of this analysis in terms of the best model will need to be implementable in SS3 to continue with the integrated modeling approach.

Determine if female spawning periodicity varies by size or age.

Expand the SEAMAP trawl survey below the Cape Canaveral area and potentially into deeper continental shelf waters.

Consider conducting an extensive tagging program to: a) better understand migration patterns; b) provide additional and individual growth rate information; c) better understand fishery selectivity; d) provide fishery exploitation rates; and e) provide information about natural mortality rates. Fishery independent recapture information (i.e., use acoustic and satellite tags) will assist with a). Age at capture information of tagged animals will assist with b). A multi-year tagging program will be required for e). The review panel recommends that a specific workshop be held to consider in detail the design of a tagging program.

LITERATURE CITED

SAFMC Amendment 20a to the fishery management plan for the coastal migratory pelagic resources of the Gulf of Mexico and the South Atlantic. South Atlantic Fishery Management Council. Charleston, SC. 157 pp.

SEDAR 38 Stock Assessment report South Atlantic king mackerel. SEDAR Charleston, SC. 502 pp.

TABLES

Table 1. Mean, minimum and maximum fork lengths (mm) and total number sampled of king mackerel aged through Program 930.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	947.4	498	1400	444
2006	956.4	433	1375	435
2007	961.8	488	1390	507
2008	872.1	595	1365	450
2009	914.3	615	1400	415
2010	961.7	589	1452	386
2011	948.9	595	1448	429
2012	955.8	588	1421	597
2013	1021.3	612	1430	413
2014	1016.3	118	1500	388

Table 2. Mean, minimum and maximum fork lengths (mm) and total number sampled of king mackerel from fishery dependent sampling programs.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	856.0	410	1400	848
2006	894.5	433	1375	725
2007	731.9	70	1390	1047
2008	730.8	43	1365	2179
2009	784.4	383	1405	1477
2010	928.2	589	1452	583
2011	884.4	595	1929	1079
2012	933.7	588	1421	1125
2013	990.4	144	1430	506
2014	881.4	118	1500	826

Table 3. Management strategies and rules for king mackerel in the South Atlantic.

Management Strategy	Outcome
24” minimum size limit	Rule 3M.0301(b)(1)
3 fish creel limit	Rule 3M.0301(b)(2)
NMFS Commercial Vessel Permit requirements	Rule 3M.0301(b)(3)(A) Rule 3M.0301(b)(3)(B)
Unlawful to use gill nets south of Cape Lookout for more than 3 king mackerel	Rules 3M.0501(b)(4)
Charter vessels or head boats with NMFS Commercial Vessel Permit must comply with possession limits when fishing with more than 3 persons	Rules 3M.0501(c)
Commercial trip limit of 3,500 lbs of King, Spanish or aggregate	Rule 3M.0501(d)
Prohibits Purse Gill Nets when taking king or Spanish mackerel	Rule 3M.0302

FIGURES

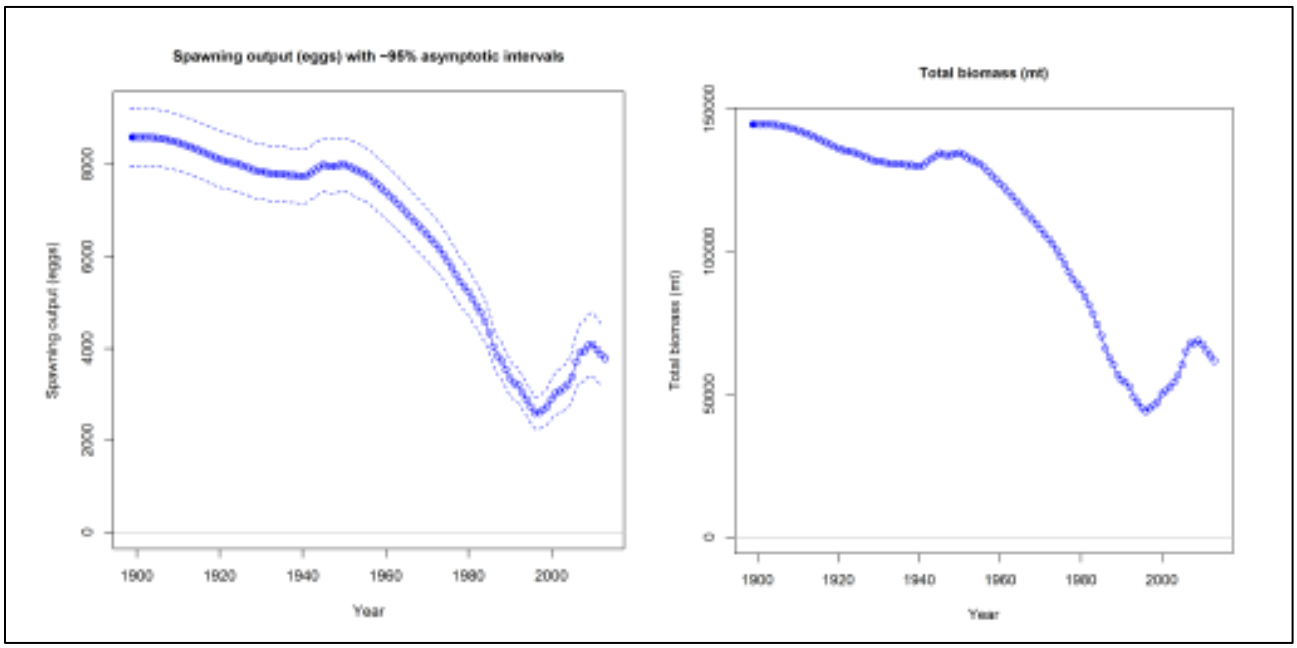


Figure 1. Predicted spawning biomass with 95% CI and total biomass in whole metric tons for king mackerel in Atlantic waters. Figure taken from SEDAR 38.

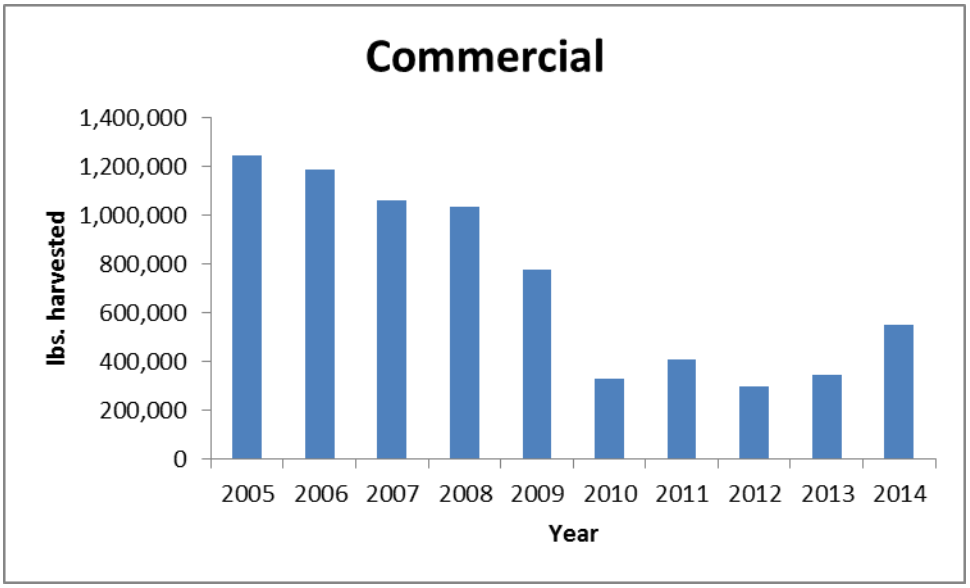


Figure 2. Commercial landings of king mackerel in North Carolina from 2005 - 2014.

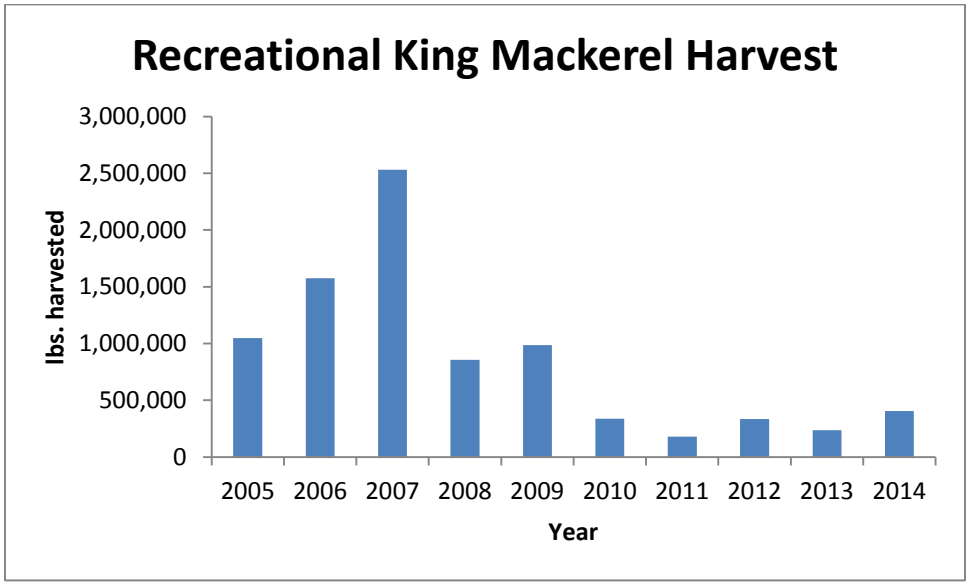


Figure 3. Estimated recreational harvest of King Mackerel in North Carolina from 2005 – 2014.

FISHERY MANAGEMENT PLAN UPDATE
MONKFISH
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 1999
Amendments:	Amendment 1 (April 1999) Amendment 2 (May 2005) Amendment 3 (February 2008) Amendment 4 (Under Development) Amendment 5 (March 2011)
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	Fall 2016

The New England Fishery Management Council (NEFMC) and Mid-Atlantic Fishery Management Councils (MAFMC) adopted a rebuilding plan for monkfish in November 1999. NEFMC has the administrative lead. The Monkfish Fishery Management Plan (FMP) is designed to stop overfishing and rebuild the stocks through a number of measures, including: limiting the number of vessels with access to the fishery and allocating days-at-sea for those vessels; setting limits for vessels fishing for monkfish; minimum fish size limits; gear restrictions; mandatory time out of the fishery during spawning season; and a framework adjustment process. The Councils manage the fishery as two stocks, Southern Fishery Management Area (SFMA) and Northern Fishery Management Area (NFMA). North Carolina is in the SFMA (SFMA) that ranges from the southern flank of Georges Bank through the Mid-Atlantic Bight to North Carolina.

In 2006, North Carolina and NOAA Fisheries Southeast Regional Office (SERO) entered into an agreement enabling limited large mesh gill net fisheries for striped bass and monkfish in state waters. The large mesh monkfish fishery, for gill nets with a stretched mesh greater than seven inches, is open by proclamation from March 16 through April 14 unless closed sooner by proclamation. The Atlantic Ocean is closed to the use of gill nets greater than seven inches stretched mesh from December 22 through April 14 by proclamation, with the exception of the monkfish and striped bass fisheries. The agreement allows the state to implement Atlantic sturgeon, sea turtle and marine mammal conservation measures under its proclamation authority as well as gear restrictions on large mesh gillnets. Participants in this fishery must confine their fishing efforts to waters from the NC/VA state line to Wimble Shoals (out 2 miles but not more than 3), and report any sea turtle or marine mammal interactions. Each year, North Carolina contacts the NOAA Fisheries SERO to ensure that they have enough days-at-

sea observer coverage for the opening of the fishery. Once NOAA Fisheries has confirmed observer coverage a proclamation is issued opening the large mesh fishery to gill nets greater than seven inches in the Atlantic Ocean. Large mesh gill nets were required to be fished every 48 hours, weather permitting. The area could be closed if reliable sea surface temperature data indicated water temperatures greater than 11° C or if an interaction occurred between large mesh gill nets and marine mammals or sea turtles. Masters of vessels that fish for monkfish in the specified area are required to possess a current year monkfish large mesh gill net permit issued by North Carolina Division of Marine Fisheries (NCDMF) to valid commercial license holders. The permit requires holders to report weekly trip information to NCDMF and mandated participation in the NOAA Fisheries observer program, in order to monitor interactions with protected species.

The original FMP was modified and amended to include an annual measure of the status of the stocks and adjustment to management measures as needed to maintain a 10-year rebuilding schedule. In April 1999, the councils adopted Amendment 1 to the monkfish FMP, which described and identified the essential fish habitat (EFH) for the monkfish fishery, compliant with provisions of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). Framework Adjustment 1 to the FMP, effective June 1999, implemented management measures for FY 2002, provided for a one-year delay in default measures for Year 4, and adjusted trip limits to account for court decision on differential gear-based limits.

Framework Adjustment 2 to the FMP, effective May 2004, established a process to determine an annual total allowable catch (TAC) and appropriate fishing measures for each management area. This method is based upon the relationship between the 3-year running average of National Marine Fisheries Service's (NOAA FISHERIES) fall trawl survey biomass index and established biomass index targets. The data indicated that the biomass indices were less than the current targets for both management areas. Due to concern about the ability of the stocks to rebuild to target levels by the end of the 10 year rebuilding period under this process, the Councils modified the management measures in the NMFA and changed the annual adjustment process.

Amendment 2 to the FMP, effective May 2005, included measures to address Essential Fish Habitat (EFH) and bycatch issues, as well as other issues raised during the public scoping process. Amendment 2 did not modify the stock-rebuilding program established in Framework Adjustment 2. Amendment 2 implemented the following measures: a new limited access permit for qualified vessels fishing south of 38°20'00.00 N latitude (south of Ocean City, MD); an offshore monkfish fishery in the Southern Fishery Management Area (SFMA); a maximum roller-gear disc diameter of 6 inches in the SFMA; closure of two deep-sea canyon areas to all gears when fishing under monkfish days at sea (DAS); establishment of a research DAS set-aside program and a DAS exemption program; a North Atlantic Fisheries Organization Regulated Area Exemptions Program; adjustments to the monkfish incidental catch limits (from 50 lb/trip to 50 lb/day not to exceed 150 lb/trip or, for qualified vessels, no more than 5 percent of the total weight of fish on board, not to exceed 450 lb tail weight); a decrease in the monkfish minimum size in the SFMA (from 14 inches to 11 inches tail length or 21 inches to 17 inches total length) to correspond to the size limits in the Northern Fishery Management Area (NFMA); removal of the 20-day block requirement; and new additions to the list of actions that can be taken under the framework adjustment process contained in the FMP.

A stock assessment (40th Northeast Regional Stock Assessment Workshop (SAW 40)) from November of 2004 showed that monkfish were not overfished in either the NFMA or the SFMA

based on existing reference points. Overfishing could not be determined as fishing mortality rates estimated from NEFSC and Cooperative survey data were not reliable.

Despite several years of increase in biomass in both stocks, by the fall of 2006 both stocks were considered to be in decline with approximately 50% of the biomass being below the annual biomass index targets. Framework Adjustment 3 to the FMP, effective November 2006, prohibited targeting monkfish on Multispecies permit B-regular days-at-sea (DAS). In 2007, Framework Adjustment 4 to the FMP was proposed by the Council to revise the monkfish management program so that the goals of the rebuilding plan could be met. Framework Adjustment 4 included, among other measures, a backstop provision that would adjust and potentially close, the directed monkfish fishery in 2009 if the landings in the 2007 fishing year exceeded the target total allowable catch by more than 30 percent.

Amendment 3 to the FMP, effective February 2008, included monkfish in part of the standardized bycatch reporting methodology omnibus amendment. The omnibus amendment was applied to FMPs of the MAFMC and NEFMC and was developed to address the requirements of the Magnuson-Stevens Act to include, in all FMPs, a standardized bycatch reporting methodology.

In July 2007, the Northeast Data Poor Stocks Working Group (DPWG) completed a new stock assessment which indicated that the monkfish stocks were not overfished and overfishing was no longer occurring. The council adopted new revised reference points recommended by the DPWG in May 2008, as Framework Adjustment 5 to the FMP. Framework Adjustment 6 to the FMP was also implemented in 2008, eliminating the backstop provision adopted in Framework Adjustment 4. The backstop provision would have adjusted and possibly closed the monkfish fishery in FY 2009 if landings exceeded the target total allowable catch (TAC) by more than 30 percent. Given that both stocks were rebuilt, the backstop provision was no longer deemed necessary.

Amendment 5 to the FMP, effective May 2011, was issued to bring the Monkfish FMP into compliance with the 2007 re-authorization of the Magnuson-Stevens Act. The Magnuson-Stevens Act was reauthorized and revised; it included the requirement that all FMPs establish Annual Catch Limits (ACLs) and measures to ensure accountability (AMs). For stocks not subject to overfishing, such as monkfish, the Act set a deadline of 2011 for the implementation of ACLs and AMs. Amendment 5 established the mechanism for specifying ACLs, AMs, annual catch target (ACT) and associated measures for DAS. Amendment 5 also brought the biological and management reference points in the FMP into compliance with the revised 2009 National Standard 1 (NS1) Guidelines.

In June 2010, another stock assessment, Stock Assessment Review Committee (SARC) 50, concluded that both stocks were above their respective biomass thresholds, and also above newly established biomass thresholds recommended during the assessment, indicating that both stocks are not overfished. The estimated fishing mortality rate for each stock was below its respective fishing mortality threshold, therefore overfishing was not occurring on either stock. The SARC 50 Report did however emphasize the continuing high degree of uncertainty in the assessment.

As a result of SARC 50, the NEFMC's Scientific and Statistical Committee (SSC) revised the estimate of ACLs for both stocks. The revised ACL for the NFMA is below the proactive AM annual catch target (ACT) for that area proposed in Amendment 5. Framework Adjustment 7, effective October 2011, adjusted the ACT for the NFMA to be consistent with the most recent

scientific advice regarding the acceptable biological catch (ABC) for monkfish. Framework Adjustment 7 also specifies a new DAS allocation and trip limits for the NFMA consistent with the new ACT. As well as, established revised biomass reference points for the NFMA and SFMA. A benchmark stock assessment for monkfish is scheduled to begin in 2016 under SARC 61.

Management Unit

In North Carolina, monkfish are included in the Interjurisdictional Fisheries Management Plan, which defers to the New England Fishery Management Council (NEFMC)/ Mid-Atlantic Fishery Management Council (MAFMC) FMP compliance requirements in federal waters (3–200 miles). Figure 1 illustrates the northern and southern fishery management areas and the boundary between the NEFMC and MAFMC.

Goal and Objectives

The FMP is intended to manage the monkfish fishery pursuant to the Magnuson-Stevens Fishery Conservation Management Act (MSFCMA) of 1976, as amended by the Sustainable Fisheries Act (SFA). The purpose of the amendment is to bring this FMP into compliance with the new and revised National Standards and other required provisions of the SFA by implementing the following:

- Reduce fishing mortality in the monkfish fishery to assure that overfishing does not occur;
- Improve the yield from this fishery;
- Promote compatible management regulations between state and federal jurisdictions;
- Promote uniform and effective enforcement of regulations; and
- Minimize regulations to achieve the management objectives stated above.

STATUS OF THE STOCK

Stock Status

Both the North and South monkfish stocks are not overfished and overfishing is not occurring. Monkfish was removed from the N.C. Stock Status Report due to the limited fishery in North Carolina. In 2014, commercial landings of monkfish were low and there were no reported recreational landings.

Stock Assessment

The NEFSC conducted a monkfish operational stock assessment in 2013. The purpose of the operational stock assessment was to update the 2010 assessment with additional data from 2010 and 2011. The model configuration has not changed substantively since the last peer-review by the SARC 50 in 2010. The model was updated with two years of data and revisions of discard estimates for 1980-2011 based on new methodology (SBRM approach). Changes in the discard estimates resulted in a minor reduction in the number of selectivity blocks in the southern stock model. Model results from the operational stock assessment indicate that the North and South monkfish stocks are not over-fished and overfishing is not occurring. The review panel summary, included in the NEFSC 2013 operational stock assessment, recommended a new benchmark assessment not proceed until new information on age, growth,

longevity and natural mortality is obtained. The review panel noted that a number of key uncertainties in landings, discards, commercial length frequencies, aging methods, life history, growth and natural mortality remain unresolved since the 2010 stock assessment. Despite these uncertainties, the work of the 2013 operational stock assessment is accepted as the best available scientific information by the review panel for assessing the status of monkfish. Projections for initial conditions of population sizes illustrated a negligible probability of the stocks becoming overfished in the short term. Based on the assessment results, the Monkfish PDT updated the OFL and ABC calculations using the default ABC control rule recommended by the SSC in 2010. The NEFSC submitted these findings in an assessment update reference document to the Council in May 2013.

This latest assessment (SARC 50) 1980-2009 placed new reference points to the existing data based on revised yield-per-recruit analysis and results of a length-tuned model that incorporates multiple survey indices and catch data. This new assessment indicates that monkfish stocks in both the Northern and Southern Management areas are not overfished and that overfishing is not taking place. To support current harvest levels and the FMP rebuilding plan for the stock, the Bthreshold is 37,245 mt for the SFMA and 26,465 mt for the NFMA. The Btarget is 74,490 mt for the SFMA and 52,930 mt for the NFMA. The 2010 estimates of total biomass are 131,218 mt for the SFMA and 66,062 mt for the NFMA. The Total Allowable Catch (TAC) remains at 15,279 mt in the SFMA and 10,745 mt in the NFMA. The assessment results continue to be uncertain due to cumulative effects of under-reported landings, unknown discards during the 1980's, uncertainty in survey indices, and incomplete understanding of key biological parameters such as age and growth, longevity, natural morality and stock structure.

Estimates (2010-2011) and projected biomass (2012-2016) were updated using the SCALE models in the 2013 assessment update. In the SFMA 2012-2016 the projected biomass ranges from 108,100 mt in 2012 to 106,600 mt in 2016, with a low of 104,200 mt in 2015. For the NFMA the projected biomass ranges from 66,600 mt in 2012 to 82,600 mt in 2016, with a low of 72,400 mt in 2013. Updated estimates of Bthreshold are 35,834 mt in the SFMA and 23,037 mt in the NFMA. Updated estimates of Btarget are 71,667 mt in the SFMA and 46,074 in the NFMA. Total updated estimates of catch are 14,328 mt SFMA and 9,383 NFMA.

STATUS OF THE FISHERY

Current Regulations

In North Carolina, a directed monkfish commercial fishery occurs from March 16 through April 14 in the Atlantic Ocean. During this time, fishermen harvesting monkfish in the Atlantic Ocean using gill nets greater than seven inches stretched mesh, must hold a valid N.C. Monkfish Large Mesh Gill Net Permit and limit fishing activity to a one mile wide area extending from two miles seaward of the coastline to three miles seaward of the coastline from the North Carolina/Virginia state line southward to Wimble Shoals (Latitude 35°30'N). The minimum size length for monkfish is 17 inches total length or 11 inches tail length for both commercial and recreational anglers. North Carolina does not set trip or possession limits for monkfish.

Commercial Landings

Annual landings of monkfish were up in 2014 compared to 2012 and 2013. Monkfish landings in North Carolina predominately occur as marketable by-catch from the summer flounder trawl fishery. In 2012 and 2013, shoaling of Oregon Inlet prevented flounder trawlers from landing in

Wanchese, NC, the closest NC port to the monkfish fishing grounds. During these years, North Carolina transferred summer flounder quota to Virginia to allow vessels to land summer flounder at Virginia fish houses when Oregon Inlet was impassible for larger vessels. In 2014, the transfer of quota between North Carolina and Virginia was not allowed; boats landed further south accessing ports through Beaufort Inlet or attempted entering Oregon Inlet when inlet conditions allowed. Tables 1 and 2 illustrate the magnitude of landings in pounds by year from each gear in both estuarine and ocean waters. For 2013 and 2014 the Atlantic Ocean large mesh gill net fishery had no reported trips and participation in the fishery has been declining. Landings from large mesh and small mesh gill nets are assumed to be as marketable by-catch and not from the targeted fishery. Prior to 2013, the landings from large mesh gill nets were significant. In recent years, weather conditions, water temperature, fish availability and activity in other fisheries have kept participation and landings low.

Recreational Landings

Not available due to low recreational activity.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

North Carolina does not have a fishery dependent monitoring program for monkfish.

Fishery-Independent Monitoring

North Carolina does not have a fishery independent monitoring program for monkfish.

MANAGEMENT STRATEGY

The monkfish fishery is managed in federal waters primarily with a days-at-sea (DAS) management system with corresponding trip limits per DAS. Every three years the biological objectives and reference points are reviewed to evaluate threshold and target biological reference points. The MAFMC or NEFMC may initiate a framework adjustment, at any time, if they find it necessary to meet or be consistent with the goals and objectives of the Monkfish FMP. The management adjustments or amendments for monkfish will require majority approval of both the MAFMC and the NEFMC. The Monkfish Monitoring Committee (MC) meets six months prior to the beginning of the next fishing year to review available data pertaining to: discards and landings; days-at-sea and other measures of fishing effort; stock status and fishing mortality rates; enforcement of and compliance with management measures; and any other relevant information. The data is provided to the MC by NMFS, but the MC may also consider data provided by the states, ASMFC, the U.S. Coast Guard and other sources. The MC reviews the data and develops target Total Allowable Catch (TAC) recommendations and management options necessary to achieve the FMP goals and objectives.

The FMP defines overfishing as when F exceeds Fmax. Overfished is defined as when the total stock biomass or Bthreshold is less than half of the Bmax Projected. The 2013 Monkfish Operational Assessment conducted by the Northeast Fisheries Science Center (NEFSC) updated the biological reference points from the 2010 stock assessment needed to evaluate stock status for both the northern and southern stock and based on the long term projections

determined that neither stock was overfished or experiencing overfishing. All of the biological reference points are based on results of the SCALE model used in the 2010 stock assessment and are subject to a high level of uncertainty due to the poor quality of data used.

Northern Stock

- Fmax = 0.44
- Bthreshold = 0.5*Bmax Projected = 23,037 mt
- Btarget = Bmax Projected = 46,074 mt
- Bmsy = Fmax Projected = 9,383 mt

Southern Stock:

- Fmax = 0.37
- Bthreshold = 0.5*Bmax Projected = 35,834 mt
- Btarget = Bmax Projected = 71,667 mt
- Bmsy = Fmax Projected = 14,328

MANAGEMENT AND RESEARCH NEEDS

From the Northeast Fisheries Science Center 2013 monkfish operational stock assessment the panel recommended further research into (NEFSC 2013):

- Resolution of age, growth, and natural mortality issues.
- Determination of movement patterns in relation to stock areas.
- Development of a one stock model given evidence of movement between the two areas and existing genetic information (on-going genetics work may resolve the two stock-area issue).
- Development of a two-sex model depending on the results of aging work (would require estimation of sex ratios in catch and survey data)

Note: The information for this Fishery Management Plan (FMP) update can be found on the Mid-Atlantic and New England Fishery Management Councils' Website (http://www.mafmc.org or http://www.nefmc.org). Information is also available on NOAA Fisheries website for the Greater Atlantic Region (http://www.greateratlantic.fisheries.noaa.gov/sustainable/species/monkfish/). Please refer to these websites for additional information.

LITERATURE CITED

NEFSC (Northeast Fisheries Science Center). 2013. 2013 Monkfish Operational Assessment. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 13-23; 116 p.

TABLES

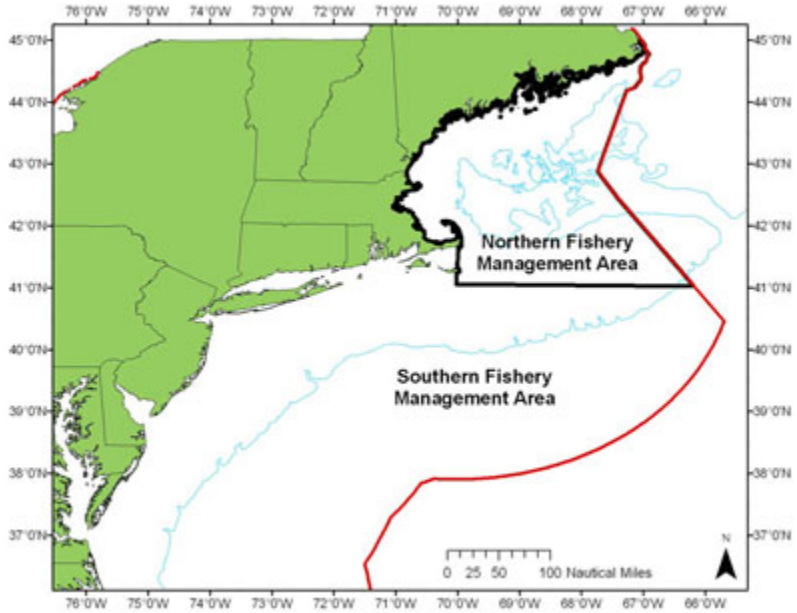
Table 1. Estuarine landings (lb) of monkfish by gear 2005-2014 (NC Trip Ticket Program).

Gear	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Crab Trawl			11		5					
Shrimp Trawl			50							
Pound Net				5				4		
Crab Pot			7							
Gill Net, < 5 inches	60	46	405		202	62	48	61	122	2
Gill Net, >=5 inches	159	74	86	180	138	30		10	27	49
Oyster Dredge								18		
Total	219	120	559	185	345	92	48	93	149	51

Table 2. Ocean landings (lb) of monkfish by gear 2005-2014 (NC Trip Ticket Program).

Gear	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Crab Trawl			11		5					
Flounder Trawl	56,423	64,424	40,026	49,961	26,967	23,960	29,371	11,626	8,009	70,988
Scallop Trawl	40	166	304	1,138				36		
Shrimp Trawl			104							
Ocean Flynet	258	1,726	2,896	2,226	1,368	7,265	162	166		1,032
Pound Net				5				4		
Crab Pot			7							
Gill Net, < 5 inches	7,550	3,456	16,238	138	18,542	460	4,072	2,673	792	834
Gill Net, >=5 inches	24,767	94,445	88,951	54,403	52,084	14,857	4,855	6,637	1,629	1,169
Gill Net, Runaround	83									
Rod-n-reel	9	45		6						22
Longline								6	11	
Oyster Dredge								18		
Scallop Dredge		156	964	180	80	28	74	150		
Total	89,130	164,418	149,501	108,057	99,046	46,570	38,534	21,316	10,441	74,045

Figure 1. 2014 Monkfish fishery management areas (NOAA Fisheries).



FISHERY MANAGEMENT PLAN UPDATE
SCUP NORTH OF CAPE HATTERAS
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	Incorporated into Summer Flounder FMP through Amendment 8 in 1996
Amendments:	Amendment 8 in 1996 Amendment 10 in 1997 Amendment 11 in 1998 Amendment 12 in 1999 Amendment 13 in 2003 Amendment 14 in 2007 Amendment 15 in 2011 Amendment 16 in 2007
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	A benchmark stock assessment is underway in 2015.

Because of their presence in, and movement between, state waters (0-3 miles) and federal waters (3-200 miles), the Mid Atlantic Fisheries Management Council manages scup north of Cape Hatteras cooperatively with the Atlantic States Marine Fisheries Commission (ASMFC). The two management entities work in conjunction with the National Marine Fisheries Service (NMFS) as the federal implementation and enforcement entity. The Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (FMP) and amendments use output controls (catch and landings limits) as the primary management tool, with landings divided between the commercial and recreational fisheries. The FMP also includes minimum fish sizes, bag limits, seasons, gear restrictions, permit requirements, and other provisions to prevent overfishing and ensure sustainability of the fisheries. Recreational bag/size limits and seasons are determined on a state-by-state basis using conservation equivalency. The commercial quota is divided into state-by-state quotas based on historical landings. Specific details for each Amendment include:

Amendments 1-7 to the FMP were completed prior to black sea bass being incorporated in the Summer Flounder, Black Sea Bass and Scup FMP

Amendment 8 - Incorporated Scup FMP into Summer Flounder FMP; established scup management measures, including commercial quotas, recreational harvest limits, size limits, gear restrictions, permits, and reporting requirements.

Amendment 10 - Modified commercial minimum mesh requirements; continued commercial vessel moratorium; prohibited transfer of summer flounder at sea; established special permit for party/charter sector for summer flounder.

Amendment 11 - Modified certain provisions related to vessel replacement and upgrading, permit history transfer, splitting, and permit renewal regulations.

Amendment 12 - Revised FMP to comply with the Sustainable Fisheries Act and established framework adjustment process; established quota set-aside for research for summer flounder, scup, and black sea bass; established state-specific conservation equivalency measures; allowed the rollover of winter scup quota; revised the start date for summer quota period for scup fishery; established a system to transfer scup at sea.

Amendment 13 - Revised black sea bass commercial quota system; addressed other black sea bass mgmt. measures; Established multi-year specification setting of quota for all three species; Established region-specific conservation equivalency measures for summer flounder; built flexibility into process to define and update status determination criteria for each plan species.

Amendment 14 - Established a rebuilding schedule for scup; scup Gear Restricted Areas made modifiable through framework adjustment process.

Amendment 15 - Established Annual Catch Limits (ACLs) and Accountability Measures

Amendment 16 - Standardized bycatch reporting methodology.

Management Unit

U.S. waters in the western Atlantic Ocean from Cape Hatteras northward to the U.S.-Canadian border.

Goal and Objectives

The objectives of the Summer Flounder, Black Sea Bass and Scup FMP are to:

1. Reduce fishing mortality in the summer flounder, scup and black sea bass fisheries to assure that overfishing does not occur;

2. Reduce fishing mortality on immature summer flounder, scup and black sea bass to increase spawning stock biomass (SSB);

3. Improve the yield from these fisheries;

4. Promote compatible management regulations between state and federal jurisdictions;

5. Promote uniform and effective enforcement of regulations;

6. Minimize regulations to achieve the management objectives stated above.

The 2011 Omnibus Amendment contains Amendment 15 to the Summer Flounder, Black Sea Bass and Scup FMP (the most recent Amendment that impacts the scup fishery). The amendment is intended to formalize the process of addressing scientific and management

uncertainty when setting catch limits for the upcoming fishing year(s) and to establish a comprehensive system of accountability for catch (including both landings and discards) relative to those limits, for each of the managed resources subject to this requirement. Specifically: (1) Establish Allowable Biological Catch (ABC) control rules, (2) Establish a Council risk policy, which is one variable needed for the ABC control rules, (3) Establish ACL(s), (4) Establish a system of comprehensive accountability, which addresses all components of the catch, (5) Describe the process by which the performance of the annual catch limit and comprehensive accountability system will be reviewed, (6) Describe the process to modify the measures above in 1-5 in the future.

STATUS OF THE STOCK

Stock Status

The stock is considered to be viable. The 2015 Benchmark Stock Assessment for U.S. waters north of Cape Hatteras indicates the stock is not overfished nor is overfishing occurring relative to biological reference points.

Stock Assessment

The 2015 Benchmark Stock Assessment used a statistical catch at age model calculated using the Age Structured Assessment Program (ASAP). In 2014 the fishing mortality rate was below the threshold reference point (F40%) and the spawning stock biomass (SSB) was above the target reference point (SSB40%).

STATUS OF THE FISHERY

Current Regulations

Commercial: 9 inches total length (TL) minimum size limit. Landings windows are set by proclamation with variable harvest limits by time-period (see most recent NCDMF proclamation).

Recreational: Season is year-round. 8 inches TL minimum size, 50 fish bag limit/day in state waters; 9 inches TL minimum size, 50 fish bag limit in federal waters

Commercial Landings

Most scup landings from north of Cape Hatteras were from flounder trawls although flynets also caught scup. Landings are constrained by the coastwide quota. Annual landings were variable in 2005 to 2014 with very low landings in 2012-2013 but an increase in 2014 (Figure 1). The low landings in 2012-2013 were partly due to the closure of Oregon Inlet to large vessels (such as trawlers) and the consequent transfer of most of North Carolina's quota allocation to Virginia and other states. In 2014, more winter trawl vessels returned to North Carolina to land catches rather than transferring quota to Virginia and other states. Trends in commercial trips have generally followed landings trends (Figure 1). Trips include the number of trip ticket records with landings reported. Trips typically represent more than one day of fishing.

Recreational Landings

Recreational harvest and trips for scup from north of Cape Hatteras only occurred in 2011 and 2012 (Table 1).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Two NCDMF sampling programs collect biological data on commercial and recreational fisheries that catch scup north of Cape Hatteras. Program 433 (Winter Trawl Fishery) is the primary program that collects harvest length data. Other commercial sampling programs focusing on fisheries that do not target scup collect biological data rarely. NCDMF sampling of the recreational fishery through the Marine Recreational Information Program (MRIP) collects harvest length data. Age data have not been collected by NCDMF for scup north of Cape Hatteras.

There were no clear trends in commercial length data in 2005-2014 (Table 2). Annual mean lengths were fairly consistent for the time-series and 2014 was typical. There is a slight increase in the annual maximum length in recent years compared to early in the time-series and 2014 had the highest maximum length. The number of fish measured in 2014 was the second highest in the time-series.

Recreational harvest length data were only collected in 2011 and 2012 for scup north of Cape Hatteras (Table 3). Only one fish was measured each year. Very few scup are encountered in this fishery.

Fishery-Independent Monitoring

NCDMF independent sampling programs did not encounter scup north of Cape Hatteras in 2005-2014. NCDMF currently does not have independent sampling programs in ocean waters north of Cape Hatteras.

MANAGEMENT STRATEGY

Management of scup has been based on results from stock assessments. Results from the 2015 Benchmark Stock Assessment will be used to guide management. Projections based on stock assessments are used to set the coastwide quota level each year. Amendments to the FMP are undertaken as issues arise that require action.

MANAGEMENT AND RESEARCH NEEDS

- Implementation of new standardized research surveys that focus on accurately indexing the abundance of older scup (ages 3 and older);
- Continuation of at least the current levels of at-sea and port sampling of the commercial and recreational fisheries in which scup are landed and discarded;
- Quantification of the biases in the catch and discards, including non-compliance;

- Experimental work to better characterize the discard mortality rate of scup captured by different commercial gear types should be conducted to more accurately quantify the magnitude of scup discard mortality.

LITERATURE CITED

NMFS NEFSC. 2015. Stock assessment of scup (*Stenotomus chrysops*). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Northeast Fisheries Science Center.

TABLES

Table 1. Recreational hook and line harvest of scup in numbers of fish north of Cape Hatteras from MRIP data 2005-2014.

Year	Harvest (numbers)	Trips
2005	0	0
2006	0	0
2007	0	0
2008	0	0
2009	0	0
2010	0	0
2011	27	48
2012	148	150
2013	0	0
2014	0	0

Table 2. Summary of scup length (TL, mm) and age data from NCDMF commercial fishery sampling programs north of Cape Hatteras.

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	272	105	372	1,817	ND	ND	ND	ND
2006	286	160	393	1,568	ND	ND	ND	ND
2007	281	190	404	1,659	ND	ND	ND	ND
2008	281	183	415	3,493	ND	ND	ND	ND
2009	281	153	403	1,740	ND	ND	ND	ND
2010	276	200	386	1,450	ND	ND	ND	ND
2011	267	198	407	1,076	ND	ND	ND	ND
2012	327	287	401	7	ND	ND	ND	ND
2013	253	192	389	261	ND	ND	ND	ND
2014	281	193	441	2,725	ND	ND	ND	ND

Table 3. Summary of scup length (TL, mm) and age data from NCDMF recreational fishery sampling programs north of Cape Hatteras.

Year	Mean Length	Minimum Length	Maximum Length	Total Measured	Modal age	Minimum age	Maximum age	Total aged
2005	0	0	0	0	ND	ND	ND	ND
2006	0	0	0	0	ND	ND	ND	ND
2007	0	0	0	0	ND	ND	ND	ND
2008	0	0	0	0	ND	ND	ND	ND
2009	0	0	0	0	ND	ND	ND	ND
2010	0	0	0	0	ND	ND	ND	ND
2011	181	181	181	1	ND	ND	ND	ND
2012	290	290	290	1	ND	ND	ND	ND
2013	0	0	0	0	ND	ND	ND	ND
2014	0	0	0	0	ND	ND	ND	ND

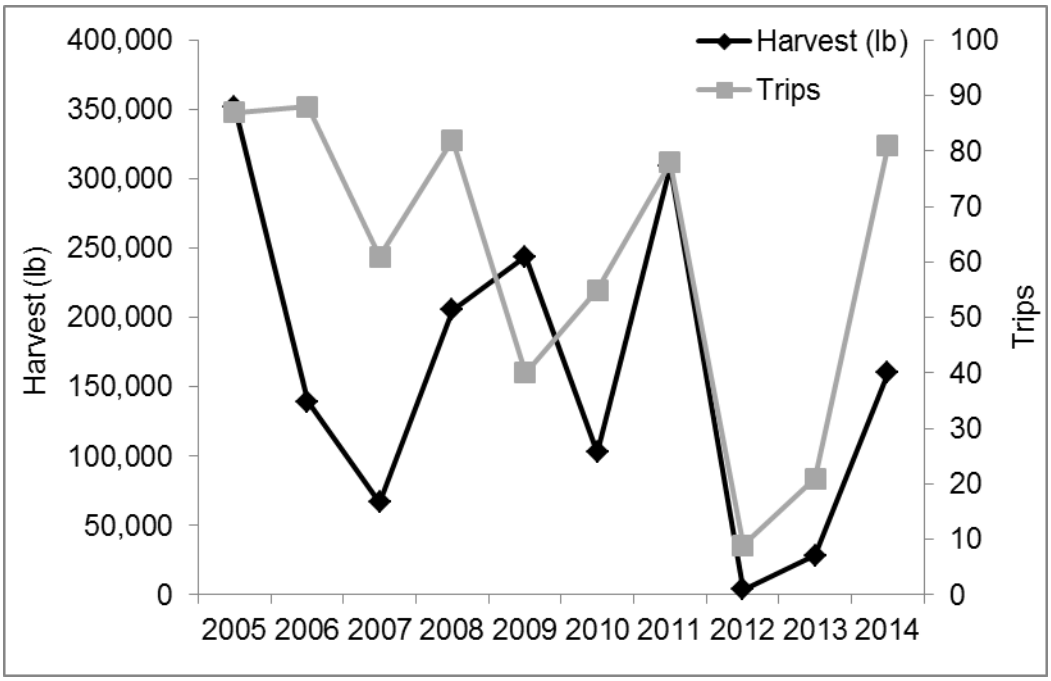


Figure 1. North Carolina commercial landings (lb) and trips for scup north of Cape Hatteras 2005-2014.

FISHERY MANAGEMENT PLAN UPDATE
SHARKS
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	August 2008
Amendments:	None
Revisions:	Addendum I (September 2009) Addendum II (May 2013) Addendum III (October 2013)
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	None

The Atlantic States Marine Fisheries Commission (ASMFC) adopted its first fishery management plan (FMP) for coastal sharks in 2008. Coastal sharks are managed under this plan as six different complexes: prohibited, research, small coastal, non-sandbar large coastal, pelagic and smooth dogfish (Table 1). The ASMFC does not actively set quotas for any shark species. The ASMFC follows National Marine Fisheries Service (NOAA Fisheries) openings and closures for small coastal sharks, non-sandbar large coastal shark and pelagic sharks. Species in the prohibited category may not be possessed or taken. Sandbar sharks (*Carcharhinus plumbeus*) may only be taken with a shark fishery research permit. All species must be landed with their fin attached to the carcass by natural means. Addendum I (2009) modified the FMP to allow limited smooth dogfish (smoothhound shark (*Mustelus canis*)) processing at sea (removal of fins from the carcass), removed smooth dogfish recreational possession limits, and removed gillnet check requirements for smooth dogfish fishermen. The goal of Addendum I was to remove restrictive management intended for large coastal sharks from the smooth dogfish (smoothhound shark) fishery, to allow fishermen to continue their operations while upholding the conservation measures of the FMP. Addendum II (2013) modified the FMP to allow year round smooth dogfish (smoothhound shark) processing at sea and allocated state-shares of the smooth dogfish (smoothhound shark) federal quota. The goal of Addendum II was to implement an accurate fin-to-carcass ratio and prevent the quota of smooth dogfish (smoothhound shark) from being harvested in one state. Addendum III (2013) modified the species groups to ensure consistency with NOAA Fisheries. The addendum also increased the recreational size limit for all hammerhead sharks species to 78 inches fork length.

Management Unit

The management unit includes the entire coast-wide distribution of the resource from the estuaries eastward to the inshore boundary of the EEZ. The management unit is split between

the Atlantic and Gulf of Mexico regions for aggregated large coastal, hammerhead, non-blacknose small coastal and blacknose sharks. No regional quotas are in place for pelagic shark species.

Goal and Objectives

The Interstate Fishery Management Plan for Coastal Sharks (FMP) established the following goal and objectives.

The goal of the Interstate Fishery Management Plan for Coastal Sharks is "to promote stock rebuilding and management of the coastal shark fishery in a manner that is biologically, economically, socially, and ecologically sound."

In support of this goal, the following objectives are in place for the Interstate Shark FMP:

- Reduce fishing mortality to rebuild stock biomass, prevent stock collapse, and support a sustainable fishery.
- Protect essential habitat areas such as nurseries and pupping grounds to protect sharks during particularly vulnerable stages in their life cycle.
- Coordinate management activities between state and federal waters to promote complementary regulations throughout the species' range.
- Obtain biological and improved fishery related data to increase understanding of state water shark fisheries.
- Minimize endangered species bycatch in shark fisheries.

STATUS OF THE STOCK

Stock Status

Stock status is assessed by species complex for most coastal shark species and by species group for species with enough data for an individual assessment (Table 1).

Stock Assessment

The Southeast Data, Assessment and Review (SEDAR) completed a benchmark stock assessment on the smoothhound (smooth dogfish) shark complex (*Mustelus spp*.) in both the Gulf of Mexico and the Atlantic. The assessment found that neither stock was overfished or experiencing overfishing. A 2011 benchmark assessment of dusky (*Carcharhinus obscures*), sandbar, and blacknose (*Carcharhinus acrontus*) sharks indicates that both sandbar and dusky sharks continue to be overfished with overfishing occurring for dusky sharks. Blacknose sharks, part of the SCS 3 complex, are overfished with overfishing occurring. The Board approved the assessment for management use in February 2012, and NOAA Fisheries' Highly Migratory Species Division (HMS) is incorporated the results of the assessment as part of Amendment 5a to its FMP. Porbeagle sharks (*Lamna nasus*) were assessed by the ICCAT Standing Committee on Research and Statistics in 2009. The assessment found that while the Northwest Atlantic

stock is increasing in biomass, the stock is considered to be overfished with overfishing not occurring. The 2007 SEDAR 13 assessed the SCS complex, finetooth (*Carcharhinus isodon*), Atlantic sharpnose (*Rhizoprionodon terraenovae*), and bonnethead (*Sphyrna tiburo*) sharks. The SEDAR 13 peer reviewers considered the data to be the 'best available at the time' and determined the status of the SCS complex to be 'adequate.' Finetooth, Atlantic sharpnose and bonnethead were all considered to be not overfished and not experiencing overfishing. Atlantic sharpnose and bonnethead were more recently assessed by SEDAR 34, and are still considered not overfished or undergoing overfishing. SEDAR 11 (2006) assessed the LCS complex and blacktip sharks (*Carcharhinus limbatus*). The LCS assessment suggested that it is inappropriate to assess the LCS complex as a whole due to the variation in life history parameters, different intrinsic rates of increase, and different catch and abundance data for all species included in the LCS complex. Based on these results, NMFS changed the status of the LCS complex from overfished to unknown. As part of SEDAR 11, blacktip sharks were assessed for the first time as two separate populations: Gulf of Mexico and Atlantic. The results indicated that the Gulf of Mexico stock is not overfished and overfishing is not occurring, while the current status of blacktip sharks in the Atlantic region is unknown.

STATUS OF THE FISHERY

Current Regulations

Commercial

All non-prohibited coastal shark complexes opened on January 1, 2014, with the exception of large coastal sharks that opened on June 1, 2014. These openings followed NOAA Fisheries openings of the species complexes. NOAA Fisheries closes the shark complexes when 80% of their quota is reached. When the fishery closes in federal waters, the Interstate FMP dictates that the fishery also closes in state waters. No harvest of size restrictions are in place with the exception of large coastal sharks, it is unlawful to possess more than 36 large coastal sharks per trip. It is unlawful to possess any shark [with the exception of smooth dogfish (smoothhound shark)] without tail and fins naturally attached to the carcass through the point of landing. Commercial fishermen may completely remove the fins of smooth dogfish (smoothhound shark). If fins are removed, the total wet weight of the shark fins may not exceed twelve (12) percent of the total dressed weight of smooth dogfish (smoothhound shark) carcasses landed or found onboard a vessel. It is unlawful for a vessel to retain, transship, land, store or sell scalloped hammerhead, great hammerhead or smooth hammerhead sharks with pelagic longline gear onboard. It is unlawful for a vessel to retain sandbar sharks unless the vessel is selected to participate in the shark research fishery, subject to retention limits established by NOAA Fisheries and only when a NOAA Fisheries-approved observer is onboard. It is unlawful to use gears other than rod and reel, handlines, large and small mesh gill nets, shortlines (maximum of 500 yards each with 50 hooks or less), and meeting the criteria in C.2. below, pound nets/fish traps, and trawl nets. It is unlawful to use a large mesh (stretched mesh size greater than or equal to 5 inches) gill net more than 2,734 yards in length to capture sharks. It is unlawful to sell sharks to anyone who is not a federally permitted shark dealer.

NOAA Fisheries sets quotas for coastal sharks through their 2006 Consolidated Highly Migratory Species Fishery Management Plan (HMS FMP). As indicated above, the states follow NOAA Fisheries openings and closings, which are based on those quotas (Table 2).

Recreational

All non-prohibited coastal shark complexes opened on January 1, 2014. These openings followed NOAA Fisheries openings of the species complexes. It is unlawful for a recreational angler to possess more than one Atlantic sharpnose, and one bonnethead and one smooth dogfish (smoothhound shark) and one additional shark from the recreationally permitted species list (Table 3) per person per calendar day. Additionally, if fishing from a vessel, it is unlawful to have more than one additional shark from the recreationally permitted species list aboard a vessel, per calendar day, regardless of the number of people on board the vessel. It is unlawful to possess silky sharks (*Carcharhinus falciformis*) and sandbar for recreational purposes. It is unlawful to possess great hammerhead, smooth hammerhead and scalloped hammerhead sharks less than 78 inches [(fork length) Table 4]. It is unlawful to possess the rest of the Large Coastal Shark and Pelagic Shark species less than 54 inches long [(fork length) Table 4]. Smooth dogfish and small coastal sharks have no minimum size. Spiny dogfish are exempt from harvest and size restrictions. It is unlawful for recreational fishermen to possess any shark without head, tail, and fins intact with the carcass through the point of landing. Anglers may still gut and bleed the carcass as long as the tail is not removed. Filleting sharks at sea is prohibited. It is unlawful to fail to return all sharks not meeting harvest requirements (including prohibited species) to the water in a manner that ensures the highest likelihood of survival. It is unlawful for recreational fishermen to catch sharks by any gear other than rod and reel or handlines. Handlines are defined as a mainline with no more than two gangions or hooks attached that are retrieved by hand only. It is unlawful to possess a great hammerhead, scalloped hammerhead, smooth hammerhead or oceanic whitetip shark while in possession of tunas, billfish or swordfish.

Commercial Landings

Coast-wide commercial landings of Atlantic large coastal shark species in 2014 were 348,733 lb dressed weight (dw). Commercial landings of hammerhead sharks were 27,586 lb dw. Both large coastal and hammerhead landings were slightly higher compared to 2013 by a total of 5,196 lb dw. Commercial landings of small coastal shark species in 2014 were 228,045 lb dw. This is a decrease of approximately 11,000 lb dw from 2013 due to the premature closure of the fishery. The non-blacknose small coastal shark quota in the Atlantic is linked to the Atlantic blacknose shark quota. This quota linkage closes the Atlantic small coastal shark fishery prematurely, if the smaller blacknose quota is harvested before the larger non-blacknose quota. Landings of Atlantic pelagic species of sharks were 339,319 lb dw 2014, higher than 2013 due to the opening of porbeagle sharks and increased landings in the “pelagic sharks other than porbeagle and blue” management group (Table 2).

Recreational Landings

Recreational harvest for small coastal sharks has fluctuated from a peak harvest number of 1,095 to 6,299 and averaged 3,238 from 2005 to 2014. Recreational landings in pounds ranged from 6,598 to 36,544 and averaged 20,049 from 2005 to 2014 (Table 5).

Recreational harvest for large coastal sharks has been on a much smaller magnitude compared to small coastal sharks. Harvest numbers have ranged from 0 to 1,105 and averaged 356 sharks from 2005 to 2014. Recreational landings in pounds ranged from 0 to 38,052 and average 11,404 from 2005 to 2014 (Table 6).

Recreational harvest of pelagic sharks is similar to large coastal sharks. Harvest numbers for pelagic sharks ranged from 28 to 1,509 and averaged 240 sharks from 2005 to 2014. Recreational landings in pounds ranged from 1,219 to 112,556 and averaged 19,109 pounds from 2005 to 2014 (Table 7).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

North Carolina does not have a fishery-dependent monitoring program for sharks.

Fishery-Independent Monitoring

NCDMF has an independent red drum longline project established in 2007, which allows for capture and tagging of Atlantic coastal sharks. The independent red drum longline project in the Pamlico Sound resulted in a catch of 18 coastal sharks in 2014 (Table 8). Four species of sharks were captured; ten blacktip, six sandbar, one Atlantic sharpnose, and one finetooth shark. Of the ten blacktip sharks nine were females and their total lengths ranged from 1129 to 1638 mm. One blacktip shark was not measured. Of the six sandbar sharks one was a male with a total length of 800 mm the other 5 were females with total lengths ranging from 890 to 937 mm. The Atlantic sharpnose shark was a female with a total length of 431 mm. The finetooth shark was a male with a total length of 1,435 mm. A total of six sandbar and five blacktip sharks were also tagged with Northeast Fisheries Science Center's (NEFSC) Apex Predators Program tags.

A fisheries independent gill net survey was initiated in North Carolina in 2001. The objective of this project is to provide annual independent relative indices of abundance for key estuarine species in sounds and rivers that can be incorporated into stock assessments and used to improve bycatch estimates, evaluate management measures, and evaluate habitat usage. Results from this project are used by the NCDMF and other Atlantic coast fishery management agencies to evaluate the effectiveness of current management measures and to identify additional measures that may be necessary to conserve marine and estuarine stocks. Developing fishery independent indices of abundance for target species allows the NCDMF to assess the status of these stocks without relying solely on commercial and recreational fishery dependent data. Sampling is a stratified random sampling design in Pamlico Sound, utilizing multiple mesh gill nets (3.0-6.5 inch, ½ inch increments). In 2014, a total of 34 individual coastal sharks were captured in the Pamlico Sound independent gill net survey (Table 9). Coastal sharks from the 2014 Pamlico Sound independent gill net survey catch included: 25 Smooth dogfish total length range 459-1,082 mm (mean= 584 mm), five bull (*Carcharhinus leucas*) total length range 598-944 mm (mean=733 mm), two bonnethead total length range 748-974 mm (mean=861 mm), and two Atlantic sharpnose sharks total length range 736-877 mm (mean=807 mm). It should be noted that one bull shark was caught in the Neuse River portion of this survey. The sex of the shark was not recorded and the total length was 671 mm.

The Fisheries Independent Assessment Program Ocean Gillnet began in February, 2008, funded by the Coastal Recreational Fishing License receipts. The program utilizes the same sampling framework as the fisheries independent gill net survey. This program is designed to gather data on fishes utilizing the nearshore ocean (<3 miles) from New River Inlet south to the SC/NC state line and the Cape Fear and New Rivers. The goals of the program are to provide CPUE data for coastal fishes, to supplement age, growth, and reproduction studies,

to evaluate catch rates and species distribution for use in management plans, and to characterize habitat use. In 2014, 565 sharks were captured in the near shore ocean waters from New River Inlet south to the SC/NC state line and the Cape Fear and New Rivers (Table 10). Coastal sharks from the 2014 ocean gillnet survey catch included: 364 Atlantic sharpnose total length range 306-1002 mm (mean=649 mm), 42 blacknose total length range 901-1,281 mm (mean=1,085 mm), 36 blacktip total length range 625-1,593 mm (mean=1,231 mm), 91 bonnethead total length range 724-1,161 mm (mean=974 mm), one bull total length range 950 mm, six sand tiger (Carcharias Taurus) total length range 1,510-3,048 mm (mean=2,279 mm), six sandbar total length range 686-1,182 mm (mean=883 mm), ten scalloped hammerhead (Sphyrna lewini) total length range 593-1,183 mm (mean=855 mm), and 13 smooth dogfish total length range 442-721 mm (mean=595 mm).

MANAGEMENT STRATEGY

These species cross domestic and international boundaries; NOAA Fisheries' HMS Management Division is responsible for managing them under the Magnuson-Stevens Fishery Conservation and Management Act. In cooperation with an advisory panel, the division develops and implements fishery management plans for these species taking into account various domestic and international requirements. The ASMFC adopts NOAA Fisheries regulations in state waters.

MANAGEMENT AND RESEARCH NEEDS

The 2013 review of the ASMFC FMP for coastal sharks lists the following research needs:

Species-Specific Priorities

- Investigate the appropriateness of using vertebrae for ageing adult sandbar sharks. If appropriate, implement a systematic sampling program that gathers vertebral samples from entire size range for annual ageing to allow tracking the age distribution of the catch as well as updating of age-length keys.
- Re-evaluate finetooth shark life history in the Atlantic Ocean in order to validate fecundity and reproductive periodicity.
- Develop and conduct tagging studies on dusky and blacknose stock structure with increased international collaboration (e.g., Mexico) to ensure wider distribution and returns of tags.
- Expand research efforts directed towards tagging of individuals in south Florida and Texas/Mexico border to get better data discerning potential stock mixing.

General Priorities

- Generally update age and growth and reproductive studies for all species currently assessed.
- Examine female sharks during the pupping periods to determine the proportion of reproductive females.
- Expand or develop monitoring programs to collect appropriate length and age samples from the catches in the commercial sector by gear type, from catches in the recreational sector, and from catches taken in research surveys to provide reliable length and age compositions for stock assessments.
- Evaluate to what extent the different CPUE indices track population abundance (e.g., through power analysis).

- Explore modeling approaches that do not require an assumption that the population is at virgin level at some point in time.

LITERATURE CITED

Atlantic Shark Commercial Landings Update from January 1-December 31, 2014. 2015. NOAA Fisheries, June 25, 2015. <http://www.nmfs.noaa.gov/sfa/hms/news/news_list/2015/1/shk_landings_update_012715.html>

Review of the ASMFC FMP for Coastal Sharks. 2013. ASMFC, June 25, 2015. <http://www.asmfc.org/uploads/file/52fa9862coastalSharksFMPreview_2013.pdf>

Stock Assessment and Fishery Evaluation (SAFE) Report for Atlantic Highly Migratory Species. 2013. NOAA Fisheries, January 8, 2013. < http://www.nmfs.noaa.gov/sfa/hms/hmsdocument_files/SAFEreports.htm>

TABLES

Table 1. Stock status of Atlantic coastal shark species and species groups (ASMFC 2014).

Species or Complex Name	Stock Status		References/Comments
	Overfished	Overfishing is Occurring	
Porbeagle	Approaching	N	Porbeagle Stock Assessment, ICCAT Standing Committee on Research and Statistics Report (2009)
Dusky	Y	Y	SEDAR 21 (2011); designated to prohibited species
Large Coastal Sharks	Unknown	Unknown	SEDAR 11 (2006); difficult to assess as a species complex due to various life history characteristics/lack of available data
Blacktip	Unknown	Unknown	SEDAR 11 (2006)
Sandbar	Y	N	SEDAR 21 (2011)
Atlantic Sharpnose	N	N	SEDAR 34 (2013)
Blacknose	Y	Y	SEDAR 21 (2011)
Bonnethead	N	N	SEDAR 34 (2013)
Finetooth	N	N	SEDAR 13 (2007)
Smooth Dogfish	N	N	SEDAR 39 (2015)

Table 2. Summary of the 2014 coastwide and North Carolina 2014 Atlantic coastal shark commercial fishery (NOAA Fisheries and NCTTP).

Management Group	Region	2014 Annual Adjusted Quota (lb dw)	Season Opening Date	Season Closing Date	2014 Estimated Coastwide Landings (lb dw)	2014 NC Commercial Landings (lb dw)
Aggregated Large Coastal Sharks	Atlantic	372,552	6/1/2014	11/30/2014	348,733	134,194
Hammerhead Sharks		59,736			27,586	14,132
Non-Blacknose Small Coastal Sharks		582,333	1/1/2014	7/28/2014	228,045	100,444
Blacknose Sharks		38,638			33,382	1,842
Blue Sharks	No Regional Quotas	601,856		12/31/2014	17,806*	18,266
Porbeagle Sharks		2,820		12/17/2014	6,414	0
Pelagic Sharks Other Than Porbeagle or Blue		1,075,856		12/31/2014	315,099	194,000

*NCTTP program landings higher than estimated coast-wide due to the error in estimation

Table 3. Recreationally permitted species list.

SPECIES AUTHORIZED FOR RECREATIONAL HARVEST			
Large Coastal Sharks (LCS) (non-ridgeback* LCS & tiger)	Small Coastal Sharks (SCS)	Pelagic Sharks	Other
Blacktip Bull Hammerhead, great** Hammerhead, scalloped** Hammerhead, smooth** Lemon Nurse Spinner Tiger	Atlantic Sharpnose Blacknose Bonnethead Finetooth	Blue Oceanic whitetip** Porbeagle Shortfinmako Thresher	Smooth dogfish (smoothhound shark) Spiny dogfish

Table 4. Recreational size and bag limits.

RECREATIONALSIZE / BAG LIMITS and SEASONS			
Species	Minimum Size (Fork Length) in Inches (")	Trip Bag Limit/Calendar Day	Season
Atlantic sharpnose	None	1 per person of each species	Jan. 1 – Dec. 31
Bonnethead	None		
Hammerheads (Great, Smooth and Scalloped)	78"	1 per vessel OR 1 per person for shore-anglers	
Large Coastal Sharks (LCS), Tiger and Pelagic Sharks	54"		
Small Coastal Sharks (SCS)	None		

Table 5. MRIP small coastal shark recreational harvest and discards 2005-2014 (NMFS 2015).

Year	Harvest Number (A+B1)	PSE (Num)	Weight (lb), (A+B1)	PSE (lb)	Number Released	PSE
2005	1,095	91.6	6,598	92.0	2,291	73.4
2006	4,605	69.2	27,690	69.6	24,791	54.1
2007	6,299	60.7	33,127	52.2	2,782	70.8
2008	3,268	66.4	18,610	66.4	.	.
2009	3,402	38.7	29,148	44.6	1,260	65.3
2010	5,989	31.9	36,544	34.1	12,358	59.6
2011	2,127	42.8	15,414	44.0	11,049	29.9
2012	1,449	51.6	9,839	51.6	3,319	46.5
2013	1,325	37.6	8,038	39.4	5,736	43.6
2014	2,821	31.8	15,479	30.5	1,540	45.6
10 Yr Average	**3,238**		**20,049**			

Table 6. MRIP large coastal shark recreational harvest and discards 2005-2014 (NMFS 2015).

Year	Harvest Number (A+B1)	PSE (Num)	Weight (lb), (A+B1)	PSE (lb)	Number Released	PSE
2005	664	95.9	38,052	95.9	5,803	59.4
2006	118	101.3	6,789	101.3	4,179	57.3
2007	1,105	70.0	17,344	46.0	8,731	46.9
2008	61	104.8	798	104.8	.	.
2009	.	.	.	.	582	89.1
2010	388	94.0	685	94.0	10,589	57.2
2011	305	99.9	471	99.9	3,342	77.9
2012	243	76.7	22,634	64.1	3,898	59.7
2013	59	113.4	11,128	113.4	2,776	35.1
2014	258	74.1	4,735	75.7	7,902	55.2
10 Yr Average	**356**		**11,404**			

Table 7. MRIP pelagic shark recreational harvest and discards 2005-2014 (NMFS 2015).

Year	Harvest Number (A+B1, MRIP)	PSE (Num)	Weight (lb), (A+B1, MRIP)	PSE (lb)	Number Released (MRIP)	PSE
2005	1,509	84.4	112,556	85.1	569	65.9
2006	254	68.6	24,001	66.5	428	95.2
2007	80	74.3	7,439	74.9	11	112.3
2008	30	79.8	2,693	79.8	.	.
2009	102	55.6	9,009	55.1	.	.
2010	87	78.2	13,559	84.4	116	98.9
2011	88	77.0	5,356	68.6	25	63.8
2012	172	63.2	11,697	61.1	13	98.0
2013	28	100.8	1,219	100.8	374	96.4
2014	45	63.8	3,558	60.5	62	110.8
10 Yr Average	**240**		**19,109**			

Table 8. Shark species captured in the NCDMF 2014 independent red drum longline project in the Pamlico Sound.

Species	Sex	Number Measured	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)
Atlantic Sharpnose Shark	Female	1	431	431	431
Atlantic Sharpnose Shark Total		**1**	**431**	**431**	**431**
Blacktip Shark	Female	9	1,437	1,125	1,638
	Sex Not Identified	1	0	0	0
Blacktip Shark Total		**10**	**1,294**	**0**	**1,638**
Finetooth Shark	Male	1	1,435	1,435	1,435
Finetooth Shark Total		**1**	**1,435**	**1,435**	**1,435**
Sandbar Shark	Male	1	800	800	800
	Female	5	910	890	937
Sandbar Shark Total		**6**	**892**	**800**	**937**
Total		**18**			

Table 9. Shark species captured in the NCDMF 2014 Pamlico Sound independent gill net survey.

Species	Sex	Number Measured	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)
Atlantic Sharpnose Shark	Male	2	736	877	807
Atlantic Sharpnose Shark Total		**2**	**736**	**877**	**807**
Bonnethead Shark	Female	2	748	974	861
Bonnethead Shark Total		**2**	**748**	**974**	**861**
Bull Shark	Sex Not Identified	5	598	944	733
Bull Shark Total		**5**	**598**	**944**	**733**
Smooth Dogfish	Male	17	490	1,082	587
	Female	8	459	690	577
Smooth Dogfish Total		**25**	**459**	**1,082**	**584**
Total		**34**			

Table 10. Shark species captured in the NCDMF 2014 Atlantic Ocean independent gillnet survey.

Species	Sex	Number Measured	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)
Atlantic Sharpnose Shark	Male	197	677	306	966
	Female	159	624	330	1,002
	Undetermined	2	910	899	921
	Sex Not Identified	6	368	335	409
Atlantic Sharpnose Shark Total		**364**	**649**	**306**	**1,002**
Blacknose Shark	Male	24	1,107	901	1,281
	Female	18	1,057	929	1,229
Blacknose Shark Total		**42**	**1,085**	**901**	**1,281**
Blacktip Shark	Male	13	1,229	1,029	1,576
	Female	23	1,231	625	1,593
Blacktip Shark Total		**36**	**1,231**	**625**	**1,593**
Bonnethead Shark	Male	27	850	771	938
	Female	64	1,002	724	1,161
Bonnethead Shark Total		**91**	**974**	**724**	**1,161**
Bull Shark	Male	1	950	950	950
Bull Shark Total		**1**	**950**	**950**	**950**
Sand Tiger Shark	Undetermined	2	2,279	1,510	3,048
Sand Tiger Shark Total		**2**	**2,279**	**1,510**	**3,048**
Sandbar Shark	Male	3	743	686	799
	Female	3	1,024	769	1,182
Sandbar Shark Total		**6**	**883**	**686**	**1,182**
Scalloped Hammerhead	Male	2	842	822	862
	Female	7	811	593	940
	Sex Not Identified	1	1,183	1,183	1,183
Scalloped Hammerhead Total		**10**	**855**	**593**	**1,183**
Smooth Dogfish	Male	7	594	442	721
	Female	6	597	521	663
Smooth Dogfish Total		**13**	**595**	**442**	**721**
Total		**565**			

FISHERY MANAGEMENT PLAN UPDATE
SNAPPER GROUPER COMPLEX
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption: August 1983 (SAFMC 1983; 48 FR 39463)

Amendments:

Amendment	Amendment approved	All Actions Effective By:
Regulatory Amendment 1	1987	March 1987
Regulatory Amendment 2	1988	March 1989
Amendment 1	1988	January 1989
Regulatory Amendment 3	1989	November 1990
Amendment 2	1990	October 1990
Amendment 3	1990	January 1991
Amendment 4	1991	January 1992
Amendment 5	1992	April 1992
Regulatory Amendment 4	1992	July1993
Regulatory Amendment 5	1992	July 1993
Amendment 6	1993	July 1994
Amendment 7	1994	January 1995
Regulatory Amendment 6	1994	May 1995
Amendment 8	1997	December 1998
Regulatory Amendment 7	1998	January1999
Amendment 9	1998	February 1999/ October 2000
Amendment 10	1998	July 2000
Amendment 11	1998	December 1999
Regulatory Amendment 8	2000	November 2000
Amendment 12	2000	September 2000
Amendment 13a	2003	April 2004
Amendment 13c	2006	October 2006
Amendment 14	2007	February 2009
Amendment 15a	2008	March 2008
Amendment 15b	2008	February 2010
Amendment 16	2009	July 2009
Amendment 19	2010	July 2010
Amendment 17a	2010	March 2011

Amendment 17b	2010	January 2011
Regulatory Amendment 10	2010	May 2011
Regulatory Amendment 9	2011	July 2011
Regulatory Amendment 11	2012	May 2012
Amendment 25	2012	April 2012
Amendment 24	2012	July 2012
Amendment 23	2011	January 2012
Amendment 18a	2012	July 2012
Amendment 20a	2012	October 2012
Regulatory Amendment 12	2012	October 2012
Amendment 18b	2012	May 2013
Regulatory Amendment 13	2013	July 2013
Regulatory Amendment 14	2013	December 2014
Regulatory Amendment 15	2013	September 2013
Amendment 27	2013	January 2014
Amendment 28	2013	August 2013
Regulatory Amendment 18	2013	September 2013
Regulatory Amendment 19	2013	October 2013
Regulatory Amendment 21	2014	November 2014
Amendment 32	2014	March 2015
Amendment 29	2014	July 2015

Revisions: N/A

Supplements: N/A

Information Updates: N/A

Schedule Changes: N/A

Next Benchmark Review: N/A

Of the 75 species managed by the South Atlantic Fishery Management Council (SAFMC), 59 of these are included in the Snapper Grouper management complex. Because of its mixed species nature, this fishery offers the greatest challenge for SAFMC to manage successfully. Initially, FMP regulations consisted of minimum sizes, gear restrictions and a provision for the designation of special management zones (SMZs). Early attempts to develop more effective management measures were thwarted by lack of data on both the resource and the fishery. The condition of many of the species within the snapper grouper complex was, and still is, unknown. Improved data collection (in terms of quantity and quality) during the 1980's and 90's has provided more management information on some of the more commercially and recreationally valuable species, but lack of basic management data on many of the species still remains the major obstacle to successful management.

Snapper grouper management is also difficult because many of these species are slow growing, late maturing, hermaphroditic, and long lived, so rebuilding efforts for some species will take

years to produce full recovery. Strict management measures, including prohibition of harvest in some cases, have been implemented to rebuild overfished species in the snapper grouper complex. Such harvesting restrictions are beneficial not only in rebuilding species, but also in helping to alleviate the need for these species to be listed in the future.

Regulatory Amendment 1 (48 FR 9864) prohibited fishing in SMZs except with hand-held hook-and-line and spearfishing gear; prohibited harvest of goliath grouper in SMZs; and implemented Special Management Zones (SMZ) off SC and GA.

Regulatory Amendment 2 (54 FR 8342) established two artificial reefs off Ft. Pierce, FL as SMZs.

Amendment 1 (SAFMC 1988; 54 FR 1720) prohibited use of trawl gear to harvest fish in the snapper grouper fishery south of Cape Hatteras, NC and north of Cape Canaveral, FL; defined directed snapper grouper fishery as a vessel with trawl gear and greater than or equal to 200-pounds of snapper grouper species onboard; and established the assumption that vessels with snapper grouper species onboard harvested these fish in the EEZ.

Regulatory Amendment 3 (55 FR 40394) established an artificial reef at Key Biscayne, FL as an SMZ in Dade County, FL; prohibited fish trapping, bottom longlining, spearfishing and harvesting of Goliath grouper in SMZs.

Amendment 2 (SAFMC 1990a; 55 FR 46213) prohibited harvest or possession of Goliath grouper in or from the EEZ in the South Atlantic, and defined overfishing for snapper grouper species according to NMFS 602 guidelines.

Amendment 3 (SAFMC 1990b; 56 FR 2443) established a management program for the wreckfish fishery which: added wreckfish to the snapper grouper management unit; defined OY and overfishing; required an annual permit to fish for, land or sell wreckfish; established a control date of March 28, 1990 for the area bounded by 33° and 30° N. latitude; established a fishing year beginning April 16; established a process whereby annual quotas would be specified; implemented a 10,000 pound trip limit and a January 15 – April 15 spawning season closure.

Amendment 4 (SAFMC 1991a; 56 FR 56016) prohibited the use of various gear, including fish traps, the use of bottom longlines for wreckfish, and powerheads in Special Management Zones off SC; established bag limits and minimum size limits for several species; established income requirements to qualify for permits; and required that all snapper grouper species possessed in South Atlantic federal waters must have heads and fins intact through landing.

Amendment 5 (SAFMC 1991b; 57 FR 7886) established an Individual Transferable Quota (ITQ) management program for the wreckfish fishery.

Regulatory Amendment 4 (SAFMC 1992a; 58 FR 36155) modified the definition of black sea bass pots; allowed for multi-gear trips and the retention of incidentally caught fish.

Regulatory Amendment 5 (SAFMC 1992b; 58 FR 35895) established eight additional Special Management Zones (SMZs) off the coast of SC.

Amendment 6 (SAFMC 1993; 59 FR 27242) established commercial quotas for snowy grouper, golden tilefish; established commercial trip limits for snowy grouper, golden tilefish, speckled

hind, and warsaw grouper; included golden tilefish in grouper recreational aggregate bag limits; prohibited sale of warsaw grouper and speckled hind; created the Oculina Experimental Closed Area; and specified data collection needs for evaluation of possible future IFQ system.

Amendment 7 (SAFMC 1994a; 59 FR 66270) established size limits and bag limits for hogfish and mutton snapper; specified allowable gear; prohibited the use of explosive charges, including powerheads, off SC; and required dealer, charter and headboat federal permits.

Regulatory Amendment 6 (SAFMC 1994b; 60 FR 19683) includes provisions to rebuild and protect hogfish by implementing a recreational bag limit of 5 fish per person off FL; protect cubera snapper by implementing a recreational bag limit of 2 per person for fish 30" total length or larger off Florida; and protect gray triggerfish by implementing a minimum size limit of 12 inches total length off Florida.

Amendment 8 (SAFMC 1997; 63 FR 38298) established a limited entry system for the snapper grouper fishery.

Regulatory Amendment 7 (63 FR 71793) established 10 SMZs at artificial reefs off SC.

Amendment 9 (SAFMC 1998a; 64 FR 3624; 65 FR 55203) increased the minimum size limits on red porgy, black sea bass, vermillion snapper (recreational only), gag, and black grouper; changed bag limits for red porgy, black sea bass, greater amberjack, gag, and black grouper; established an aggregate recreational bag limit of 20 fish per person per day inclusive of all snapper grouper species currently not under a bag limit, excluding tomtate and blue runners; and specified that vessels with bottom longline gear aboard may only possess snowy grouper, warsaw grouper, yellowedge grouper, misty grouper, golden tilefish, blueline tilefish, and sand tilefish.

Amendment 10 (SAFMC 1998b; 65 FR 37292) identified Essential Fish Habitat (EFH) and EFH - Habitat Areas of Particular Concern for species in the snapper grouper management unit.

Amendment 11 (SAFMC 1998c; 64 FR 59126) amended the Fishery Management Plan (FMP) as required to make definitions of MSY, OY, overfishing and overfished consistent with "National Standard Guidelines"; identified and defined fishing communities; and addressed bycatch management measures.

Regulatory Amendment 8 (65 FR 61114) established 12 SMZs at artificial reefs off GA; revised boundaries of seven existing SMZs off GA to meet Coast Guard permit specs; restricted fishing in new and revised SMZs.

Amendment 12 (SAFMC 2000; 65 FR 51248) set regulatory limits for red porgy including a recreational bag limit, a commercial incidental catch limit, and a recreational and commercial size limit. It also permitted the transfer of the 225-pound trip limited commercial permit to another vessel (not another person) regardless of vessel size.

Amendment 13A (SAFMC 2003; 69 FR 15731) extended regulations within the Oculina Experimental Closed Area off the east coast of Florida that prohibit fishing for and retention of snapper grouper species for an indefinite period with a 10 year re-evaluation by the Council. The Council will review the configuration and size of the area within 3 years of publication of the Final Rule (March 26, 2004).

Amendment 13C (SAFMC 2006; 71 FR 55096) addressed overfishing for snowy grouper, golden tilefish, black sea bass and vermilion snapper. The amendment also allowed for a moderate increase in the harvest of red porgy as stock continues to rebuild.

Amendment 14 (SAFMC 2007a; 74 FR 1621) established a series of deepwater marine protected areas in the South Atlantic Exclusive Economic Zone.

Amendment 15A (SAFMC 2008a; 73 FR 14942) updated management reference points for snowy grouper, black sea bass, and red porgy; modified rebuilding schedules for snowy grouper and black sea bass; defined rebuilding strategies for snowy grouper, black sea bass, and red porgy; and redefined the minimum stock size threshold for the snowy grouper stock.

Amendment 15B (SAFMC 2008b; 74 FR 58902) prohibited sale the sale of bag-limit caught snapper grouper species; reduced the effects of incidental hooking on sea turtles and smalltooth sawfish; changed the commercial permit renewal period and transferability requirements; implemented a plan to monitor and address bycatch; and established management reference points for golden tilefish. Amendment 15B also established allocations between recreational and commercial fishermen for snowy grouper and red porgy.

Amendment 16 (SAFMC 2009a; 74 FR 30964) included measures to end overfishing for gag grouper and vermilion snapper; established commercial and recreational allocations for both species; established a January through April spawning season closure for gag, black grouper, red grouper, scamp, red hind, rock hind, yellowmouth grouper, tiger grouper, yellowfin grouper, graysby, and coney; reduced the aggregate grouper bag limit from 5 fish to 3 fish, and within that, reduced the gag bag limit from 2 fish to 1 gag or black grouper, combined; reduced the vermilion snapper bag limit from 10 fish to 5 fish; established a recreational closed season for vermilion snapper of November through March; excluded captain and crew on for-hire vessels from retaining a bag limit of groupers; and required the use of dehooking tools to reduce bycatch mortality.

Amendment 19 (SAFMC 2009b; 75 FR 35330) was included under the Comprehensive Ecosystem-Based Amendment 1 (CE-BA 1) and included measures to provide presentation of spatial information for Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concern (EFH-HAPC) designations under the Snapper Grouper FMP; and designation of deepwater coral HAPCs.

Amendment 17A (SAFMC 2010a; 75 FR 76874) addressed management measures to end overfishing of red snapper and rebuild the stock, including Annual Catch Limits and Accountability Measures. It extended the prohibition of red snapper in federal waters throughout the South Atlantic EEZ effective immediately. Amendment 17A also included a regulation requiring the use of non-stainless circle hooks north of 28 degrees N. latitude effective March 3, 2011.

Amendment 17B (SAFMC 2010b; 75 FR 82280) established Annual Catch Limits (ACLs) and Accountability Measures (AMs) and addressed overfishing for nine species in the snapper grouper management complex: golden tilefish, snowy grouper, speckled hind, warsaw grouper, black grouper, black sea bass, gag, red grouper, and vermilion snapper. Measures in Amendment 17B included a deepwater closure (240 ft. seaward) for deepwater species to help protect warsaw grouper and speckled hind. Additional measures in the amendment included a reduction in the snowy grouper bag limit; establishment of a combined ACL for gag, black grouper, and red grouper; an allocation of 97% commercial and 3% recreational for the golden

tilefish fishery based on landings history; and establishment of accountability measures as necessary.

Regulatory Amendment 10 (SAFMC 2010c; 76 FR 23728) eliminated the large area closure in Amendment 17A for all snapper grouper species off the coasts of southern GA and north/central FL. The regulatory amendment modified measures implemented in Amendment 17A to end overfishing for red snapper.

Regulatory Amendment 9 (SAFMC 2011a; 76 FR 34892) reduced the bag limit for black sea bass from 15 fish per person to 5 fish per person, established trip limits on vermilion snapper and gag, and increased the trip limit for greater amberjack.

Regulatory Amendment 11 (SAFMC 2011b; 77 FR 27374) eliminated a restriction on the possession or harvest of some deepwater snapper grouper species in waters greater than 240 feet deep.

Amendment 25 (Comprehensive Annual Catch Limit Amendment) (SAFMC 2011c; 77 FR 15916) met the 2011 deadline mandated by the Magnuson-Stevens Act to establish Annual Catch Limits (ACLs) and Accountability Measures (AMs) for species managed by the Council that are not undergoing overfishing.

Amendment 24 (SAFMC 2011d; 77 FR 34254) proposed measures to end overfishing and establish a rebuilding plan for red grouper. The amendment also implemented or revised parameters such as Maximum Sustainable Yield (MSY), Minimum Stock Size Threshold (MSST), Annual Catch Limits (ACLs) and Accountability Measures (AMs) and specified allocations for the commercial and recreational sectors.

Amendment 23 (Comprehensive Ecosystem-Based Amendment 2) (SAFMC 2011e; 76 FR 82183) included measures to designate the Deepwater MPAs as EFH-HAPCs; limited harvest of snapper grouper species in SC Special Management Zones to the bag limit; and modified sea turtle release gear.

Amendment 18A (SAFMC 2012a; 77 FR 32408) established management actions to limit participation and effort in the black sea bass fishery. Measures included establishment of an endorsement program and other modifications to the commercial black sea bass pot fishery; establishment of a commercial trip limit (all gear-types) for black sea bass; and increased minimum size limits for both commercial and recreational black sea bass fisheries.

Amendment 20A (SAFMC 2012b; 77 FR 59129) defined and reverted inactive shares within the wreckfish ITQ program; redistributed reverted shares to active shareholders; established a share cap; and implemented an appeals process.

Regulatory Amendment 12 (77 FR 61295) adjusted the Annual Catch Limit (ACL) and Optimum Yield (OY) for golden tilefish; specified a commercial Annual Catch Target (ACT); and revised recreational Accountability Measures (AMs) for golden tilefish.

Amendment 18B (SAFMC 2013a; 78 FR 23858) addressed management of golden tilefish. Actions included in the amendment are: An endorsement program for the longline sector of the golden tilefish component of the snapper-grouper fishery; establishment of landings criteria to determine who will receive endorsements; an appeals process for the golden tilefish

endorsement program; establishment of a procedure to allow transferability of golden tilefish endorsements; allocation of 75% of the commercial annual catch limit to the longline sector and 25% to the hook-and-line sector; and modification of the golden tilefish trip limit.

Regulatory Amendment 13 (78 FR 36113) revised the acceptable biological catch estimates, annual catch limits (including sector annual catch limits), and recreational annual catch targets for 37 un-assessed snapper-grouper species. The revisions incorporated updates to the recreational data for these species, as per the new Marine Recreational Information Program, as well as revisions to commercial and for-hire landings. Regulatory Amendment 13 was necessary to avoid triggering accountability measures for these snapper-grouper species based on annual catch limits that were established by the Comprehensive Annual Catch Limit Amendment in April 2012, using recreational data under the Marine Recreational Fisheries Statistics Survey system.

Regulatory Amendment 14 (SAFMC 2013b; 79 FR 66316) modified the fishing year for greater amberjack; revised the minimum size limit measurement for gray triggerfish; increased the minimum size limit for hogfish; modified the commercial and recreational fishing year for black sea bass; adjusted the commercial fishing season for vermilion snapper; modified the aggregate grouper bag limit; and revised the Accountability Measures for gag and vermilion snapper.

Regulatory Amendment 15 (SAFMC 2013c; 78 FR 49183) modified the existing specification of optimum yield and annual catch limit for yellowtail snapper in the South Atlantic; modified existing regulations for yellowtail snapper in the South Atlantic; and modified the existing gag commercial annual catch limit and accountability measure for gag that requires a closure of all other shallow water groupers (black grouper, red grouper, scamp, red hind, rock hind, graysby, coney, yellowmouth grouper, and yellowfin grouper) in the South Atlantic when the gag commercial annual catch limit is met or projected to be met.

Amendment 27 (SAFMC 2013d; 78 FR 78770) assumed management of Nassau grouper in the Gulf of Mexico; modified the crew size restriction for dual-permitted vessels (those with a Snapper Grouper Unlimited or 225-Pound Permit and a Charter/Headboat Permit for Snapper Grouper); modified the bag limit retention restriction for captain and crew of for-hire vessels; changed the existing snapper grouper framework procedure to allow for more timely adjustments to annual catch limits; and removed blue runner from the fishery management unit.

Amendment 28 (SAFMC 2013e; 78 FR 44461) established a process to determine if a red snapper fishing season will occur each year, including specification of the allowable harvest for both sectors and season length for the recreational sector; an equation to determine the annual catch limit amount for red snapper for each sector; and management measures if fishing for red snapper is allowed.

Regulatory Amendment 18 (SAFMC 2013f; 78 FR 47574) adjusted the annual catch limit (and sector annual catch limits) for vermilion snapper and red porgy based on the stock assessment updates for those two species and removed the annual recreational closure for vermilion snapper.

Regulatory Amendment 19 (SAFMC 2013g; 78 FR 58249) adjusted the black sea bass annual catch limits based on the results of the 2013 assessment. Because the increase to the annual catch limit was substantial, there was concern that this could extend fishing with pots into the calving season for right whales and create a risk of entanglement for large migratory whales

during the fall months. To minimize this risk, the amendment also established a closure to black sea bass pot gear from November 1 to April 30.

Regulatory Amendment 21 (SAFMC 2014a; 79 FR 60379) prevents snapper-grouper species with low natural mortality rates (red snapper, blueline tilefish, gag, black grouper, yellowtail snapper, vermilion snapper, red porgy, and greater amberjack) from being unnecessarily classified as overfished. For these species, even small fluctuations in biomass due to natural conditions rather than fishing mortality may cause a stock to be classified as overfished. Modifying the minimum stock size threshold definition (used in determining whether a species is overfished) prevents these species from being classified as overfished unnecessarily.

Amendment 32 (SAFMC 2014b; 80 FR 16583) addressed the determination that blueline tilefish are overfished and undergoing overfishing. The amendment removed blueline tilefish from the deep-water complex; established blueline tilefish commercial and recreational sector annual catch limits (ACLs) and accountability measures (AMs); revised the deep-water complex ACLs and AMs; established a blueline tilefish commercial trip limit; and revised the blueline tilefish recreational bag limit and harvest season.

Amendment 29 (SAFMC 2014c; 80 FR 30947) becomes effective July 1, 2015. The amendment revises annual catch limits (ACLs) and recreational annual catch targets (ACTs) for four unassessed snapper grouper species and three snapper grouper species complexes based on an update to the acceptable biological catch (ABC) control rule and revised ABCs for 14 snapper-grouper stocks. Additionally, this final rule revises management measures for gray triggerfish in Federal waters in the South Atlantic region, including modifying minimum size limits, establishing a split commercial season, and establishing a commercial trip limit.
There are several amendments either in development or under secretarial review (Table 1).

Management Unit

The original SAFMC plan stated the management unit of the snapper-grouper fishery is the stocks within the EEZ from North Carolina/ Virginia border through the east coast of Florida. In the case of black sea bass, the unit is limited to south of Cape Hatteras.
Since the inception of the FMP, there has been the addition of four species: wreckfish (1990), spadefish, banded rudderfish, and lesser amberjack. In recent years, 14 species have been removed; 13 in 2012 (tiger grouper, sheepshead, Queen triggerfish, puddingwife, black margate, yellow jack, Crevalle jack, porkfish, grass porgy, small mouth grunt, French grunt, Spanish grunt, and blue striped grunt) and one in 2014 (blue runner).

Objectives

The following are the fishery management plan objectives for the snapper grouper fishery as specified by the Council. These were last updated in Snapper Grouper FMP Amendment 8 in July 1997 (SAFMC 1997).

1. Prevent overfishing.

2. Collect necessary data.

3. Promote orderly utilization of the resource.

4. Provide for a flexible management system.
5. Minimize habitat damage.
6. Promote public compliance and enforcement.
7. Mechanism to vest participants.
8. Promote stability and facilitate long-run planning.
9. Create market-driven harvest pace and increase product continuity.
10. Minimize gear and area conflicts among fishermen.
11. Decrease incentives for overcapitalization.
12. Prevent continual dissipation of returns from fishing through open access.
13. Evaluate and minimize localized depletion.

STATUS OF THE STOCK

Stock Status

Concern – Of the 59 species in the South Atlantic Fishery Management Council (SAFMC) management unit, several species are either overfished or experiencing some degree of overfishing.

Stock Assessment

The status of a number of the species within the snapper grouper complex is unknown. However, for some of the species assessments are available through various federal entities; the snapper grouper complex is regionally (North Carolina south to eastern Florida) managed, and none of the assessments have been conducted by NCDMF (Table 2).

Since 2002, stock assessments have been conducted through the Southeast Data, Assessment, and Review (SEDAR) which is the cooperative process by which stock assessment projects are conducted in NOAA Fisheries' Southeast Region. Currently stock assessments are available for 10 of the complex species. There is an upcoming assessment (SEDAR 41) for gray triggerfish and red snapper that will be final in April 2016. There are also assessments scheduled for Goliath grouper (SEDAR 47) and Black grouper (SEDAR 48) to be final in August 2016; scamp and gray snapper have assessments to be scheduled after 2017. Blueline tilefish, tilefish, red grouper, vermillion snapper, and greater amberjack have updates to their assessments scheduled in the next few years.

Some of the other species have status updates provided by National Marine Fisheries Service (NFMS). These updates are based on landings data to determine whether or not the stock is overfished or undergoing overfishing. This information is updated quarterly by NMFS and available on their website (http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/).

STATUS OF THE FISHERY

Current Regulations

The following species have state and federal regulations for minimum lengths:

- Greater Amberjack: 28” Fork Length (FL) (recreational); 36” FL (commercial)
- Lesser Amberjack: 16” Total Length (TL)
- Black and Gag groupers: 24” TL
- Red, Scamp, Yellowfin, and Yellowmouth groupers: 20” TL
- Red Porgy : 14” TL
- Vermilion, Dog, Gray, Cubera, Mahogany, Queen, Silk, Yellowtail, Black, and Blackfin snappers : 12” TL
- Hogfish (not pigfish): 12” FL
- Mutton snapper: 16” TL
- Gray Triggerfish: 12” FL

All species have ACLs and recreational bag limits, see the SAFMC or NCDMF websites for the most current information.

The fisheries are open year round, with the exception of:

- Goliath grouper, Nassau grouper, Warsaw grouper, and speckled hind, unlawful to possess/harvest (commercial and recreational)
- Red snapper, unlawful to possess/harvest (commercial and recreational); limited season may occur based on previous year’s data
- January-April shallow water grouper spawning closure (commercial and recreational); Commercial also has same closure for red porgy
- Wreckfish have commercial spawning closure January 15-April 15; recreational fishery open July 1-August 31 annually
- April commercial closure for greater amberjack

Temporary closures may result for species if their ACL is met. See the SAFMC or NCDMF websites for more details and the most current information.

Commercial Landings

Commercial gear used in the snapper grouper fishery includes bandit reels, electromate reels, manual hook-and-line, long lines, fish pots, spear, and trolling. Bandit reels, followed by electromate rods and reels are the two most prevalent gear types used, especially south of Cape Hatteras (NCDMF 2015a). Spear fishing seems to be limited to south of Hatteras, while longlines are primarily fished north of Hatteras (NCDMF 2015a); their use is limited to six deepwater species and depths greater than 50 fathoms. Fish pots are used primarily to target black sea bass. Trip lengths vary dependent on the area fished and the gear used, but tended to average between 2-3d in length over the past 5 years; trips ranged from 1 day to 12 days for the entire commercial snapper grouper fleet (NCDMF 2015a).

The average landings for commercially caught snapper grouper from 2005-2014 was 2,328,834 pounds with a dockside value of $5,118,394.[1] The highest landings from the past 10 years were in 2008 and 2009, after which landings dropped; landings have been under 2 million pounds for the last 3 years (Figure 1). The decline in landings over the past 5 years is most likely due to the removal of species from the complex, as well as the changes to annual catch limits by the SAFMC (i.e., gag grouper).

Over the last 5 years landings have been dominated by five main aggregates, sea bass, grouper, snapper, triggerfish, and tilefish though the dominant group varies by year (Table 3). The top ten dominant species over the last 5 years are: black sea bass, vermillion snapper, blueline tilefish, gag, triggerfish, red grouper, red porgy, amberjack, scamp, and grunts (NCDMF 2015a).

Recreational Landings

Recreational fishing uses many of the same gear types as the commercial fishery, with the exception of fish pots and longlines. The average recreational catch of snapper grouper species was 1,246,252 pounds for 2005-2014. Since 2008, the total amount of fish landed has declined steadily; the highest amount landed was in 2007/2008 and the lowest in 2014 (Figure 2; Table 4). Recreational landings have dropped by approximately 75% from 2007 to 2014. As with the commercial fishery this is most likely due to the removal of species from the complex, as well as the changes to annual catch limits by SAFMC. For the last four years, the number of releases has been above 80% of the total fish caught (Table 4).

For 2014, the dominant species (by harvest number) landed were black sea bass, white grunt, gray triggerfish, vermillion snapper, blueline tilefish, Atlantic spadefish, and red porgies. This pattern mainly holds true for the last 5 years, though occasionally some of the jack species are dominant (Table 5).

MONITORING PROGRAM DATA

Most of the data (dependent and independent) collected by NCDMF is provided to National Marine Fisheries Service (NMFS). The Division received a grant, which ended in 2014, to look the age structure and release mortality of the commercial snapper grouper fishery in general and at the south of Hatteras black sea bass stock age structure specifically. Data collected for this grant is summarized in the final MARFIN reports (NCDMF 2015a, b).

Fishery-Dependent Monitoring

Commercial fisheries are monitored by port agents (state and federal) who collect information on trips, as well as biological information. Information is collected through the Trip Information Program (TIP), seafood dealer reporting, and logbooks (SAMFC 2015a). Recreational fisheries are monitored through the Southeast Region Headboat Survey program and the Marine Recreation Information Program (MRIP) (SAFMC 2015b). North Carolina contributes to this data through the collection of trip and biological information for both fisheries.

[1] These averages do not include sheepshead, as well as a number of other species, as they were removed from the complex in 2012. See Amendment 25 for list of species removed from complex.

Fishery-Independent Monitoring

The Southeast Reef Fish Survey (SERFS) maintains the fisheries independent data for the snapper grouper complex. SERFS is a collective program for gathering fisheries independent data within the South Atlantic federal waters. There are three primary programs that contribute to the data:

- Marine Resources Monitoring, Assessment, and Prediction (MARMAP) survey
- Southeast Fisheries-Independent Survey (SEFIS), and
- Southeast Area Monitoring and Assessment Program (SEAMAP)- South Atlantic. (SAFMC 2015).

North Carolina contributes to the data collected through programs such as the gag ingress work.

MANAGEMENT STRATEGY

The snapper grouper complex is managed under the various amendments of the SAFMC fisheries management plan. The fishery is a regional fishery, and the Council has authority within the federal 200-mile limit of the Atlantic Ocean off the coasts of North Carolina, South Carolina, Georgia, and east Florida to Key West with the exception of black sea bass north of Cape Hatteras, North Carolina. In state waters, North Carolina defers to the Council and the same regulations are followed. Thresholds and targets for the species are determined by the SAFMC and are species dependent.

MANAGEMENT AND RESEARCH NEEDS

The reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act in 2006 directed that all regional management councils develop a prioritized research plan for annual submission to the Secretary of Commerce. The following are research and management needs as determined by the council in 2007 (SAFMC 2007b). All needs are ongoing; however the emphasis changes annually based on the SAFMC Science and Statistical Committee review of these needs. The reviewed list and priorities for the year are then approved for submission to the NMFS Southeast Fisheries Science Center. The council has developed a series of research and monitoring needs for the period of 2015-2019 (SAFMC 2015c).

- Continue monitoring of catches
- Collect otoliths and spines for ageing
- Estimate mortality rates
- Determine if stock structure exists for many of the species
- Note seasonal and spawning migrations
- Map essential fish habitat
- Determine spawning locations and seasons
- Continue life history studies
- Estimate reproductive parameters including fecundity, age and size of maturity, age and size of sexual transition, and sex ratio
- Determine reliability of historical landings
- Expand diet studies
- Develop juvenile and adult indexes

LITERATURE CITED

48 Fed. Reg. 39463 (August 31, 1983) (codified at 50 C.F.R. 622)

52 Fed. Reg. 9864 (March 27, 1987) (codified at 50 C.F.R. 622)

54 Fed. Reg. 1720 (January 12, 1989) (codified at 50 C.F.R. 622)

54 Fed. Reg. 8342 (March 30, 1989) (codified at 50 C.F.R. 622)

55 Fed. Reg. 40394 (November 02, 1990) (codified at 50 C.F.R. 622)

55 Fed. Reg. 46213 (October 30, 1990) (codified at 50 C.F.R. 622)

56 Fed. Reg. 2443 (January 31, 1991) (codified at 50 C.F.R. 622)

56 Fed. Reg. 56016 (January 01, 1992) (codified at 50 C.F.R. 622)

57 Fed. Reg. 7886 (April 6, 1992) (codified at 50 C.F.R. 622)

58 Fed. Reg. 35895 (July 31, 1993) (codified at 50 C.F.R. 622)

58 Fed. Reg. 36155 (July 6, 1993) (codified at 50 C.F.R. 622)

59 Fed. Reg. 27242 (July 27, 1994) (codified at 50 C.F.R. 622)

59 Fed. Reg. 66270 (January 23, 1995) (codified at 50 C.F.R. 622)

60 Fed. Reg. 19683 (April 20, 1995) (codified at 50 C.F.R. 622)

63 Fed. Reg. 38298 (July 16, 1998) (codified at 50 C.F.R. 622)

64 Fed. Reg. 59126 (November 2, 1999) (codified at 50 C.F.R. 622)

65 Fed. Reg. 37292 (June 14, 2000) (codified at 50 C.F.R. 622)

65 Fed. Reg. 51248 (August 23, 2000) (codified at 50 C.F.R. 622)

65 Fed. Reg. 61114 (October 16, 2000) (codified at 50 C.F.R. 622)

69 Fed. Reg. 15731 (March 26, 2004) (codified at 50 C.F.R. 622)

71 Fed. Reg. 55096 (September 21, 2006) (codified at 50 C.F.R. 622)

73 Fed. Reg. 14942 (March 20, 2008) (codified at 50 C.F.R. 622)

74 Fed. Reg. 1621 (January 13, 2009) (codified at 50 C.F.R. 622)

74 Fed. Reg. 30964 (June 29, 2009) (codified at 50 C.F.R. 622)

74 Fed. Reg. 58902 (November 16, 2009) (codified at 50 C.F.R. 622)

75 Fed. Reg. 35330 (June 22, 2010) (codified at 50 C.F.R. 622)

75 Fed. Reg. 76874 (December 9, 2010) (codified at 50 C.F.R. 622)

75 Fed. Reg. 82280 (December 30, 2010) (codified at 50 C.F.R. 622)

76 Fed. Reg. 23728 (April 28, 2011) (codified at 50 C.F.R. 622)

76 Fed. Reg. 34892 (June 15, 2011) (codified at 50 C.F.R. 622)

76 Fed. Reg. 82183 (December 30, 2011) (codified at 50 C.F.R. 622)

77 Fed. Reg. 15916 (March 16, 2012) (codified at 50 C.F.R. 622)

77 Fed. Reg. 27374 (May 10, 2012) (codified at 50 C.F.R. 622)

77 Fed. Reg. 32408 (June 1, 2012) (codified at 50 C.F.R. 622)

77 Fed. Reg. 34254 (June 11, 2012) (codified at 50 C.F.R. 622)

77 Fed. Reg. 59129 (September 26, 2012) (codified at 50 C.F.R. 622)

77 Fed. Reg. 61295 (October 9, 2012) (codified at 50 C.F.R. 622)

78 Fed. Reg. 23858 (April 23, 2013) (codified at 50 C.F.R. 622)

78 Fed. Reg. 36113 (June 17, 2013) (codified at 50 C.F.R. 622)

78 Fed. Reg. 44461 (July 24, 2013) (codified at 50 C.F.R. 622)

78 Fed. Reg. 47574 (August 6, 2013) (codified at 50 C.F.R. 622)

78 Fed. Reg. 49183 (August 13, 2013) (codified at 50 C.F.R. 622)

78 Fed. Reg. 58249 (September 23, 2013) (codified at 50 C.F.R. 622)

78 Fed. Reg. 78770 (December 27, 2013) (codified at 50 C.F.R. 622)

79 Fed. Reg. 60379 (October 7, 2014) (codified at 50 C.F.R. 622)

79 Fed. Reg. 66316 (November 7, 2014) (codified at 50 C.F.R. 622)

80 Fed. Reg. 16583 (March 30, 2015) (codified at 50 C.F.R. 622)

80 Fed. Reg. 30947 (June 1, 2015) (codified at 50 C.F.R. 622)

NCDMF (North Carolina Division of Marine Fisheries). 2015a. Age Sampling of the Commercial Snapper Grouper Fishery and Age Description of the Black Sea Bass

Fishery in North Carolina: MARFIN Completion Report Grant NA10NMF4330117. NC Division of Marine Fisheries, 3441 Arendell St, Morehead City, NC 28557. 56pp.

NCDMF (North Carolina Division of Marine Fisheries). 2015b. North Carolina Snapper/Grouper Ageing and Estimation of Release Mortality in the Snapper Grouper Complex Fishery: MARFIN Completion Report Grant NA10NMF4330117. NC Division of Marine Fisheries, 3441 Arendell St, Morehead City, NC 28557. 29pp.

NMFS (National Marine Fisheries Council). 2014. National Marine Fisheries Council-- 4th Quarter 2014 Update. NOAA Fisheries,1315 East-West Highway, Silver Spring, MD 20910. 51pp. Available online at: http://www.fisheries.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

NMFS (National Marine Fisheries Council). 2015. National Marine Fisheries Council-- 1st Quarter 2015 Update. NOAA Fisheries,1315 East-West Highway, Silver Spring, MD 20910. 51pp. Available online at: http://www.fisheries.noaa.gov/sfa/fisheries_eco/status_of_fisheries/status_updates.html

SAFMC (South Atlantic Fishery Management Council). 1983. Fishery Management Plan, Regulatory Impact Review and Final Environmental Impact Statement for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Circle, Suite 306, Charleston, South Carolina, 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupFMP.pdf)

SAFMC (South Atlantic Fishery Management Council). 1988. Amendment Number 1 and Environmental Assessment and Regulatory Impact Review to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend1.pdf)

SAFMC (South Atlantic Fishery Management Council). 1990a. Amendment Number 2, to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend2.pdf)

SAFMC (South Atlantic Fishery Management Council). 1990b. Amendment Number 3, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend3.pdf).

SAFMC (South Atlantic Fishery Management Council). 1991a. Amendment Number 4, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SGAmend4.pdf).

SAFMC (South Atlantic Fishery Management Council). 1991b. Amendment 5 to the Fishery

Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend5.pdf).

SAFMC (South Atlantic Fishery Management Council). 1992a. Regulatory Amendment 4 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SG%20Amend%204%20Regulatory.pdf).

SAFMC (South Atlantic Fishery Management Council). 1992b. Regulatory Amendment 5 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SG%20Amend%205%20Regulatory.pdf)

SAFMC (South Atlantic Fishery Management Council). 1993. Amendment Number 6, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 155 pp. (Available online at: http://safmc.net/Library/pdf/SG%20Amend%206.pdf)

SAFMC (South Atlantic Fishery Management Council). 1994a. Amendment Number 7, Regulatory Impact Review, Social Impact Assessment, Initial Regulatory Flexibility Analysis and Supplemental Environmental Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. 110 pp. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend7.pdf)

SAFMC (South Atlantic Fishery Management Council). 1994b. Regulatory Amendment 6 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend6.pdf)

SAFMC (South Atlantic Fishery Management Council). 1997. Amendment Number 8, Regulatory Impact Review, Social Impact Assessment, Initial Regulatory Flexibility Analysis and Supplemental Environmental Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. 124 pp. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend8.pdf)

SAFMC (South Atlantic Fishery Management Council). 1998a. Amendment 9, Final Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 246 pp. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend9.pdf)

SAFMC (South Atlantic Fishery Management Council). 1998b. Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region (Amendment 10 to the Snapper Grouper Fishery Management Plan). South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online

at: http://www.safmc.net/ecosystem/EcosystemManagement/HabitatProtection/SAFMCHabitatPlan)

SAFMC (South Atlantic Fishery Management Council). 1998c. Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and Other Required Provisions in Fishery Management Plans of the South Atlantic Region (Amendment 11 to the Snapper Grouper Fishery Management Plan). South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. 151 pp. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend11.pdf)

SAFMC (South Atlantic Fishery Management Council). 2000. Amendment Number 12, Regulatory Impact Review, Social Impact Assessment, Initial Regulatory Flexibility Analysis and Supplemental Environmental Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend12.pdf)

SAFMC (South Atlantic Fishery Management Council). 2003. Amendment Number 13A, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Suite 306, Charleston, S.C. 29407-4699. (Available online at: http://safmc.net/Library/pdf/SnapGroupAmend13A.pdf)

SAFMC (South Atlantic Fishery Management Council). 2006. Amendment 13C, Final Environmental Assessment, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699. 631 pp. (Available online at: http://safmc.net/Library/pdf/SG%20Amend%2013C%202-23-06%20FINAL.pdf)

SAFMC (South Atlantic Fishery Management Council). 2007a. Amendment 14, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SG%20Amend%2013C%202-23-06%20FINAL.pdf)

SAFMC (South Atlantic Fishery Management Council). 2007b. South Atlantic Research and Monitoring Plan. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2008a. Amendment 15A, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SGAmend15A_FEIS.pdf)

SAFMC (South Atlantic Fishery Management Council). 2008b. Amendment 15B, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management

Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/Final%20SG%20Amend15B%20with%20Appendix%20A.pdf)

SAFMC (South Atlantic Fishery Management Council). 2009a. Amendment 16, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405.(Available online at: http://safmc.net/Library/pdf/SnapGroupAmend16FINAL.pdf)

SAFMC (South Atlantic Fishery Management Council). 2009b. Comprehensive Ecosystem Based Amendment 1, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for South Atlantic Region (Amendment 19 to the Snapper Grouper FMP). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. 286 pp.(Available online at: http://safmc.net/Library/EcosystemHome)

SAFMC (South Atlantic Fishery Management Council). 2010a. Amendment 17A, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/Amend17Afinal071910.pdf)

SAFMC (South Atlantic Fishery Management Council). 2010b. Amendment 17B, Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at:: http://safmc.net/Library/pdf/17B%20Final.pdf)

SAFMC (South Atlantic Fishery Management Council). 2010c. Regulatory Amendment 10, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SGReg10Final.pdf)

SAFMC (South Atlantic Fishery Management Council). 2011a. Regulatory Amendment 9, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/RegAmend9Final.pdf)

SAFMC (South Atlantic Fishery Management Council). 2011b. Regulatory Amendment 11, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management

Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SGRegAmend11_FINAL%2020110927.pdf)

SAFMC (South Atlantic Fishery Management Council). 2011c. Comprehensive Annual Catch Limit (ACL) Amendment (Amendment 25 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201,North Charleston, S.C. 29405. (Available online at: https://www.dropbox.com/s/iz8wn5vec36hpis/CompACLAm_101411_FINAL.pdf?dl=0)

SAFMC (South Atlantic Fishery Management Council). 2011d. Amendment 24 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SGAmend24.pdf)

SAFMC (South Atlantic Fishery Management Council). 2011e. Comprehensive Ecosystem Based Amendment 2, Final Environmental Assessment, Regulatory Flexibility Analysis/Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. (Amendment 23 to the Snapper Grouper FMP). South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/EcosystemHome)

SAFMC (South Atlantic Fishery Management Council). 2012a. Amendment 18A to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SG_Amend18A013112.pdf)

SAFMC (South Atlantic Fishery Management Council). 2012b. Amendment 20A to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place, Ste 201, North Charleston, S.C. 29405. (Available online at: http://safmc.net/Library/pdf/SGAM20A_FINAL.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013a. Amendment 18B to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region with Final Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://safmc.net/sites/default/files/Resource%20Library/pdf/SG%20Am/SA_Amend18B_Aug28_2012_FINAL_small.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013b. Regulatory Amendment 14 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://sero.nmfs.noaa.gov/sustainable_fisheries/s_atl/sg/2014/reg_am14/documents/pdfs/sa_reg_am14.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013c. Regulatory Amendment 15 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C.

29405. (Available online at: http://safmc.net/sites/default/files/Resource%20Library/pdf/SG%20Am/SG%20Reg%20Amend%2015.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013d. Amendment 27 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://sero.nmfs.noaa.gov/sustainable_fisheries/s_atl/sg/2013/am27/documents/pdfs/sa_am27_final_ea.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013e. Amendment 28 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://sero.nmfs.noaa.gov/sustainable_fisheries/s_atl/sg/2013/am28/documents/pdfs/sg_amend28.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013f. Regulatory Amendment 18 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://safmc.net/sites/default/files/Resource%20Library/pdf/SG%20Am/sa_reg_amend18_final.pdf)

SAFMC (South Atlantic Fishery Management Council). 2013g. Regulatory Amendment 19 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://safmc.net/sites/default/files/meetings/pdf/Public%20Hearings%20&%20Scoping/Nov%202013%20-%20webinars/sa_reg_am19_appen.pdf)

SAFMC (South Atlantic Fishery Management Council). 2014a. Regulatory Amendment 21 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://sero.nmfs.noaa.gov/sustainable_fisheries/s_atl/sg/2014/reg_am21/documents/pdfs/sg_reg_am21_ea.pdf)

SAFMC (South Atlantic Fishery Management Council). 2014b. Amendment 32 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at: http://sero.nmfs.noaa.gov/sustainable_fisheries/s_atl/sg/2014/am32/documents/pdfs/sg_am32_ea.pdf)

SAFMC (South Atlantic Fishery Management Council). 2014c. Amendment 29 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. (Available online at:

http://safmc.net/sites/default/files/Resource%20Library/pdf/SG%20Am/SGAmend29_October14_MASTER.pdf)

SAFMC (South Atlantic Fishery Management Council). 2015a. Connecting the dots in fisheries management- Part 2: Fisher dependent data collection. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015b. Connecting the dots in fisheries management- Part 3: Fisher independent data collection. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015c. DRAFT South Atlantic Research and Monitoring Prioritization Plan for 2015-2019. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405.

SAFMC (South Atlantic Fishery Management Council). 2015d. Regulatory Amendment 16 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region: Summary document. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, Charleston, S.C. 29405. 58pp. (Available online at: http://safmc.net/resource-library/snapper-grouper-regulatory-amendment-16)

SEDAR. 2008. SEDAR 15—South Atlantic Greater Amberjack Stock Assessment Report 2. SEDAR, North Charleston SC. 379 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=15

SEDAR. 2010a. SEDAR 19-- South Atlantic red grouper Stock Assessment report. SEDAR, North Charleston SC. 111 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=19

SEDAR. 2010b. SEDAR 19-- South Atlantic and Gulf of Mexico black grouper Stock Assessment report. SEDAR, North Charleston SC. 661 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=19

SEDAR. 2010c. SEDAR 24-- South Atlantic red snapper Stock Assessment Report. SEDAR, North Charleston SC. 524 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=24

SEDAR. 2011a. SEDAR 23—South Atlantic and Gulf of Mexico Goliath grouper Stock Assessment Report. SEDAR, North Charleston SC. 248 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=23

SEDAR. 2011b. SEDAR 25—South Atlantic Tilefish Stock Assessment Report. SEDAR, North Charleston SC. 330 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=25

SEDAR. 2012a. SEDAR 17 Update-- South Atlantic Vermilion Snapper Stock Assessment Report: SEDAR update assessment. SEDAR, North Charleston SC. 110 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=17

SEDAR. 2012b. SEDAR 1 Update-- Stock assessment of red porgy off the southeastern United States: SEDAR update assessment. SEDAR, North Charleston SC. 144 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=1

SEDAR. 2012c. SEDAR 27A – The 2012 Stock Assessment Report for Yellowtail Snapper in the South Atlantic and Gulf of Mexico. SEDAR, North Charleston SC. 341 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=27A

SEDAR. 2013a. SEDAR 36-- South Atlantic Snowy Grouper Stock Assessment Report. SEDAR, North Charleston SC. 146 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=36

SEDAR. 2013b. SEDAR 25 Update-- Stock assessment of black sea bass off the southeastern United States: SEDAR update assessment. SEDAR, North Charleston SC. 102 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=25

SEDAR. 2013c. SEDAR 32 – South Atlantic blueline tilefish Stock Assessment Report. SEDAR, North Charleston SC. 378 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=32

SEDAR. 2013d. SEDAR 37 – The 2013 Stock Assessment report for Hogfish in the South Atlantic and Gulf of Mexico. SEDAR, North Charleston SC. 573 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=37

SEDAR. 2014. SEDAR 10 Update-- Stock assessment of gag off southeastern United States: SEDAR update assessment. SEDAR, North Charleston SC. 112 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=10

SEDAR. 2015. SEDAR 15A Update—Stock assessment of Mutton Snapper of the U.S. South Atlantic and Gulf of Mexico through 2013: SEDAR update assessment. SEDAR, North Charleston SC. 142 pp. available online at: http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=15A

TABLES

Table 1. Amendments under consideration/review by the SAFMC. Summaries of the issues the amendment addresses are included.

Amendment	Issue addressed	Where in process	Documentation
Regulatory 16	Black sea bass pots (remove seasonal prohibition)	Under development by council (SAFMC)	1. SG Regulatory 16 website (SAFMC) 2. Summary document (SAFMC 2015d)
Regulatory 17	Marine Protected Areas	Development of amendment stopped in June 2014 to focus on SG Amendment 36	SG Regulatory 17 website (SAFMC)
22	Recreational harvest tag program for species with low ACL	Development of amendment postponed in March 2015 to instead work with NMFS MRIP staff to address alternate means of tracking "low-intercept" species	SG Amendment 22 website (SAFMC)
36	Spawning Special Management Zones	Under development by council (SAFMC	SG Amendment 36 website (SAFMC)
35	Removal of species from the snapper grouper fishery management unit: black snapper, dog snapper, mahogany snapper, and schoolmaster.	Under development by council (SAFMC)	SG Amendment 35 website (SAFMC)
Comprehensive Ecosystem-Based Amendment (CE-BA) 3	Improvements in bycatch/discard data collection methods	Under development by council (SAFMC)	CE-BA 3 website (SAFMC)
34	Accountability measures for snapper grouper species	Under secretarial review	SG Amendment 34 website (SAFMC)
33	Transport of snapper grouper fillets from the Bahamas	Under secretarial review	SG Amendment 33 website (SAFMC)
Regulatory 22	Measures for gag grouper and wreckfish	Under secretarial review	SG Regulatory 22 website (SAFMC)
Regulatory 20	Management measures for snowy grouper	Under secretarial review	SG Regulatory 20 website (SAFMC)

Table 2. Stock status of the 59 species within the snapper grouper complex. Documentation is provided for the assessment associated with each species. No assessments have been conducted by NCDMF due to the nature of the fishery.

Family (species aggregate)	Species	Overfishing?	Overfished?	Approaching overfished condition?	Documentation
Serranidae (Sea basses and Groupers)	Gag (*Mycteroperca microlepis*)	No** (**based on NMFS assessment)	No	No	SEDAR 10 Update (SEDAR 2014); NMFS 2014
	Red grouper (*Epinephelus morio*)	No	No	No	SEDAR 19 (SEDAR 2010a)
	Scamp (*Mycteroperca phenax*)	No	Unknown	Unknown	NMFS 2014
	Black grouper (*Mycteroperca bonaci*)	No	No	No	SEDAR 19 (SEDAR 2010b)
	Rock hind (*Epinephelus adcensionis*)	Unknown	Unknown	Unknown	NMFS 2014
	Red hind (*Epinephelus guttatus*)	Unknown	Unknown	Unknown	NMFS 2014
	Graysby (*Cephalopholis cruentata*)	Unknown	Unknown	Unknown	NMFS 2014
	Yellowfin grouper (*Mycteroperca venenosa*)	Unknown	Unknown	Unknown	NMFS 2014
	Coney (*Cephalopholis fulva*)	Unknown	Unknown	Unknown	NMFS 2014
	Yellowmouth grouper (*Mycteroperca interstitialis*)	Unknown	Unknown	Unknown	NMFS 2014
	Goliath grouper (*Epinephelus itajara*)	No (Permanent closure)	Unknown	Unknown	SEDAR 23 (SEDAR 2011a); NMFS 2014
	Nassau grouper (*Epinephelus striatus*)	No (Permanent closure)	Unknown	Unknown	NMFS 2014
	Snowy grouper (*Epinephelus niveatus*)	No	Yes	No	SEDAR 36 (SEDAR 2013a); NMFS 2014
	Yellowedge grouper (*Epinephelus flavolimbatus*)	Unknown	Unknown	Unknown	NMFS 2014

* indicates ecosystem component species which do not have management measures in place and are not assessed.

Table 2 (continued).

Family (species aggregate)	**Species**	**Overfishing?**	**Overfished?**	**Approaching overfished condition?**	**Documentation**
Serranidae (Sea basses and Groupers)	Warsaw grouper (*Epinephelus nigritus*)	Yes	Unknown	Unknown	SG Amendment 17b (SAFMC 2010b); NMFS 2014
	Speckled hind (*Epinephelus drummondhayi*)	Yes	Unknown	Unknown	SG Amendment 17b (SAFMC 2010b); NMFS 2014
	Misty grouper (*Epinephelus mystacinus*)	Unknown	Unknown	Unknown	NMFS 2014
	Black sea bass (*Centropristis striata*)	No	No	No	SEDAR 25 (SEDAR 2013b); NMFS 2014
	*Bank sea bass (*Centropristis ocyurus*)	N/A	N/A	N/A	
	*Rock sea bass (*Centropristis philadelphica*)	N/A	N/A	N/A	
Polyprionidae (Wreckfish)	Wreckfish (*Polyprion americanus*)	No	No	No	NMFS 2014
Lutjanidae (Snappers)	Queen snapper (*Etelis oculatus*)	Unknown	Unknown	Unknown	NMFS 2014
	Yellowtail snapper (*Ocyusus chrysurus*)	No	No	No	SEDAR 27A (SEDAR 2012c); NMFS 2014
	Gray snapper (*Lutjanus griseus*)	Unknown	Unknown	Unknown	NMFS 2014
	Mutton snapper (*Lutjanus analis*)	No	No	No	SEDAR 15A Update (SEDAR 2015); NMFS 2014
	Lane snapper (*Lutjanus synagris*)	Unknown	Unknown	Unknown	NMFS 2014
	Cubera snapper (*Lutjanus cyanopterus*)	Unknown	Unknown	Unknown	NMFS 2014
	Dog snapper (*Lutjanus jocu*)	Unknown	Unknown	Unknown	NMFS 2014
	Schoolmaster (*Lutjanus apodus*)	Unknown	Unknown	Unknown	NMFS 2014

* indicates ecosystem component species which do not have management measures in place and are not assessed.

Table 2 (continued).

Family (species aggregate)	Species	Overfishing?	Overfished?	Approaching overfished condition?	Documentation
Lutjanidae (Snappers)	Mahogany snapper (*Lutjanus mahogoni*)	Unknown	Unknown	Unknown	NMFS 2014
	Vermilion snapper (*Rhomboplites aurorubens*)	No	No	No	SEDAR 17 Update (SEDAR 2012a); NMFS 2014
	Red snapper (*Lutjanus campechanus*)	Yes	Yes	N/A	SEDAR Assessment 24 (SEDAR 2010c); NMFS 2014
	Silk snapper (*Lutjanus vivanus*)	Unknown	Unknown	Unknown	NMFS 2014
	Blackfin snapper (*Lutjanus buccanella*)	Unknown	Unknown	Unknown	NMFS 2014
	Black snapper (*Apsilus dentatus*)	Unknown	Unknown	Unknown	NMFS 2014
Sparidae (Porgies)	Red Porgy (*Pagrus pagrus*)	No	Yes	No	SEDAR 1 Update (SEDAR 2012b); NMFS 2014
	Knobbed porgy (*Calamus nodosus*)	Unknown	Unknown	Unknown	NMFS 2014
	Jolthead porgy (*Calamus bajonado*)	Unknown	Unknown	Unknown	NMFS 2014
	Scup (*Stenotomus chrysops*)	Unknown	Unknown	Unknown	NMFS 2014
	Whitebone porgy (*Calamus leucosteus*)	Unknown	Unknown	Unknown	NMFS 2014
	Saucereye porgy (*Calamus calamus*)	Unknown	Unknown	Unknown	NMFS 2014
	*Longspine porgy (*Stenotomus caprinus*)	N/A	N/A	N/A	
Haemulidae (Grunts)	White grunt (*Haemulon plumieri*)	Unknown	Unknown	Unknown	NMFS 2014
	Margate (*Haemulon album*)	Unknown	Unknown	Unknown	NMFS 2014
	Tomtate (*Haemulon aurolineatum*)	Unknown	Unknown	Unknown	NMFS 2014

* indicates ecosystem component species which do not have management measures in place and are not assessed.

Table 2 (continued).

Family (species aggregate)	**Species**	**Overfishing?**	**Overfished?**	**Approaching overfished condition?**	**Documentation**
Haemulidae (Grunts)	Sailor's choice (*Haemulon parra*)	Unknown	Unknown	Unknown	NMFS 2014
	*Cottonwick (*Haemulon melanurum*)	N/A	N/A	N/A	
Carangidae (Jacks)	Greater Amberjack (*Seriola dumerili*)	No	No	No	SEDAR 15 (SEDAR 2008); NMFS 2014
	Almaco jack (*Seriola rivoliana*)	Unknown	Unknown	Unknown	NMFS 2014
	Banded rudderfish (*Seriola zonanta*)	Unknown	Unknown	Unknown	NMFS 2014
	Bar jack (*Caranx ruber*)	Unknown	Unknown	Unknown	NMFS 2015
	Lesser Amberjack (*Seriola fasciata*)	Unknown	Unknown	Unknown	NMFS 2014
Malacanthidae (Tilefishes)	Golden tilefish (*Lopholatilus chamaeleonticeps*)	No	No	No	SEDAR Assessment 25 (SEDAR 2011b); NMFS 2014
	Blueline (or gray) tilefish (*Caulolatilus microps*)	Yes	No** (**based on NMFS assessment)	N/A	SEDAR Assessment 32 (SEDAR 2013c); NMFS 2015
	Sand tilefish (*Malacanthus plumier*)	Unknown	Unknown	Unknown	NMFS 2014
Balistidae (Triggerfishes)	Gray triggerfish (*Balistes capriscus*)	No	Unknown	Unknown	NMFS 2014
	*Ocean triggerfish (*Canthidermis sufflamen*)	N/A	N/A	N/A	
Labridae (Wrasses)	Hogfish (*Lachnolaimus maximus*)	Unknown (Carolinas); Yes (FL)	Unknown (Carolinas); Yes (FL)	Unknown	NFMS 2015; SEDAR 37 (SEDAR 2013d)
Eppiphidae (Spadefishes)	Atlantic spadefish (*Chaetodipterus faber*)	Unknown	Unknown	Unknown	NMFS 2014

* indicates ecosystem component species which do not have management measures in place and are not assessed.

Table 3. Landings (in pounds) of snapper grouper, by aggregate groups, for the commercial fishery from 2010-2014. Aggregate groups are those used by the SAFMC and are done by family (as in Table 2). Sheepshead were removed from the fishery in 2012 and therefore not included past 2011; these are included in the porgy aggregate. Only black sea bass and scup from south of Cape Hatteras are included, as the northern populations are managed by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fisheries Management Council (MAFMC); scup are included in the porgies for 2013 and 2014, 2010-2012 scup landings are confidential.

	Year				
Species	2010	2011	2012	2013	2014
Sea basses	292,879	173,681	194,778	241,403	312,078
Grouper	561,926	408,491	382,085	309,116	299,539
Wreckfish	--	23	--	--	--
Snapper	320,256	326,371	279,367	276,533	251,062
Porgies	242,412	211,699	83,918	72,666	82,655
Grunts	7,219	33,443	49,733	44,698	39,043
Jacks	131,050	73,810	140,525	104,673	202,152
Tilefish	430,394	133,824	361,074	217,079	91,074
Triggerfish	225,671	220,202	143,085	160,573	109,764
Hogfish	13,046	10,793	8,256	7,847	9,767
Spadefish	18,827	21,535	24,238	20,369	22,761
Unclassifed	17,763	7,681	12,038	14,928	21,962

Table 4. Landings of all snapper grouper species for the recreational fishery for 2005-2014. Sheepshead were removed from the fishery in 2012 and therefore not included past 2011.

Year	**Number Harvested**	**Weight of harvested fish (pounds)**	**Number Released**	**Percent Released**
2005	796,893	1,722,649	1,580,733	66%
2006	578,306	2,179,721	1,977,019	77%
2007	805,106	2,698,359	2,024,885	72%
2008	742,366	3,012,206	1,611,634	68%
2009	623,418	2,367,512	1,300,583	68%
2010	566,613	1,787,832	1,405,122	71%
2011	291,867	762,491	1,265,506	81%
2012	317,072	848,327	2,323,541	88%
2013	198,372	524,504	1,556,568	89%
2014	186,338	478,650	1,482,627	89%

Table 5. Recreational landings (in pounds), by aggregate groups, for 2010-2014. Aggregate groups are those used by the SAFMC and are done by family (as in Table 2). Sheepshead were removed from the fishery in 2012 and therefore not included past 2011; these are included in the porgy aggregate. Only black sea bass from south of Cape Hatteras are included, as the northern population is managed by ASMFC.

Species aggregate	**Year**				
	2010	**2011**	**2012**	**2013**	**2014**
Black sea bass	186,803	143,234	127,621	68,225	134,662
Groupers	275,085	107,852	126,567	54,417	20,363
Snappers	35,041	25,167	60,164	14,013	15,739
Porgies	460,919	191,262	26,249	16,720	17,453
Grunts	56,802	44,213	95,724	26,769	41,392
Jacks	440,846	138,703	175,197	197,482	94,917
Tilefish	43,333	27,163	43,681	33,951	41,970
Triggerfish	160,737	77,371	149,895	96,262	77,176
Hogfish	1,398	1,539	14,961	3,619	0
Atlantic Spadefish	125,088	2,711	25,905	12,459	34,789

FIGURES

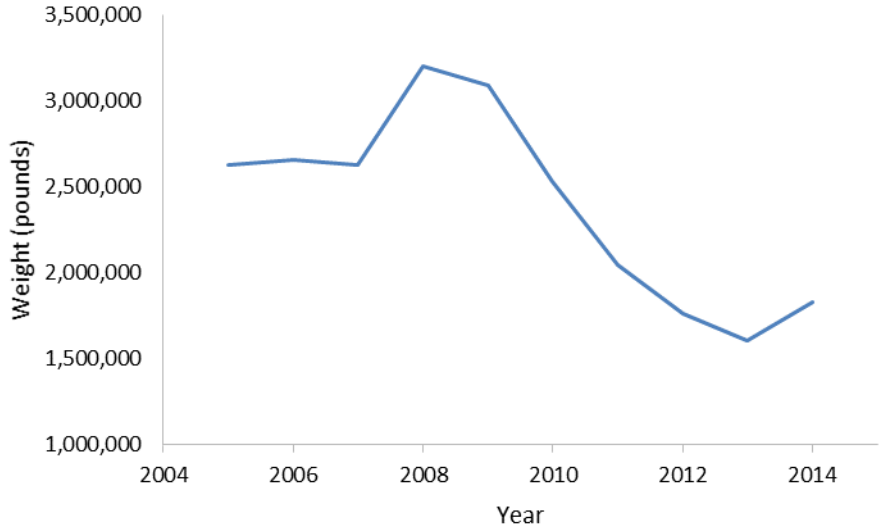


Figure 1. Commercial landings for all species within the snapper grouper complex from 2005-2014.

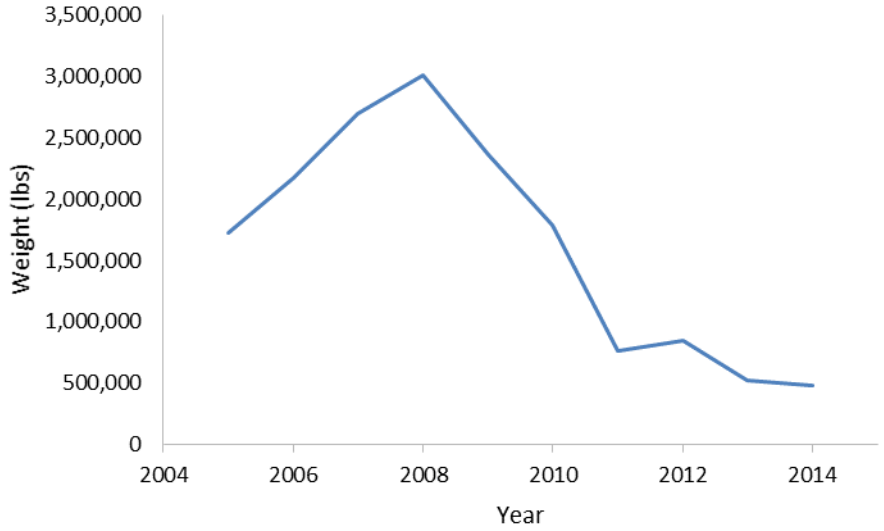


Figure 2. Recreational landings for all species within the snapper grouper complex from 2005-2014.

FISHERY MANAGEMENT PLAN UPDATE
SPANISH MACKEREL
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	February 1983
Amendments:	Amendment 2 – July 1987 Amendment 3 – August 1989 Amendment 4 – October 1989 Amendment 5 – August 1990 Amendment 6 – November 1992 Amendment 8 – March 1998 Amendment 9 – April 2000 Amendment 10 – June 1999 Amendment 11 – December 1999 Amendment 12 – October 2000 Amendment 13 – August 1992 Amendment 14 – July 2002 Amendment 15 – February 2004 Amendment 18 – December 2011 Amendment 20a – July 2014 Amendment 20b – March 2015 Omnibus Amendment – August 2011 Addendum I to Omnibus Amendment – August 2011
Revisions:	None
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	A benchmark stock assessment was completed for Spanish mackerel in the South Atlantic in 2012. The next assessment has not been scheduled.

Spanish mackerel are currently included in the Interjurisdictional Fishery Management Plan which defers to the Atlantic States Marine Fisheries Commission's (ASMFC) Fishery Management Plan for Spanish mackerel and South Atlantic Fishery Management Council's Coastal Migratory Pelagics Fishery Management Plan. The original Gulf and South Atlantic Fisheries Management Councils (GSAFMCs) fishery management plan (FMP) for Coastal Migratory Pelagic Resources (mackerels) was approved in 1983. This plan treated king and Spanish mackerel each as one U.S. stock. Allocations were established for recreational and commercial fisheries, and the commercial allocation was divided between net and hook–and–line fishermen; Established procedures for the Secretary to take action by regulatory

amendment to resolve possible future conflicts in the fishery, such as establish fishing zones and local quotas to each gear or user group. Numerous amendments have been implemented since the first FMP and those relevant to Spanish mackerel are described below:

Amendment 2, established in 1987 revised Spanish mackerel maximum sustainable yield (MSY) downward, recognized two migratory groups, and set commercial quotas and bag limits. Charter boat permits were required, and it was clarified that Total allowable catch (TAC) for overfished stocks must be set below the upper range of acceptable biological catch (ABC). The use of purse seines on overfished stocks was prohibited.

Amendment 3 (1989) prohibited drift gill nets for coastal pelagics and purse seines and run-around gillnets for the overfished groups of mackerels. The habitat section of the FMP was updated and vessel safety considerations were included in the plan. A new objective to minimize waste and bycatch in the fishery was added to the plan.

Amendment 4 (1989) reallocated Spanish mackerel equally between recreational and commercial fishermen on the Atlantic group with an increase in TAC.

Amendment 5 established in 1990 Extended the management area for the Atlantic groups of mackerels through Mid-Atlantic Fishery Management Council (MAFMC) jurisdiction. It revised problems in the fishery and plan objectives, revised the definition of "overfishing", added cobia to the annual stock assessment procedure, provided that the SAFMC will be responsible for pre–season adjustments of TACs and bag limits for the Atlantic migratory groups of mackerels, redefined recreational bag limits as daily limits; created a provision specifying that the bag limit catch of mackerel may be sold, provided guidelines for corporate commercial vessel permits, imposed a bag limit of two cobia per person per day for all fishermen, established a minimum size of 12–inch (30.5 cm.) fork length or 14–inch total length for king mackerel and included a definition of "conflict" to provide guidance to the Secretary.

Amendment 6 (1992) Identified additional problems and an objective in the fishery, provided for rebuilding overfished stocks of mackerels within specific periods, provided for biennial assessments and adjustments, provided for more seasonal adjustment actions, including size limits, vessel trip limits, closed seasons or areas, and gear restrictions, provided for commercial Atlantic Spanish mackerel possession limits, changed commercial permit requirements to allow qualification in one of three preceding years, discontinued the reversion of the bag limit to zero when the recreational quota is filled, modified the recreational fishing year to the calendar year; and changed minimum size limit for king mackerel to 20 inches fork length, and changed all size limit measures to fork length only.

Amendment 8 (1996) Identified additional problems in the fishery, specified allowable gear, established a moratorium on new commercial Spanish and king mackerel permits and provided for transferability of permits during the moratorium, revised qualifications for a commercial permit, extended the management area of cobia through New York, allowed retention of up to 5 damaged king mackerel on vessels with commercial trip limits, revised the seasonal framework procedures to a). delete a procedure for subdividing the Gulf migratory group of king mackerel, b). request that the stock assessment panel provide additional information on spawning potential ratios and mixing of king mackerel migratory groups, c). provide for consideration of public comment, d). redefine overfishing and allow for adjustment by framework procedure, e). allow changes in allocation ratio of Atlantic Spanish mackerel, f). allow setting zero bag limits, g). allow gear regulation including prohibition.

Amendment 9 (2000) changed the percentage of the commercial allocation of TAC for the Florida east coast (North Area) and Florida west coast (South/West Area) of the Eastern Zone to 46.15 percent North and 53.85 percent South/West (previously, this allocation was 50%/50%); and allowed possession of cut-off (damaged) king or Spanish mackerel that comply with the minimum size limits and the trip limits in the Gulf, Mid-Atlantic, or South Atlantic EEZ (sale of such cut-off fish is allowed and is in addition to the existing allowance for possession and retention of a maximum of 5 cut-off (damaged) king mackerel that are not subject to the size limits or trip limits, but that cannot be sold or purchased, nor counted against the trip limit). (Note: Several other changes were made involving allocation and gear restrictions that affected the Florida west coast and Gulf fisheries).

Amendment 10 (1998) designated Essential Fish Habitat (EFH) and EFH-Habitat Areas of Particular Concerns for coastal migratory pelagics.

Amendment 11 (1998) amended Fishery Management Plan (FMP) as required to make definitions of MSY, optimal yield (OY), overfishing and overfished consistent with "National Standard Guidelines"; identified and defined fishing communities and addressed bycatch management measures.

Amendment 13 (2002) established two marine reserves in the exclusive economic zone (EEZ) of the Gulf of Mexico in the vicinity of the Dry Tortugas, Florida known as Tortugas North and Tortugas South, in which fishing for coastal migratory pelagic species is prohibited. This action complements previous actions taken under the National Marine Sanctuaries Act.

Amendment 18 establishes Annual Catch Limits and Accountability Measures for king and Spanish mackerel, as well as cobia.

Amendment 20a prohibits the sale of king mackerel caught under the bag limit unless the fish are caught as part of a state-permitted tournament and the proceeds from the sale are donated to charity. In addition, the rule removes the income qualification requirement for king mackerel commercial vessel permits.

Amendment 20b eliminates the 500-pound trip limit that is effective when 75 percent of the respective quotas are landed for king mackerel in the Florida west coast Northern and Southern Subzones, allows transit of commercial vessels with king mackerel through areas closed to king mackerel fishing, if gear is appropriately stowed, creates Northern and Southern Zones for Atlantic migratory group king and Spanish mackerel, each with separate quotas. NOAA Fisheries will close each zone when the respective quota is met or expected to be met. The dividing line between the zones is at the North Carolina/South Carolina state line.

The ASMFC approved the Omnibus Amendment in 2011. The management goal for the Omnibus Amendment is to bring the Fishery Management Plan for Spanish mackerel under authority of the Atlantic Coastal Fisheries Cooperative Management Act, providing for more efficient and effective management and changes to management in the future. Addendum I to the Omnibus Amendment (August 2013) establishes a pilot program that would allow states to reduce the Spanish mackerel minimum size limit for the commercial pound net fishery to 11 ½ inches during the summer months of July through September for the 2013 and 2014 fishing years only.

Management Unit

The management unit is defined as Spanish mackerel within US waters of the Atlantic.

Goals and Objectives

Omnibus amendment 1 objectives include:

1. Manage the Spanish mackerel fishery by restricting fishing mortality to rates below the threshold fishing mortality rates to provide adequate spawning potential to sustain long-term abundance of the Spanish mackerel populations.

2. Manage the Spanish mackerel stock to maintain the spawning stock biomass above the target biomass levels.

3. Minimize endangered species bycatch in the Spanish mackerel fishery.

4. Provide a flexible management system that coordinates management activities between state and federal waters to promote complementary regulations throughout Spanish mackerel's range which minimizes regulatory delay while retaining substantial ASMFC, Council, and public input into management decisions; and which can adapt to changes in resource abundance, new scientific information and changes in fishing patterns among user groups or by area.

5. Develop research priorities that will further refine the Spanish mackerel management program to maximize the biological, social, and economic benefits derived from the Spanish mackerel population.

STATUS OF THE STOCK

Stock Status

A statistical catch-age model was used to assess the population of Atlantic Spanish mackerel. The age-structured assessment indicated that the stock was not overfished and that overfishing was not occurring.

Stock Assessment

There is a lack of available fishery independent indices of abundance for this species. Many of the indices of abundance that were made available were rejected due to concerns about the way the fishers targeted Spanish mackerel. The schooling behavior of Spanish mackerel makes a random survey of their population particularly difficult. The one fishery independent index used (SEAMAP young of the year) was highly variable, as would be expected for a recruitment index. The base run of the age-structured assessment model indicated that the stock is not over shed ($SSB_{2009\text{-}2011}=SSB_{MSY} = 1.49$) and that overfishing is not occurring ($F_{2011}=F_{MSY} = 0.57$). The sensitivity analyses yielded similar results and there was no retrospective pattern of concern. Conclusions about stock status during the MCB analysis were most sensitive to different combinations of input data and variance around fixed parameters (steepness, recreational discard mortality, historical recreational landings and natural mortality).

STATUS OF THE FISHERY

Current Regulations

Commercial: 3,500 lb trip limit

Recreational: 12 inches FL minimum size; 15 fish/day

Commercial Landings

From 2005 - 2014, landings of Spanish mackerel stayed below 500,000 lbs until 2009 in which time landings almost doubled to over 900,000 lbs (Figure 1.)

Recreational Landings

During the time series (2005 – 2014), estimated MRIP landings of Spanish mackerel peaked in 2008 at 744,139 lbs and declined and stabilized over the next 6 years to < 500,000 lbs in for the remainder of the series (Figure 2.)

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Length-frequency information for the commercial Spanish mackerel fishery in North Carolina is collected by port agents through the trip ticket program and fish house samplers, specifically programs 431, 434, 4371 and 461. Maximum sizes of king mackerel sampled over the last 10 years have fluctuated from < 700 mm to over 1000 mm but, average lengths of harvested fish have remained steady at about 400 mm (Table 1.).

Fishery-Independent Monitoring

Spanish mackerel are frequently caught in the division's statewide independent gill net survey (Prg. 915) and Pamlico Sound trawl survey (Prg. 195) from which ageing structures are collected. Ageing structures are collected from both independent and dependent sampling programs and sent to the Southeast Fisheries Science Center in Panama City, Florida for processing and aging (Table 2.) The average size of Spanish mackerel caught in the independent surveys (~ 330 mm) is smaller than the fish sampled from the fishery (~ 400 mm; Table 1. and Table 3.)

MANAGEMENT STRATEGY

In North Carolina, Spanish mackerel are currently included in the Interjurisdictional Fishery Management Plan (FMP), which defers to the South Atlantic Fishery Management Council management measures and is currently managed under recent Amendments 20A (2014) and Framework Amendment 1 (2014) to the Coastal Migratory Pelagics Fishery Management Plan. Amendment 20A prohibits the sale of all bag-limit-caught Spanish mackerel, except those harvested during a state-permitted tournament. Framework Amendment 1 modifies the annual catch limits for Atlantic Spanish mackerel and modifies the recreational annual catch target, based on the results of the most recent stock assessments for these stocks. Current

management strategies for Spanish mackerel in South Atlantic waters are summarized in Table 4.

MANAGEMENT AND RESEARCH NEEDS

From Omnibus Amendment:

- Increase collection of fishery-dependent length, sex, age, and CPUE data to improve stock assessment accuracy. Simulations on CPUE trends should be explored and impacts on assessment results determined. Data collection is needed for all states, particularly those north of North Carolina.
- Develop fishery-independent methods to monitor stock size.
- Develop methodology for predicting year class strength and determination of the relationship between juvenile abundance and subsequent year class strength.
- To ensure more accurate estimates of t0, increase efforts to collect age 0 specimens for use in estimating von Bertalanffy growth parameters.
- Provide better estimates of recruitment, natural mortality rates, fishing mortality rates, and standing stock. Specific information should include an estimate of total amount caught and distribution of catch by area, season, and type of gear.
- Commission and member states should support and provide the identified data and input needed to improve the SEDAR process.
- Conduct yield per recruit analyses relative to alternative selective fishing patterns.
- Investigate the discard mortality of Spanish mackerel in the commercial and recreational trolling fisheries and commercial gill net fishery.
- Need observer coverage for Spanish mackerel fisheries: gill nets, cast nets, handlines, pound nets, and shrimp trawl bycatch.
- Evaluate potential bias of the lack of appropriate stratification of the data used to generate age-length keys.
- Evaluate CPUE indices related to standardization methods and management history, with emphasis on greater temporal and spatial resolution in estimates of CPUE.
- Expand TIP sampling to better cover all statistical areas.
- Complete research on the application of assessment and management models relative to dynamic species such as Spanish mackerel.
- Establish a monitoring program to characterize the bycatch and discards of Spanish mackerel in the directed shrimp fishery in Atlantic Coastal waters.
- Obtain adequate data to determine gutted to whole weight relationships.
- Conduct inter-lab comparisons of age readings from test sets of otoliths in preparation for any future stock assessment.
- Address issue of fish retained for bait (undersized) or used for food by crew (how to capture these as landings).
- Investigate whether catchability varies as a function of fish density and/or environmental conditions.
- Investigate how temporal changes in migratory patterns may influence indices of abundance.
- Investigate the possibility of using models that allow catchability to follow a random walk, which can be useful in tracking longer-term trends in time-varying catchability and thus detect changes over time in CPUE (from SEDAR 2009)

LITERATURE CITED

ASMFC Omnibus Amendment to the Interstate Fishery Management Plans for Spanish Mackerel, Spot, and Spotted Seatrout. 161 pp.

SEDAR 28 Stock Assessment report South Atlantic Spanish mackerel. SEDAR Charleston, SC. 444 pp.

TABLES

Table 1. Mean, minimum and maximum fork lengths (mm) and total number sampled of Spanish mackerel from fishery dependent sampling programs.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	412.8	237	695	1844
2006	430.4	178	704	2238
2007	372.3	64	810	2445
2008	376.7	75	668	2489
2009	395.3	54	971	3606
2010	411.6	172	677	4785
2011	420.9	256	1080	5523
2012	413.4	30	704	5576
2013	417.9	31	723	4009
2014	411.0	77	766	4558

Table 2. Mean, minimum and maximum fork lengths (mm) and total number sampled of Spanish mackerel aged through Prg. 930.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	373.1	38	646	304
2006	378.6	254	683	291
2007	379.3	265	805	297
2008	362.6	196	684	328
2009	387.9	235	638	317
2010	377.5	174	645	411
2011	383.3	155	712	430
2012	367.5	159	670	557
2013	385.1	188	699	370
2014	373.7	192	656	515

Table 3. Mean, minimum and maximum fork lengths (mm) and total number sampled of Spanish mackerel from fishery independent sampling programs.

Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2005	356.5	47	612	67
2006	357.1	176	542	47
2007	291.2	55	553	164
2008	328.7	80	680	371
2009	356.6	110	568	547
2010	344.6	75	550	378
2011	356.5	52	520	132
2012	340.9	38	580	122
2013	301.1	117	608	80
2014	266.0	42	483	45

Table 4. Summary of management strategies by North Carolina for Spanish Mackerel

Management Strategy	Outcome
12” minimum size limit	Rule 3M.0301(a)(1)
15 fish creel limit	Rule 3M.0301(a)(2)
15 fish creel limit outside 3 miles only with a NMFS Commercial Vessel Permit	Rule 3M.0301(a)(3)
Charter vessels or head boats with NMFS Commercial Vessel Permit must comply with possession limits when fishing with more than 3 persons	Rules 3M.0301(c)
Commercial trip limit of 3,500 lbs of Spanish, King or aggregate	Rule 3M.0301(d)
Prohibits Purse Gill Nets when taking king or Spanish mackerel	Rule 3M.0302

FIGURES

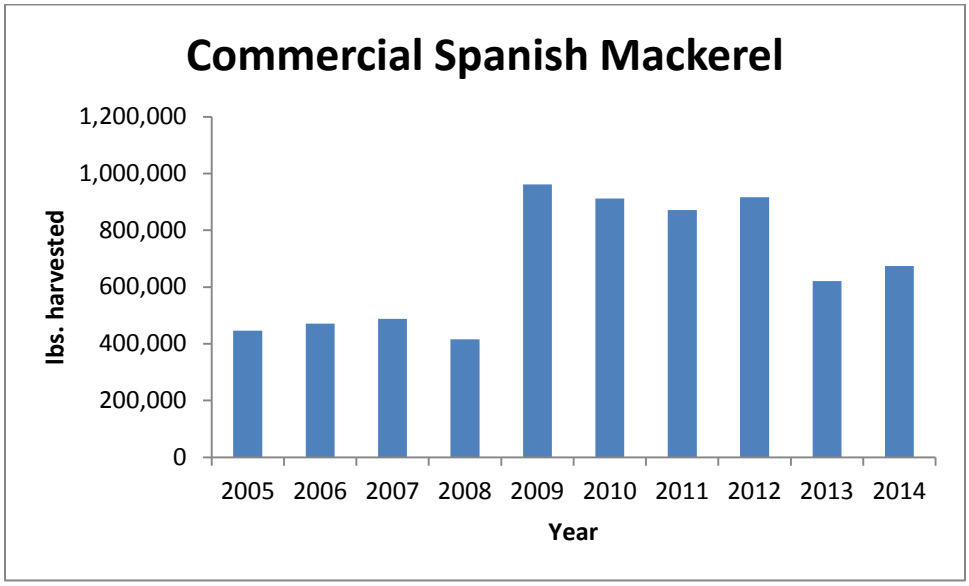


Figure 1. Commercial landings of Spanish mackerel in North Carolina from 2005 - 2014.

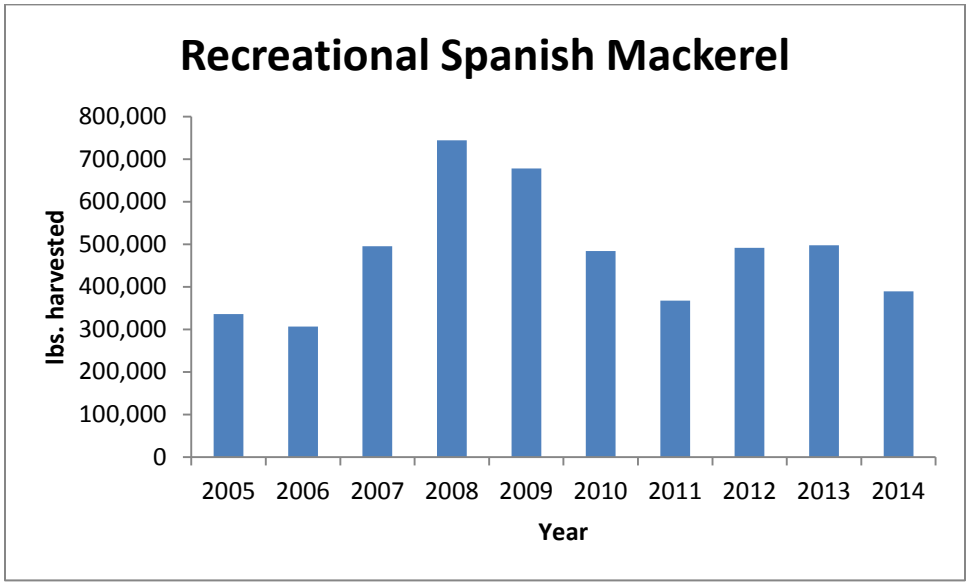


Figure 2. Estimated recreational harvest of Spanish Mackerel in North Carolina from 2005 – 2014.

FISHERY MANAGEMENT PLAN UPDATE
SPINY DOGFISH
AUGUST 2015

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 2002
Amendments:	None
Revisions:	Addendum I November 2005 Addendum II October 2008 Addendum III April 2011 Addendum IV August 2012 Addendum V October 2014
Supplements:	None
Information Updates:	None
Schedule Changes:	None
Next Benchmark Review:	None

The Interstate Fishery Management Plan for Spiny Dogfish (FMP) was approved by the Atlantic States Marine Fishery Commission (ASMFC) in November 2002 with implementation for the 2003/2004 fishing year. The 2002 FMP established the annual quota and possession limit system. The Spiny Dogfish and Coastal Shark Management Board (Board), Advisory Panel, Technical Committee, and Plan Review Team oversee the management of spiny dogfish in state waters. The management unit includes the entire coast-wide (Maine-Florida) distribution of the resource from the estuaries eastward to the inshore boundary of the EEZ.

There are no amendments to the interstate FMP but there are four addenda. Addendum I approved in November 2005 allowed the Board to set multi-year specifications. Addendum II approved October 2008 established regional allocation of the annual quota with 58% to states from Maine to Connecticut. Addendum III established state shares for New York to North Carolina. For these southern region states, Addendum III also allowed for quota transfer between states, rollovers of up to five percent, state-specified possession limits, and included a three-year reevaluation of the measures. North Carolina is allocated 14.036% of the southern quota. Addendum IV approved in August 2012 addressed the differences in the definitions of overfishing between the New England Fishery Management Council (NEFMC), Mid-Atlantic Fishery Management Council (MAFMC) and the ASMFC. The Board adopted the fishing mortality threshold to be consistent with the federal plan. Addendum V, approved in 2014, ensured consistency in spiny dogfish management with the Shark Conservation Act of 2010 by prohibiting processing at-sea, including the removal of fins.

Management Unit

The entire coastwide distribution of the resource in the Atlantic from the estuaries eastward to the inshore boundary of the Exclusive Economic Zone (EEZ), is managed by the ASMFC, NEFMC and MAFMC. North Carolina is allotted a state specific share of the coastwide quota and allowed to specify possession limits in state waters.

Goal and Objectives

The goal of the ASMFC FMP for spiny dogfish is to promote stock rebuilding and management of the spiny dogfish fishery in a manner that is biologically, economically, socially, and ecologically sound. In support of this goal, the following objectives are recommended:

1. Reduce fishing mortality and rebuild the female portion of the spawning stock biomass to prevent recruitment failure and support a more sustainable fishery.

2. Coordinate management activities between state, federal and Canadian waters to ensure complementary regulations throughout the species range.

3. Minimize the regulatory discards and bycatch of spiny dogfish within state waters.

4. Allocate the available resource in biologically sustainable manner that is equitable to all the fishers.

5. Obtain biological and fishery related data from state waters to improve the spiny dogfish stock assessment that currently depends upon data from the federal bottom trawl survey.

STATUS OF THE STOCK

Stock Status

N.C. Division of Marine Fisheries 2014 Stock Status Report classifies the spiny dogfish stock as viable because they are not overfished and overfishing is not occurring.

Stock Assessment

The 2014 stock assessment update, conducted by the Northeast Fisheries Science Center (NEFSC), estimates spiny dogfish are not overfished and not experiencing overfishing. Female spawning stock biomass estimates from 2009 to 2013 exceeded the biomass reference point (Figure 1). Therefore, the stock was not overfished and remained rebuilt in 2013.

The NEFSC report also provides the most recent estimate of F (fishing mortality). F was 0.15 in 2012 and has been consistently below the fishing mortality target in recent years. As such, spiny dogfish are not overfished and overfishing is not occurring. Unfortunately, record low pup production from 1997 to 2003 has left a recruitment deficit that will cause SSB to drop soon. The amplitude of this drop increases as fishing mortality increases and still occurs when fishing mortality is hypothetically zero.

Spiny dogfish was declared ‘rebuilt’ in 2008 when SSB exceeded the target for the first time since the ASMFC began managing spiny dogfish in 2002. Prior to the ‘rebuilt’ status, quotas were based on the short term target Frebuild = 0.11. The FMP allows for quotas based on Ftarget (as opposed to the more conservative Frebuild) “once the mature female portion of the spawning stock has reached the target”.

STATUS OF THE FISHERY

Current Regulations

Spiny dogfish are primarily harvested commercially with no recreational regulations in effect. Commercial harvest of spiny dogfish is quota managed with harvest periods and trip limits in federal waters and through regional and state quota allocations in state waters. The ASMFC Spiny Dogfish Board approved a 49.37 million pound quota for the 2014/2015 fishing season (May 1 – April 30). The quota is subdivided into a northern region share of 58% and state-specific shares for the southern region from New York to North Carolina. North Carolina receives 14.0036 % of the annual quota. For the 2014/2015 fishing season North Carolina was allocated 6,929,573 pounds of the southern regions quota. The NCDMF set the trip limit at 10,000 pounds per day and increased it to 20,000 pounds effective February 19, 2015.

Commercial Landings

Prior to the Fishery Conservation and Management Act of 1976 (now known as the Magnuson-Stevens Reauthorization Act), foreign fleets caught the majority of dogfish in U.S. waters but U.S. fishermen have had uncontested access ever since the Act's passage. The National Marine Fisheries Service (NMFS) encouraged commercial fishermen to target the bountiful stocks of spiny dogfish in the 1980s and 1990s when stocks of other commercially valuable fish in the Northeast declined. Then in 1998, NMFS determined that spiny dogfish were overfished and implemented stringent harvest restrictions in federal waters to allow the stock to rebound. The states followed shortly after with complementary regulations for state waters.

Coastwide landings were approximately 37.2 million pounds in 1992, gradually increasing to a peak of about 60 million pounds in 1996. In the late 1990s, landings declined to an average of around 40 million. After federal and state regulations were implemented in the early 2000s, landings declined to less than five million pounds in 2001 and 2002. They then ranged between two and eight million pounds between 2003 and 2009. As the stock began to improve, landings were increased to 21 million pounds in 2011. Commercial landings continue to be mostly female dogfish, with female landings comprising about 98% of the total commercial catch. Commercial landings totaled 16 million pounds in 2014, a decrease in recent years due to poor market conditions. Discards have remained fairly stable, around 11 million pounds over the past decade and are expected to remain near that level in the future.

The coastwide commercial quota was set at 49,037,000 pounds for fishing year 2014. The fishing year runs from May 1, 2014 to April 30, 2015. The quota is subdivided into a northern region (Maine - Connecticut) share of 58% and state-specific shares for the southern region, allocated as follows New York (2.707%); New Jersey (7.644%); Delaware (0.896%); Maryland (5.92%); Virginia (10.795%; and North Carolina (14.036%). Any overages from the previous fishing seasons will be paid back by the region or state in the following season, as has been done in the past. Landings in North Carolina have been increasing correlating to the increase in quota (Figure 2). Primarily, landings occur from ocean gill nets (Table 1 and Figure 3). While

estuarine gill nets do not target spiny dogfish, landings increased for the gear in 2013 and 2014 possibly due to the season opening earlier and the marketability of the incidental catch of spiny dogfish when targeting flounder or American shad.

Recreational Landings

Recreational landings are insignificant for 2005 through 2014 (Table 2) and were obtained from the Marine Recreational Information Program (MRIP). As a source of total mortality, recreational catch can be considered negligible (Rago and Sosebee 2014).

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Fishery-dependent monitoring programs for beach seine, estuarine gill net, ocean gill net and ocean trawl sampled spiny dogfish from 2005 to 2014. Samples were taken at fish packing houses while the catches were being offloaded. Captain or crew members were interviewed to obtain information including area fished, gear specifications and water depth. Samples were collected and recorded in metric units (kilograms and millimeters). Each sample was weighed to the nearest 0.1 kg, individual spiny dogfish were measured to the nearest millimeter for both total and fork length, and sex determined. The total catch weight was obtained from the fish house dealer's records. Table 3 summarizes all the length data collected from fishery-dependent sampling from 2005 to 2014. Tables 4 through 7 summarize the fishery-dependent length data by gear from 2005 to 2014. The majority of spiny dogfish are sampled from the ocean gill net fishery, the primary gear used to target spiny dogfish in North Carolina. The number of trips sampled and spiny dogfish measured has been increasing since 2012 while the mean total length has stayed between 850 to 899 millimeters. Total length has ranged from 470 to 1,080 millimeters in the ocean gill net fishery. Mean length of spiny dogfish harvested from this gear has remained constant, only dropping below 850 millimeters in 2007 to an average of 847 millimeters.

Numbers of spiny dogfish measured have ranged from 0 in 2005 to 2,461 in 2012. Female spiny dogfish contribute to the majority of the harvest and samples collected. Female fish are larger and more abundant in the nearshore areas where most fishing occurs. Tables 8 and 9 summarize the length data for male and female spiny dogfish collected from fishery-dependent sampling from 2005 to 2014. Figure 3 illustrates the female to male sampling composition.

Fishery-Independent Monitoring

The NCDMF initiated a fisheries independent gill net survey in 2001 and expanded its coverage in 2008 to include the Cape Fear River and the near shore (0-3 miles) Atlantic Ocean from New River Inlet south to the South Carolina state line. The objective of this project is to provide annual, independent, relative-abundance indices for key estuarine species in the near shore Atlantic Ocean, Pamlico Sound, Pamlico, Pungo, Neuse, and Cape Fear rivers. These indices can also be incorporated into stock assessments and used to improve bycatch estimates, evaluate management measures, and evaluate habitat usage. Results from this project will be used by the NCDMF and other Atlantic coast fishery management agencies to evaluate the effectiveness of current management measures and to identify additional measures that may be necessary to conserve marine and estuarine stocks. Developing fishery independent indices of abundance for target species allows the NCDMF to assess the status of these stocks without

relying solely on commercial and recreational fishery dependent data. The survey employs a stratified random sampling design and utilizes multiple mesh gill nets (3.0 inch to 6.5 inch stretched mesh, by ½ inch increments). A total of 775 spiny dogfish were caught in the Pamlico Sound portion of the independent gill net study from 2001 to present. Total length ranged from 511 to 1,010 millimeters and averaged 842 millimeters. The nearshore, ocean gill net component of the survey caught 1,237 spiny dogfish from 2008 to present. Total length ranged from 569 to 1,024 and averaged 864 millimeters (Table 10).

MANAGEMENT STRATEGY

The spiny dogfish fishery is managed complementarily by the MAFMC and NEFMC in federal waters, and ASMFC in state waters. In order to set the annual quota a joint meeting between the ASMFC Technical Committee (TC) and MAFMC Monitoring Committee (MC) occurs each fall. The TC and MC review the best available science and make quota recommendations to the Spiny dogfish and Coastal Shark Management Board (Board) and MAFMC for the following fishing year's quota. The first step to making a quota recommendation is to calculate a harvest level that coincides with the appropriate F rate. In 2002, ASMFC adopted the MAFMC's target, and threshold, fishing mortality rates in the original FMP. In 2009, the MAFMC revised status determinations criteria to define Fthreshold as "Fmsy (or a reasonable proxy thereof) as a function of productive capacity, and based upon the best scientific information consistent with National Standards 1 and 2" and did not include and Ftarget value. In 2012, the ASMFC adopted the MAFMC's Fthreshold definition to be consistent with the federal plan through Addendum IV to the FMP. Overfishing is defined as an F rate that exceeds the Fthreshold. The Board retains the authority to set an Ftarget based on the TC's recommendations. While the federal plan does not specify an Ftarget and quotas are calculated based on Fmsy. The Board is not required to specify an Ftarget and if specified, an Ftarget would apply to one fishing season.

- Fmsy = 0.244; allows for the production of 1.5 female pups per female that will recruit to the spawning stock biomass (SSB).
- Fthreshold = 0.325; allows for the production of one female pup per female that will recruit to the SSB.
- SSBtarget = 159,288 mt (351 million pounds); level of biomass that would maximize recruitment to the population (100% SSBmax).
- SSBthreshold = 79,644 mt (175 million pounds); 50% of SSBmax

The NEFSC conducts a spring bottom trawl survey to gather data used to update population abundance estimates. Due to mechanical problems in 2014 critical strata in the Mid-Atlantic region were unable to be sampled. For this reason, it was not possible to update population abundance estimates in 2014 nor was it possible to provide updated estimates of fishing mortality rates, or conduct projections of stock size under varying fishing mortality rates. Instead the total estimated catch of spiny dogfish in 2013 was summarized and compared to catch projections from previous years.

U.S. landings decreased about 31% from 10,660 mt in 2012 to 7,312 mt in 2013. Recreational landings and distant water fleet landings are negligible. Canadian landings have averaged about 77 mt since 2009. Total discards increased slightly from 11,626 mt in 2012 to 12,820 mt in 2013. The 2013 estimate is approximately equal to the average of the previous 5 years. Similar patterns were observed for dead discards. Total dead discards have been relatively stable since 2000. The ratio of dead discards to landings in 2013 increased slightly to 0.68. The 3 year average of female SSB swept area biomass in 2013 of 235,900 mt was about the same as the 241,000 mt in 2012. Pup production was the highest observed in the time series since 1968. Female SSB estimates from 2009 to 2013 exceeded the biomass reference point. Fishing mortality was estimated to be 0.15 in 2012, well below the plan's threshold (0.244).

MANAGEMENT AND RESEARCH NEEDS

Continuing research priorities from the ASMFC FMP include:

- Determine area, season, and gear specific discard mortality estimates coast wide in the recreational, commercial, and non-directed (bycatch) fisheries.
- Monitor the level of effort and harvest in other fisheries as a result of no directed fishery for spiny dogfish.
- Characterize and quantify bycatch of spiny dogfish in other fisheries.
- Increase observer trips to document the level of incidental capture of spiny dogfish during the spawning stock rebuilding period.
- Conduct a coast wide tagging study to explore stock structure, migration, and mixing rates.
- Standardize age determination along the entire East Coast. Conduct an ageing workshop for spiny dogfish, encouraging participation by NEFSC, NCDMF, Canada DFO, other interested agencies, academia, and other international investigators with an interest in dogfish ageing.

LITERATURE CITED

NMFS 2015. Personal communication from the National Marine Fisheries Service, Fisheries Statistics Division June 3, 2015.

Rago P.J. and K.A. Sosebee. 2014. Update of Landings and Discards. Report to MAFMC SSC September 15, 2014. 19 p.

TABLES

Table 1. Commercial spiny dogfish landings (lb) by gear 2005-2014 (NCDMF Trip Ticket. Program)

Year	Ocean Gill Net	Estuarine Gill Net	Beach Seine	Ocean Trawl	Ocean Hook N-Line	Annual Total
2005	16,979	1,021		850	15	18,865
2006	11,547	27				11,574
2007	148,147	434	800		162	149,543
2008	158,562	165				158,727
2009	1,405,549	327	10,486			1,416,362
2010	1,695,878	116	11,170	1,273		1,708,437
2011	2,553,293	130		4,500		2,557,923
2012	2,663,008	229	65,645			2,728,882
2013	3,000,602	10,356				3,010,958
2014	5,643,146	5,339		1,800		5,650,285

Table 2. Recreational spiny dogfish harvest and discards from MRIP survey for 2005-2014 (NMFS 2015).

Year	Harvest Number (A+B1)	PSE (Num)	Weight (lb), (A+B1)	PSE (lb)	Number Released	PSE
2005					802	94.2
2006	430	100.0	1,752	100.0	20,934	38.5
2007					12,573	50.8
2008					10,139	58.4
2009					8,854	73.2
2010	1,070	64.7	5,399	69.7	31,644	37.7
2011	1,247	73.3	8,294	75.9	39,908	41.1
2012	140	71.2	712	71.2	25,515	36.9
2013	3,404	75.4	6,134	67.4	135,333	47.5
2014	1,044	63.1	4,947	71.4	80,970	36.7
10 Yr Average	**1,223**		**4,540**		**36,667**	

Table 3. Summary table of spiny dogfish trips sampled, sample weight (kg) and length data collected from dependent sampling 2005-2014.

Year	Number of Trips Sampled	Total Number Measured	Sample Weight (kg)	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)
2005	0					
2006	2	82	231.7	886	765	1,045
2007	27	1,201	3,273.7	855	675	1,020
2008	10	545	1,369.2	859	724	995
2009	28	1,048	2,650.1	864	704	1,080
2010	23	843	2,227.1	861	712	1,015
2011	24	686	1,893.2	847	661	1,005
2012	67	2,461	7,030.7	876	681	1,074
2013	66	2,373	6,765.1	877	668	1,035
2014	63	2,168	6,025.4	878	470	1,065

Table 4. Spiny dogfish length data collected from the commercial beach seine fishery 2005-2014.

Year	Number of Trips Sampled	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Number Male	Number Female	Total Number Measured
2005							
2006							
2007							
2008							
2009	1	873	805	1,010		14	14
2010	2	856	713	997	7	90	97
2011							
2012	1	869	771	982	8	78	43
2013	4	850	735	959	22	238	130
2014							

Table 5. Spiny dogfish length data collected from the commercial estuarine gill net fishery 2005-2014.

Year	Number of Trips Sampled	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Number Male	Number Female	Total Number Measured
2005							
2006	1	864	825	888		6	6
2007							
2008							
2009							
2010							
2011							
2012							
2013							
2014	2	864	800	907		18	9

Table 6. Spiny dogfish length data collected from the commercial ocean gill net fishery 2005-2014.

Year	Number of Trips Sampled	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Number Male	Number Female	Total Number Measured
2005							
2006	1	888	765	1,045	1	75	76
2007	27	855	675	1,020	184	1,017	1,201
2008	10	859	724	995	18	527	545
2009	27	864	704	1,080	54	980	1,034
2010	21	861	712	1,015	42	704	746
2011	24	847	661	1,005	34	647	698
2012	65	877	681	1,074	166	4,592	2,380
2013	62	879	668	1,035	154	4,332	2,243
2014	61	878	470	1,065	148	4,170	2,159

Table 7. Spiny dogfish length data collected from the commercial ocean trawl fishery 2005-2014.

Year	Number of Trips Sampled	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Number Male	Number Female	Total Number Measured
2005							
2006							
2007							
2008							
2009							
2010							
2011							
2012	1	881	797	970		76	38
2013							
2014							

Table 8. Length data collected from male spiny dogfish sampled from all gears 2005-2014.

Year	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Total Number Measured
2005	.	.	.	.
2006	765	765	765	1
2007	764	675	930	184
2008	792	741	937	18
2009	786	721	940	54
2010	785	712	895	49
2011	765	700	829	34
2012	769	702	882	87
2013	779	670	896	88
2014	776	641	844	74

Table 9. Length data collected from female spiny dogfish sampled from all gears 2005-2014.

Year	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Total Number Measured
2005	0	0	0	0
2006	888	786	1,045	81
2007	871	740	1,020	1,017
2008	862	724	995	527
2009	868	704	1,080	994
2010	865	715	1,015	794
2011	852	661	1,005	647
2012	880	681	1,074	2,373
2013	881	668	1,035	2,285
2014	882	470	1,065	2,094

Table 10. Fisheries independent assessment programs length data for spiny dogfish.

Program	Time Series	Mean Total Length (mm)	Minimum Total Length (mm)	Maximum Total Length (mm)	Total Number Measured
Pamlico Sound Independent Gill Net Survey-915	2001-present	842	511	1,010	775
Ocean Gill Net Independent Survey-916	2008-present	864	569	1,024	1,237

FIGURES

Figure 1. NEFSC Spiny Dogfish Spawning Stock Biomass 1991-2013.

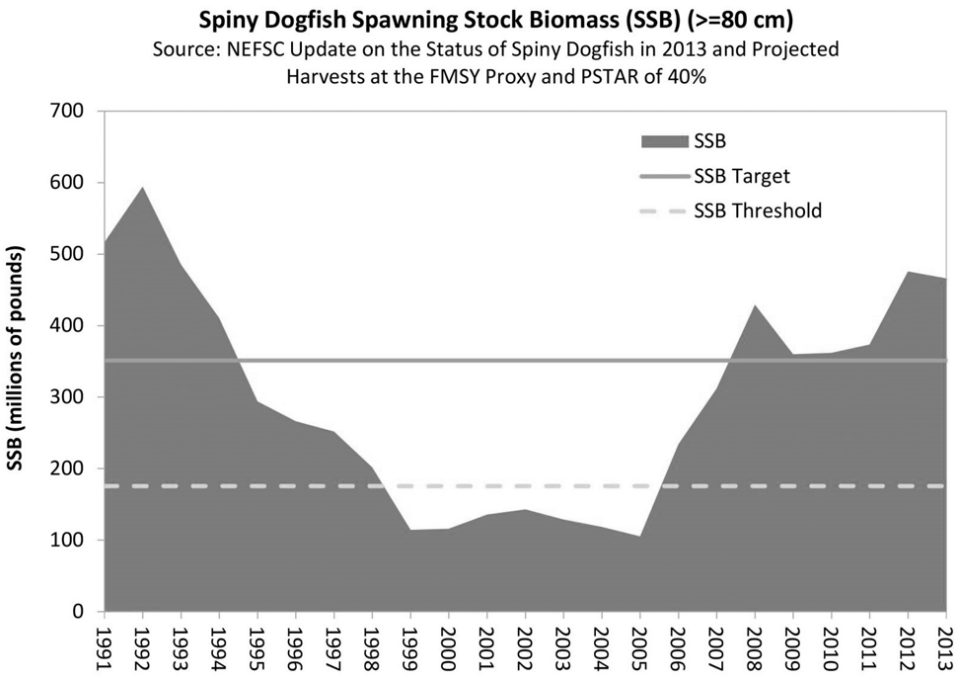


Figure 2. Annual commercial spiny dogfish landings (lb) 2005-2014 (NCDMF Trip Ticket Program).

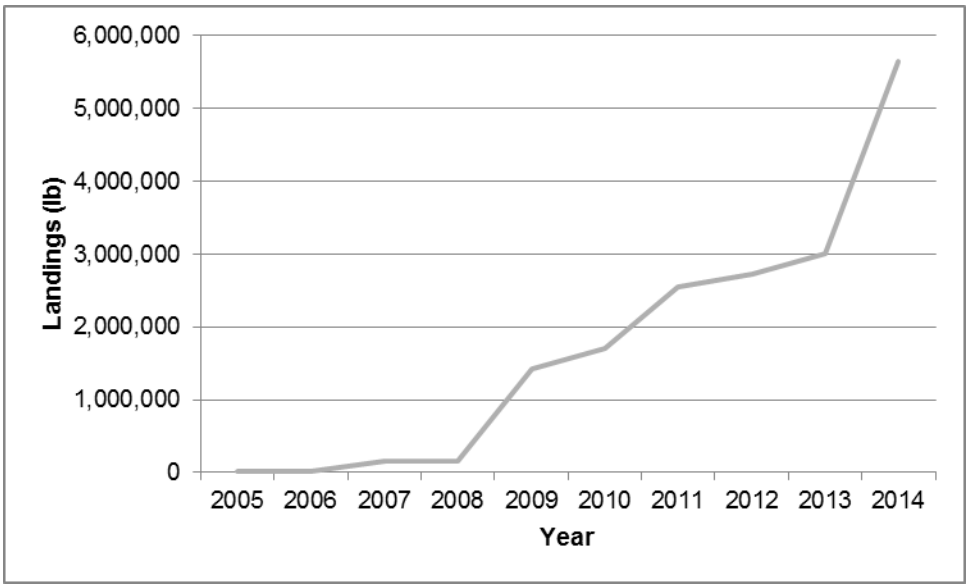


Figure 3. Annual commercial spiny dogfish landings (lb) by gear 2005-2014 (NCDMF Trip Ticket Program).

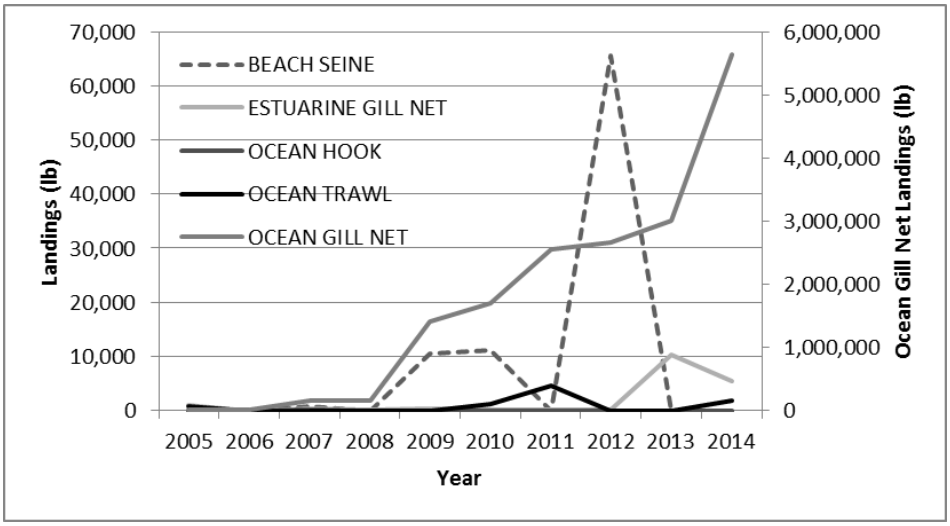
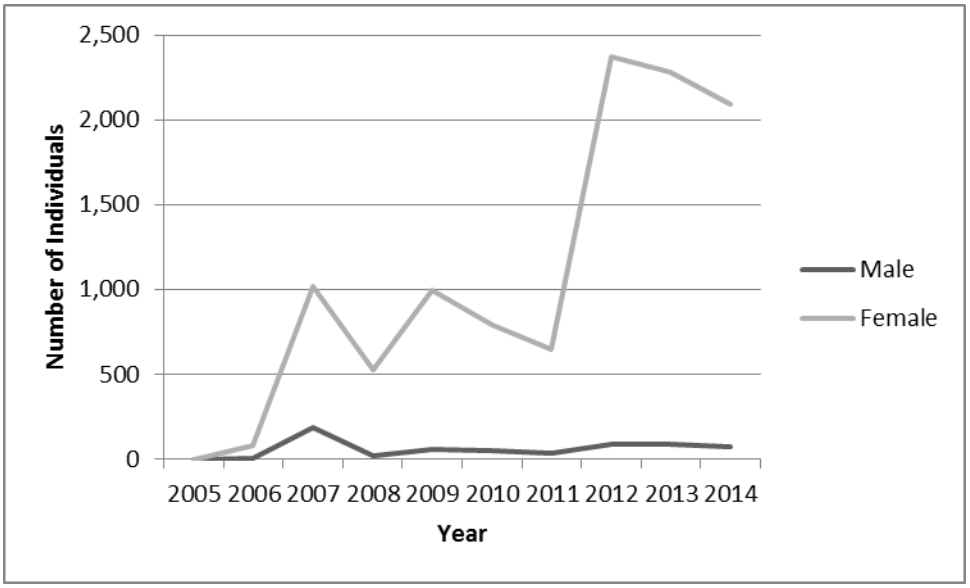


Figure 4. Number of individuals measured by year and sex 2005-2014.



North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

July 30, 2015

Memorandum

To: Marine Fisheries Commission

Through: Louis B. Daniel III, Director

From: Don Hesselman, License & Statistics Section Chief

Subject: Commercial License Sales FY15 and FY16 Pre-sales

The purpose of this memo is to provide a summary and trend analysis of commercial fishing license sales and revenue to assess and estimate revenue changes as a result of recent fee increases. In general, reduction in sales as a result of the 25-percent rate increase for the 2014/2015 license year was minimal and not significantly different from other years, although the general trend continues to show a decrease.

We are limited in the ability to estimate revenues for the 2015/2016 license year with the 100 percent fee increases. We can only provide estimates based on the April 15 – June 30 pre-sales period. Comparing prior pre-sale license years, we found an attrition rate close to 5 percent; therefore, we estimated another 5-percent decrease for license year 2015-2016.

A 5 percent attrition rate for license year 2015/2016 would result in total estimated revenues of $3,293,126 for all license sales. Of that, $1,436,270 would come from the increased fee and be applied directly to the At Sea Observer Program. This will more than cover the $1.3 million annual funding need for the At Sea Observer Program. However, it will be May 2016 before the division can determine if the 5 percent attrition rate is accurate. Additionally, the division cannot determine how much of the At Sea Observer Program budget will remain unspent until the end of the fiscal year on June 30, 2016.

North Carolina Division of Marine Fisheries

Quota Monitoring

Landings Report

North Carolina Quota Monitored Species Reporting

Species currently under a quota monitoring requirement by the North Carolina Division of Marine Fisheries (NCDMF) include summer flounder, striped bass, black sea bass North of Cape Hatteras, spiny dogfish, and river herring. Seasons are opened and closed by proclamation as shown in the table below. Landings reports are updated weekly during the proclamation season.

2015 North Carolina Quota Monitored Landings

Updated 07/28/2015

Species	2015 Total Quota (LBS)	80% of Quota for Winter Fishery	2015 Transfer	2015 Harvest	Quota Remaining	Proclamation	Trip Limit (pounds)	Comments
2015 Summer Flounder	3,038,093	2,430,474	61,850	2,299,705	68,919	FF-22-2015	7,500	**Closes** 09/30/2015 at 6:00pm
2015 Black Sea Bass N of Cape Hatteras	243,422		509	237,257	5,656	FF-27-2015	100 trawl, hook & line, fish pot /week	**Closed**
2014/2015 Spiny Dogfish	7,276,052			5,198,409	2,077,640	FF-05-2015	per day: 20,000	**Closed** 04/30/2015 at 6:00pm
A.O. Striped Bass	360,360							
TRAWL	120,120			0	120,120	FF-1-2015	100 fish/day	Closed 3/31/15
SEINE	120,120			0	120,120	FF-77-2014	150 fish/day	Closed 3/31/15
GILL NET	120,120			0	120,120	FF-91-14	50 fish/day	Closed 02/14/2015
ASMA Striped Bass	137,500			80,843	56,657	FF-15-15	20 fish/day	Closed 04/30/2015
CSMA Striped Bass	25,000			25,573	-573	FF-14-15	10 fish/day	Closed 03/18/2015

*** All figures are in pounds unless otherwise noted**

For questions about quota monitoring or to report landings:

Permitted Species	FAX	E-mail Address	Telephone #
Striped Bass, River Herring	**252-264-3723**	LANDINGS@ncdenr.gov	800-338-7805
Summer Flounder, Black Sea Bass North of Cape Hatteras, Spiny Dogfish	**252-726-3903**	FLOUNDER@ncdenr.gov	800-682-2632

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

MEMORANDUM

TO: Louis Daniel
Sammy Corbett

FROM: Chris Batsavage, Protected Resources Section Chief/Special Assistant for Councils
Division of Marine Fisheries, NCDENR

DATE: July 31, 2015

SUBJECT: Protected Resources Section Update

OBSERVER PROGRAM

Tables summarizing observer coverage and protected species interactions from January through June 2015 are found in the briefing book. Observer coverage for the large mesh gill net fishery was 7.4% and coverage for the small mesh gill net fishery was 2.9%. Observer coverage estimates are based on the number of gill net trips from prior years because 2015 trip numbers are preliminary.

Also included in the briefing book are tables summarizing the observer coverage for the winter and spring seasons, by management unit. Large mesh gill net observer coverage by management unit in the winter ranged from 0% to 18% and from 0% to 7% for small mesh gill nets. The windy weather combined with very cold temperatures this past winter impacted the number of gill net and observer trips. Large mesh gill net observer coverage by management unit in the spring ranged from 0% to 24% and from 2% to 10% for small mesh gill nets.

A total of 14 sea turtle interactions were observed in large mesh gill nets and 2 in small mesh gill nets from January through June 2015. These interactions occurred in every management unit except for D1 and D2 with most of the interactions taking place in Management Unit B (10). No self-reported sea turtle interactions by gill net fishermen occurred.

A total of 19 Atlantic sturgeon interactions were observed in large mesh gill nets and 9 in small mesh gill nets. These interactions occurred in every management unit with most of the interactions taking place in Management Unit A (19). No self-reported Atlantic sturgeon interactions by gill net fishermen occurred.

MANAGEMENT UNIT CLOSURES

Management Unit B closed for large mesh gill nets on June 8, 2015 due to the allowed number of live and dead green sea turtle interactions being approached. Management Unit A closed for all anchored gill nets

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on June 12, 2015 due to the total number of allowed interactions (4) being exceeded. Management Unit C closed on July 23, 2015 due to sea turtle interactions (please see Incidental Take Permit Status for 2014-2015 Fishing Year below for more information). The closures will remain in place until at least September 1, 2015, which is the beginning of the next fishing year for the incidental take permits. However, the reopening could occur later, depending on the abundance of sea turtles in those areas at that time.

SEA TURTLE INCIDENTAL TAKE PERMIT UPDATE

Spring Seasonal Progress Report

Included in the briefing book is the spring seasonal progress report for the Sea Turtle Incidental Take Permit, which covers the period from March through May 2015. Based on the number of gill net trips from prior years for large mesh gill nets, the minimum observer coverage was reached or exceeded in all of the management units except Management Unit D1. Coverage was not met in Management Unit D1 due to the minimal amount of fishing effort that occurred and the annual closure beginning on May 7 in the management unit. Based on the number of gill net trips from prior years for small mesh gill nets, the minimum observer coverage was exceeded in all of the management units.

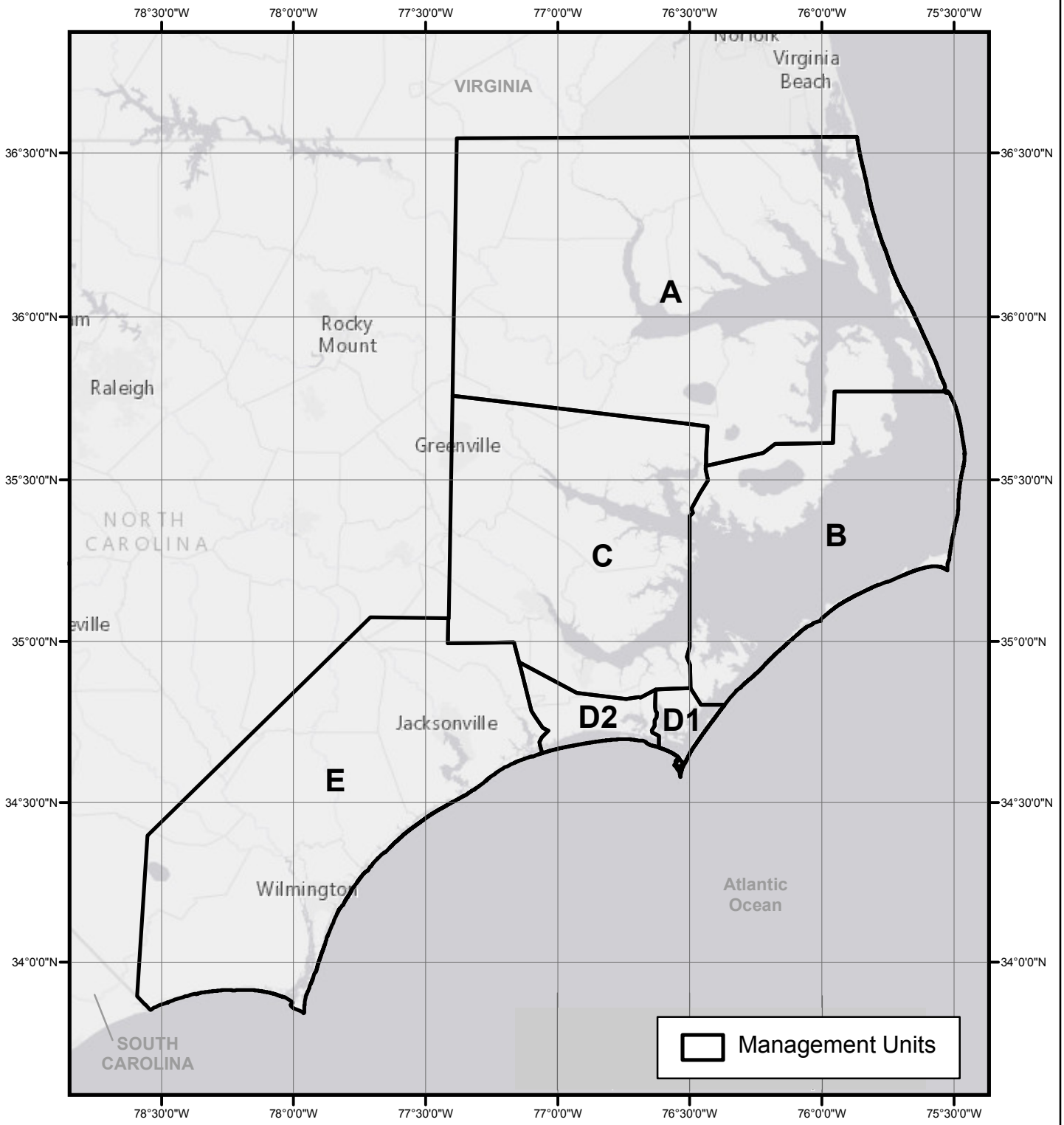
Annual Review of Incidental Take Permit for 2013-2014 Fishing Year

The National Marine Fisheries Service recently reviewed the Sea Turtle Incidental Take Permit for the 2013-2014 fishing year, and they concluded that the division met all of the requirements under the incidental take permit for that fishing year. In their review, the National Marine Fisheries Service acknowledged that the Estuarine Gill Net Permit played a major role in this accomplishment by improving compliance with the incidental take permit. In addition, the implementation of the Estuarine Gill Net Permit met the requirement of a fishermen registry and did so well in advance of the deadline set by National Marine Fisheries Service (September 1, 2015).

Incidental Take Permit Status for 2014-2015 Fishing Year

The sea turtle takes in Management Unit A this fishing year (6) exceeded the allowed annual takes for that management unit (4). According to the Endangered Species Act regulations, a violation of any of the terms and conditions of the incidental take permit will subject the division, and any individual who is operating under the authority of this permit, to the penalties as provided in the Endangered Species Act. In order to return to compliance this fishing year and to provide more flexibility in managing the fishery to ensure that authorized take levels are not exceeded in the future, the division requested a minor modification to the incidental take permit that combines the authorized takes for Management units A and C. Each management unit was originally allowed 4 sea turtle takes of any species or disposition (dead/alive) for both small and large mesh gill nets. This minor modification was implemented on July 21, 2015. A total of two sea turtle interactions already occurred in Management Unit C this fishing year, so the combined number of allowed takes for both management units was reached. Consequently, the division closed Management Unit C for all anchored gill nets on July 23, 2015 to prevent the combined takes from being exceeded. As with Management units A and B, the closure will remain in place until at least September 1, 2015.

The division is also developing an issue paper for potential amendments to the sea turtle and Atlantic sturgeon incidental take permits. An amendment is required for changes that are beyond the scope of a minor modification as determined by the National Marine Fisheries Service. The issue paper will be presented to the Sea Turtle Advisory Committee and the regional advisory committees in September. Based on feedback from the committees and the public that attend the meetings, the division will present the amendment items to the National Marine Fisheries Service for their consideration. The amendment will be available for public comment on the Federal Register, and the approval of the amendment by National Marine Fisheries Service will not be made until public comment and the analysis of impacts are considered. As such, the amendment process generally takes about one year, but the time period depends on the number of requested amendment items and their complexity.



NCDMF ESTUARINE GILLNET PERMIT MAP

April 2015

0 12.5 25 50 Miles

Table 1. Preliminary data collected by month through the NCDMF Observer Program through June 2015.

	Trips		Observer Large Mesh				Observed Takes By Species								
							Kemp's		Green		Loggerhead		Unknown	A. Sturgeon	
Month	Estimated [1]	Actual [2]	AP Attempts [3]	Trips	Yards	Coverage [4]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
January	245	355	85	16	12,600	6.5	0	0	0	0	0	0	0	**2**	0
February	811	385	125	43	24,375	5.3	0	0	0	0	0	0	0	0	0
March	1,871	2,154	135	157	110,740	8.4	0	0	0	0	0	0	0	**9**	0
April	1,227	1,308	140	84	55,058	6.8	0	0	**1**	0	0	0	0	**2**	0
May	952	673	123	101	80,890	10.6	**1**	0	**3**	**3**	0	0	0	**5**	0
June	1,429	405	67	84	54,330	5.9	0	0	**4**	**2**	0	0	0	**1**	0
Total	6,536	5,280	675	485	337,993	7.4	1	0	8	5	0	0	0	19	0

[1] Finalized trip ticket data averaged from 2011-2014

[2] Preliminary trip ticket data for 2015

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

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

Table 2. Preliminary data collected by month through the NCDMF Observer Program through June 2015.

	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	712	495	15	9,440	2.1	0	0	0	0	0	0	0	0	0
February	819	290	30	16,205	3.7	0	0	0	0	0	0	0	0	0
March	953	642	43	24,290	4.5	0	0	0	0	0	0	0	0	0
April	1,407	1,018	41	27,242	2.9	0	0	0	**1**	0	0	0	**7**	**2**
May	988	523	24	8,725	2.4	0	0	0	0	0	0	0	0	0
June	817	356	11	6,000	1.3	0	0	**1**	0	0	0	0	0	0
Total	5,694	3,324	164	91,902	2.9	0	0	1	1	0	0	0	7	2

[1] Finalized trip ticket data averaged from 2013-2014

[2] Preliminary trip ticket data for 2015

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

Table 3. Preliminary data collected by month and management unit through the NCDMF Observer Program through June 2015.

								Observed Takes By Species								
		Trips		Observer Large Mesh				Kemp's		Green		Loggerhead		Unknown	A.Sturgeon	
Season	Unit	Estimated [1]	Actual [2]	AP Attempts [3]	Trips	Yards	Coverage [4]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
Winter	A	765	619	56	38	27,800	5.0	0	0	0	0	0	0	0	**2**	0
	B	94	57	37	0	0	0.0	0	0	0	0	0	0	0	0	0
	C	159	47	49	13	7,800	8.2	0	0	0	0	0	0	0	0	0
	D1	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	0
	D2	1	0	17	1	200	0.0	0	0	0	0	0	0	0	0	0
	E	38	17	51	7	1,175	18.3	0	0	0	0	0	0	0	0	0
Spring	A	2,254	2,348	110	158	153,925	7.0	0	0	0	0	0	0	0	**14**	0
	B	614	338	79	44	31,700	7.2	**1**	0	**4**	**3**	0	0	0	0	0
	C	839	1,040	57	72	36,318	8.6	0	0	0	0	0	0	0	0	0
	D1	30	9	5	0	0	0.0	0	0	0	0	0	0	0	0	0
	D2	61	80	26	7	5,900	11.4	0	0	0	0	0	0	0	0	0
	E	251	320	121	61	18,845	24.3	0	0	0	0	0	0	0	**2**	0
Total		5,106	4,875	608	401	283,663	7.9	1	0	4	3	0	0	0	18	0

[1] Finalized trip ticket data averaged from 2011-2014

[2] Preliminary trip ticket data for 2015

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

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

Table 4. Preliminary data collected by month and management unit through the NCDMF Observer Program through June 2015.

		Trips		Observer Small Mesh			Observed Takes By Species								
							Kemp's		Green		Loggerhead		Unknown	A.Sturgeon	
Season	Unit	Estimated [1]	Actual [2]	Trips	Yards	Coverage [3]	Live	Dead	Live	Dead	Live	Dead	Live	Live	Dead
Winter	A	1,327	384	27	17,945	2.0	0	0	0	0	0	0	0	0	0
	B	483	160	4	4,050	0.8	0	0	0	0	0	0	0	0	0
	C	152	163	10	2,350	6.6	0	0	0	0	0	0	0	0	0
	D1	7	1	0	0	0.0	0	0	0	0	0	0	0	0	0
	D2	64	55	0	0	0.0	0	0	0	0	0	0	0	0	0
	E	76	22	4	1,300	5.3	0	0	0	0	0	0	0	0	0
Spring	A	1,436	722	52	24,425	3.6	0	0	0	0	0	0	0	**2**	0
	B	1,337	1,056	23	20,880	1.7	0	0	0	**1**	0	0	0	0	**1**
	C	276	195	12	5,900	4.4	0	0	0	0	0	0	0	0	0
	D1	49	15	5	4,650	10.3	0	0	0	0	0	0	0	**5**	**1**
	D2	42	40	2	600	4.8	0	0	0	0	0	0	0	0	0
	E	209	155	14	3,802	6.7	0	0	0	0	0	0	0	0	0
Total		5,453	2,968	153	85,902	2.8	0	0	0	1	0	0	0	7	2

[1] Finalized trip ticket data averaged from 2013-2014

[2] Preliminary trip ticket data for 2015

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

Spring 2015 Seasonal Progress Report
Incidental Take Permit No. 16230
March 1 – May 31, 2015

Jacob Boyd
Protected Species Biologist
North Carolina Division of Marine Fisheries

June 25, 2015

Summary

The spring season for large and small mesh gill nets in North Carolina is March through May for Incidental Take Permit (ITP) Year 2015 (September 1, 2014 – August 31, 2015) as defined in ITP No. 16230. The Division closed anchored large mesh gill nets via proclamation M-6-2015 on May 8, 2015 in management unit D1 through October 14, 2015 as part of the annual closure. All other management units remained open for the duration of the spring season.

Observer coverage was calculated for the spring 2015 season in each management unit by estimating fishing trips using an average of the previous four year's trip ticket data (2011-2014) for large mesh gill nets and the average of the previous two year's (2013-2014) trip ticket data for small mesh gill nets compared to the observer trips completed throughout the spring season. The average was used when estimating fishing trips to account for the fluctuation of fishing effort over the previous four years due to closures and other regulations put in place throughout the time series. The Observer Program achieved an estimated 8.5% overall large mesh gill-net coverage for the spring 2015 season meeting the minimum requirement (n = 7.0%) in all management units except D1 (Table 1). Coverage was not met in management unit D1 due to the minimal amount of fishing effort that occurred and the closure of 25 days in the management unit. Once trip ticket data are finalized in May of 2016, the final observer coverage will be recalculated. This information will be provided annually to finalize all estimates of observer coverage. The Observer Program achieved an estimated 3.2% small mesh gill-net coverage for the spring 2015 season meeting the minimum requirement (n = 1.0%) in each management unit (Table 2).

There were 8 observed sea turtle interactions from large mesh gill nets and 1 observed from small mesh gill nets in the spring 2015 season (Table 3). The species composition was made up of primarily green sea turtles (n = 4 alive; n = 4 dead), with 1 alive Kemp's ridley sea turtle (Table 3). There were no reported sea turtle interactions during this time period. The cumulative estimated and/or observed takes for large and small mesh gill nets through the spring 2015 season for ITP Year 2015 are in Tables 4 and 5.

Marine Patrol made 394 gill net checks for the spring 2015 season. Due to a staffing shortage in the Marine Patrol section, the number of gill net checks made in April and May by Marine Patrol in the southern portion of the state (management unit E) are not included. Of these 394 gill net checks, there were 14 citations written (Table 6).

As per the ITP, the Division established a permit in September 2014 to register all fishermen participating in the anchored large and small mesh gill-net fisheries (Estuarine Gill Net Permit – EGNP). This multifaceted permit allows the Division to closely monitor for compliance with the permit system the Division already has in place. As of June 17, 2015 there have been 2,650 EGNPs issued for Fiscal Year 15. Permits are renewed on an annual basis, based on Fiscal Year (July 1 – June 30) for licenses. During the spring 2015 season there were 14 Notice of Violations (NOV) issued for the EGNP (Table 7).

The Observer Program has various ways to contact fishermen to set up trips. Due to limited resources and fishermen leaving from their residence or private ramps, the most efficient and common way to contact fishermen is by phone. One of the many checks the Program has is a contact log which is filled out for every contact that is made when attempting to obtain a trip. Each contact is put into a specific category and other information is gathered (Table 8). The contact log was analyzed by month and category to determine what percentage of contacts (n = 4,080) resulted in positive observer trips (Table 9). Of the 4,080 contacts that were made, 57.2% were categorized as 1, 8, 11, 12, 13, and 14 which inclusively represent not being able to get in touch with fishermen or fishermen refusing trips. Fishermen compliance decreased by 11.0% from the fall 2014 season with observers making 2,007 more contacts in the spring 2015 season. This decrease may be partly due to the increase in the number of contacts made.

Tables

Table 1. Estimated observer coverage calculated from previous year's trip ticket data (average 2011-2014) and observer data from the spring 2015 season (March - May) by management unit for large mesh gill nets for ITP Year 2015.

	Trips		
Management Unit [1]	Estimated (2011-2014) [2]	Observed	Coverage (%)
A	2,254	158	7.0
B	614	44	7.2
C	839	72	8.6
D1	22	0	0.0
D2	61	7	11.5
E	251	63	25.1
Total	4,041	344	8.5

[1] Management unit D1 was closed during portions of the spring 2015 season.

[2] Finalized trip ticket data averaged from 2011-2014

Table 2. Estimated observer coverage calculated from previous year's trip ticket data (average 2013-2014) and observer data from the spring 2015 season (March - May) by management unit for small mesh gill nets for ITP Year 2015.

	Trips		
Management Unit	Estimated (2013-2014) [1]	Observed	Coverage (%)
A	1,435	52	3.6
B	1,337	23	1.7
C	275	12	4.4
D1	48	5	10.4
D2	41	2	4.9
E	208	13	6.3
Total	3,344	107	3.2

[1] Finalized trip ticket data averaged from 2013-2014

Table 3. Summary of observed sea turtle interactions in large and small mesh gill nets from the spring 2015 season (March - May) for ITP Year 2015.

Date	Management Unit	Latitude	Longitude	Species	Disposition	Tag		Curved Carapace (mm)	
						PIT	Inconel	Length	Width
4/10/2015	B	3510.924	7549.519	green [1]	dead	n/a	n/a	238	206
4/17/2015	B	3507.242	7557.741	green	alive	989.001001952762	n/a	236	200
5/14/2015	B	3449.196	7622.597	green	alive	n/a	n/a	n/a	n/a
5/14/2015	B	3448.986	7622.668	green	dead	n/a	n/a	289	241
5/14/2015	B	3449.582	7622.140	Kemp's	alive	989.001001951753	n/a	257	264
5/27/2015	B	3458.360	7622.268	green	dead	n/a	n/a	240	216
5/28/2015	B	3448.900	7622.949	green	alive	989.001001952770	n/a	320	290
5/29/2015	B	3459.148	7614.202	green	alive	989.001001951712	n/a	239	217
5/29/2015	B	3504.129	7625.871	green	dead	n/a	n/a	240	216

[1] Indicates small mesh gear

Table 4. Summary of estimated and/or observed cumulative sea turtle interactions through the spring 2015 season (March - May) by management unit for large mesh gill nets for ITP Year 2015.

Management Unit	Green		Kemp's ridley		Loggerhead		Unknown	
	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
A	*1	0	*1	0	0	0	*1	0
B	201.7	93.2	27.1	7.1	*1	0	*1	0
C	0	0	0	0	0	0	0	0
D1	2.0	0	0	0	0	0	0	0
D2	0	0	0	0	0	0	0	0
E	0	0	7.5	0	*1	0	0	0
Total	204.7	93.2	35.6	7.1	2	0	2	0

*Indicates observed takes

Table 5. Summary of observed cumulative sea turtle interactions through the spring 2015 season (March - May) by management unit for small mesh gill nets for ITP Year 2015.

	Green	
Management Unit	Alive	Dead
B	0	*1
E	*1	0
Total	*1	0

*Indicates observed takes

Table 6. Citations written by Marine Patrol for large and small mesh gill nets by violation code during the spring 2015 season (March - May) for ITP Year 2015.

Violation		
Date	Code	Description
3/4/2015	NETG09	Gill net set too close to bridge
3/9/2015	NETG09	Gill net set too close to bridge
3/21/2015	NETG22	Improperly set gill net
3/21/2015	NETG53	Use large mesh gill net with corks or floats on top line
3/21/2015	NETG38	Use large mesh gill net in Pamlico Sound later than 1 hour after sunrise
4/2/2015	NETG08	Gill net within 200 yards of pound net
4/2/2015	NETG12	Net in middle third of marked navigational channel
4/2/2015	NETG08	Gill net within 200 yards of pound net
4/2/2015	NETG12	Net in middle third of marked navigational channel
4/5/2015	NETG10	Gill net with illegal mesh size
4/10/2015	NETG29	RCGL gear without proper buoys
5/4/2015	NETG04	Leave gill net in waters when could not be legally fished
5/5/2015	NETG03	Using gill net with improper buoys or identification
5/20/2015	NETG01	Leave gill net in coastal waters unattended

Table 7. Notice of Violations issued by date and violation code for the Estuarine Gill Net Permit during the spring 2015 season for ITP Year 2015.

Date	Code	Description
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/12/2015	EGNP08	Failure to notify DMF of a change in phone number within 14 days
3/13/2015	EGNP25	Refuse to allow fisheries observers onboard or collect data
3/17/2015	EGNP25	Refuse to allow fisheries observers onboard or collect data
3/17/2015	EGNP25	Refuse to allow fisheries observers onboard or collect data
3/25/2015	EGNP09	Failure to set or retrieve nets in accordance with time restrictions
4/6/2015	EGNP25	Refuse to allow fisheries observers onboard or collect data

Table 8. Categories and descriptions 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 9. The percent of contacts (n = 4,080) made by the observers trying to set up trips by month categorized by contact type (0-14) and defined in table 8 for the spring 2015 season (March - May) for ITP Year 2015.

	Categories (%)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
March	1.3	9.5	2.1	0.6	0.5	0.6	2.5	0.0	2.0	1.3	2.2	0.7	5.7	15.2	44.2
April	1.3	5.7	2.0	0.2	0.4	0.3	1.4	0.1	2.3	0.3	1.8	0.5	3.5	9.5	29.2
May	1.0	5.4	2.7	0.1	0.3	0.3	0.8	0.0	1.2	0.4	1.0	0.2	3.0	10.1	26.6
Total	3.6	20.6	6.8	1.0	1.2	1.2	4.6	0.1	5.4	2.1	5.0	1.4	12.2	34.8	100.0

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

MEMORANDUM

TO: Louis Daniel
Sammy Corbett

FROM: Chris Batsavage, Protected Resources Section Chief/Special Assistant for Councils
Division of Marine Fisheries, NCDENR

DATE: July 6, 2015

SUBJECT: Mid-Atlantic Fishery Management Council Meeting— June 8-11, 2015

The Mid-Atlantic Fishery Management Council (Council) met on June 8-11, 2015 in Virginia Beach, VA. Management actions taken by the Council are discussed below.

DEEP SEA CORALS AMENDMENT

The Council selected preferred alternatives for the Deep Sea Corals Amendment and approved the amendment for submission to the Secretary of Commerce. The amendment's management measures are designed to protect deep sea corals in the mid-Atlantic region from bottom tending fishing gear through 15 discrete zones around the offshore canyons and a broad zone designation between the 400 meter and 500 meter depth contour, targeting the 450 meter depth contour. These zones protect an area of over 38,000 square miles, or nearly the size of Virginia. The amendment exempts the deep sea red crab fishery from the bottom tending fishing gear restrictions for at least two years in the discrete zones and indefinitely in the broad zones. The American lobster fishery is also exempt from the bottom tending fishing gear restrictions because the Council does not have management authority for this fishery (managed by the Atlantic States Marine Fisheries Commission). The amendment also requires vessel monitoring systems (VMS) for all *Illex* squid moratorium vessels, and allows for vessel transit through or across all deep sea coral zones with a requirement that the vessel's fishing gear be stowed during transit.

ATLANTIC MACKEREL, SQUID, AND BUTTERFISH SPECIFICATIONS

The Council recommended a 9,177-metric ton annual quota for Atlantic mackerel in 2016-2018, a 56 percent reduction from 2015. The annual quota has drastically decreased over the last several years as Atlantic mackerel have become conspicuously absent from commercial, recreational, and fishery-independent survey catches. Although the stock status of mackerel is currently classified as unknown, the Council's Scientific and Statistical Committee (SSC) recently concluded that the stock is in a depleted state relative to historical levels of abundance.

The Council recommended no changes to the specifications previously recommended for 2016 for longfin squid, *Illex* squid, and butterfish.

RIVER HERRING AND SHAD CATCH CAP

The Council recommended lowering the shad and river herring catch cap from 89 metric tons in 2015 to 82 metric tons in 2016 for the Atlantic mackerel trawl fishery. This was based on the expected quota reduction for Atlantic mackerel in 2016 and the minimal shad and river herring catch in the Atlantic mackerel trawl fishery in recent years.

UPCOMING MEETING

The next regularly scheduled meeting of the Mid-Atlantic Fishery Management Council will be August 10-13, 2015 at the Holiday Inn Midtown in New York City, NY.

June 2015 Council Meeting Report

June 8 – 11, 2015

Virginia Beach, Virginia

The following summary highlights Council actions and issues considered at the Mid-Atlantic Fishery Management Council's June 2015 meeting in Virginia Beach, VA. Presentations, briefing materials, and audio recordings are available at www.mafmc.org/briefing/june-2015.

Deep Sea Corals Amendment

The Council selected preferred alternatives for the Deep Sea Corals Amendment and approved the amendment for submission to the Secretary of Commerce. Below is a summary of the Council's preferred alternatives.

Deep Sea Coral Zone Designations: The Council approved the designation of fifteen discrete coral zones with the boundaries developed during the April 2015 Corals Workshop. The Council also voted to establish a broad coral zone with a landward boundary drawn between the 400 meter and 500 meter depth contour, targeting the 450 meter depth contour. The broad zone would originate at this landward boundary and extend seaward to the boundaries of the Council's management region.

Gear Restrictions: In both types of coral zones, the Council voted to prohibit the use of all bottom-tending gear, including both mobile and stationary/passive gear types.

Exemptions: The Council approved an exemption from gear restrictions for the red crab fishery. This exemption would apply indefinitely in the broad zones and for a period of *at least* two years in the discrete zones.

Framework Adjustments: The Council voted to allow the use of framework adjustments to (1) modify coral zone boundaries and management measures, (2) add additional discrete coral zones, or (3) implement a special access program, provided that such adjustments are in keeping with the purpose of the amendment. Modification of management measures through framework actions could be directed at gear and species not currently addressed in the FMP if the purpose of such measures is to further the objectives of the amendment.

VMS: The amendment would also require the use of Vessel Monitoring Systems (VMS) for all *Illex* squid moratorium vessels regardless of whether fishing activity is occurring within or outside of any proposed deep sea coral zones.

Transit Provision: The Council also approved a provision that would allow for vessel transit through or across all deep sea coral zones with a requirement that the vessel's fishing gear be stowed during transit.

Mackerel, Squid, Butterfish Specifications

All to be implemented for 2016

Atlantic Mackerel Quotas (2016-2018): The Council adopted three-year Atlantic mackerel specifications for 2016, 2017, and 2018. Although the stock status of mackerel is currently classified as unknown, the Council's Scientific and Statistical Committee (SSC) recently concluded that the stock is in a depleted state relative to historical levels of abundance. The SSC also determined that the foundation used previously to establish the Acceptable Biological Catch (ABC) for the stock was no longer valid. In light of these findings and consideration of a mackerel management strategy evaluation (MSE) conducted under contract for the Council, the SSC

recommended setting the ABC at 19,898 metric tons (mt) for 2016-2018, a 50% reduction from the 40,165 mt ABC in 2015.

The Council adopted the ABC recommended by the SSC, resulting in a U.S. Annual Catch Limit (ACL) of 11,009 mt. After accounting for discards and management uncertainty, the Council recommended a commercial domestic annual harvest (DAH) of 9,177 mt and a recreational annual catch target (ACT) of 614 mt.

Summary of Atlantic Mackerel Specifications 2016-2018	
Acceptable Biological Catch (ABC)	19,898 mt
Annual Catch Limit (ACL)	11,009 mt
Recreational Annual Catch Target	614 mt
Commercial Annual Catch Target	9,294 mt
Domestic Annual Harvest (DAH)	9,177 mt

The Council also voted to lower the RH/S cap for the Atlantic mackerel fishery from 89 metric tons (mt) to 82 mt. This will continue to provide a strong incentive for the fishery to avoid RH/S in order to preserve their ability to harvest the mackerel quota.

Squid and Butterfish Quotas (2016): In 2016 the *Illex* squid, longfin squid, and butterfish fisheries will be in year 2 of multi-year specifications for 2015-2017. The Council recommended no changes to the specifications previously recommended for 2016. These specifications are described in detail in the final rule published March 20, 2015: http://www.greateratlantic.fisheries.noaa.gov/regs/2015/March/15smbspecs20152017fr.pdf.

Butterfish Gear Issues: The Council voted to increase the threshold for requiring a minimum 3-inch mesh size from 2,500 lbs to 5,000 lbs of butterfish. Industry participants have reported that this will increase opportunistic butterfish landings during squid trips and recent data suggest directed butterfish fishing will predominantly occur on larger trips that will still need to use 3-inch mesh. The Council also voted to allow the use of 5" strengtheners (square or diamond mesh). Industry participants have indicated they would like the regulations clarify that, as in the longfin squid fishery, strengtheners of at least 5 inches may be used. This is the current practice by some fishery participants (often with 5-inch diamond mesh scup nets), where a piece of netting outside of the primary net/liner keeps it from bursting from large catches.

Longfin Squid Pre-Trip Notification*:* Because of the limited conservation use of the 48-hour longfin squid pre-trip notification requirement and the burden it places on industry, the Council voted to suspend this requirement until further notice.

Squid Capacity Amendment

Staff presented a summary of scoping comments on a potential amendment to address latent capacity in the squid fisheries. After considering 17 written comments and summaries of 6 public hearings, the Council voted to continue amendment development and added three additional issues: (1) new allocations/permits for Maine/northern states; (2) longfin trimester issues; and (3) longfin squid buffer zones (e.g. 10 miles) beyond state waters in the area south of Martha's Vineyard/Nantucket to allow squid to enter/spawn in Nantucket Sound. Based on the public comment received, catch share programs will not be further considered in this action.

Surfclams and Ocean Quahogs

2016 Specification Review

Next year the surfclam and ocean quahog fisheries will be in the third year of multi-year specifications set for 2014-2016. The Council reviewed updated catch and landings information for both stocks, as well as recommendations from staff, the surfclam and ocean quahog AP, and the SSC, and determined that no changes are warranted. The Council also voted to recommend suspending the minimum shell length for surfclams in 2016. These specifications are described in detail in the final rule published December 20, 2013: http://www.greateratlantic.fisheries.noaa.gov/regs/2013/December/13clam20142016specsfr.pdf

Unmanaged Forage Fish Action

Staff presented an update on development of an action to prohibit the development of new, or expansion of existing, directed fisheries for unmanaged forage species. The Council reviewed and provided comments on a draft scoping document, voting to add the following item to the *Issues for Consideration* section of the scoping document: "The ability of current scientific data and models to fully inform prospective Council action to manage the suite of forage fish species in the region." The Council recommended that staff delay scoping until after August in order to enable more people to attend scoping hearings.

Jim Gilmore also provided an update on an effort by ASMFC staff to poll member states regarding (1) whether they have management measures in place for forage fisheries not currently managed by the ASMFC or the Mid-Atlantic Council, and (2) if they have any regulations in place for emerging fisheries. He noted that many states do not have the resources to collect baseline data on small bait fisheries and recommended that the Council keep this in mind when considering future actions on forage species.

Monkfish

Framework 9

The Council indicated a general preference for the alternatives recommended recently by the Monkfish Committee at a joint Monkfish Committee and Monkfish Advisory Panel meeting. The Council was advised that the New England Groundfish Committee has recommended one option that was different from the New England Monkfish Committee. This option involved the monkfish trip limits in the Northern Management Area while vessels are fishing for New England groundfish. The Council voted for a modified middle-road option that would allow increased monkfish catch in the Northern Management area if vessels use a monkfish day at sea, which should limit unintended effort shifts from the northern management area to the southern management area.

Presentations and Other Business

Species Interactions Workshop

The Council hosted a one-day Species Interactions Workshop on the first day of the meeting. This was the third in a series of workshops that the Council has held to support the development of an Ecosystem Approach to Fisheries Management (EAFM) guidance document. This workshop focused on potential strategies to fully consider species interactions and climate drivers in the stock assessment process, determination of catch limits, and to build capacity within the region to conduct comprehensive management strategy evaluations (MSEs).

Listening Session: Proposed Rule to Revise Listing Status of Humpback Whales

The Council held a listening session on a proposed rule to revise the Endangered Species Act (ESA) listing of the humpback whale. Under the proposal, the humpback whale would be reclassified into fourteen distinct population segments, ten of which would be removed from the endangered species list. Of the remaining population segments, two would be listed as endangered and two would be classified as threatened. During the listening session, a brief presentation was provided by Marta Nammack, from NMFS Office of Protected Resources, followed by an opportunity for Council members and members of the public to ask questions and provide comments for the record.

Cooperative Research Committee

Staff provided a summary of the Cooperative Research Committee Meeting held on June 2, 2015. The Council expressed support for the draft timeline and the proposed approach for development of cooperative research alternatives. The Council also supported the Committee's recommendation that an advisory panel and technical working group be established to provide additional input and expertise.

NROC Commercial Fishery Mapping in Support of Regional Ocean Planning

George Lapointe gave a presentation on a multi-year project with the Northeast Regional Ocean Council (NROC) to map activity of commercial fishing and party/charter boats in New England. The maps produced from this project will be used to coordinate regional ocean use and reduce use conflicts. Additional information about this project is available at http://northeastoceancouncil.org/.

Guidelines for SAW Working Group Formation and Participation

Dr. Jim Weinberg provided an overview of new guidelines for Stock Assessment Workshop (SAW) Working Group formation, participation, and function. The guidelines, which will be phased in for use in 2016, are intended to improve consistency in composition and process across SAW working groups.

Trawl Survey Advisory Panel Formation

Dr. Bill Karp provided an update on the formation of a Northeast Trawl Survey Advisory Panel (NTAP). The purpose of NTAP is to identify concerns with trawl survey performance, identify methods to address these concerns, and promote mutual understanding and acceptance of survey results. The panel will be co-chaired by the Mid-Atlantic and New England Councils and will be composed of commercial fishing, fishery survey, and fishery management professionals.

Departing Council members Jeff Deem of Virginia and Preston Pate of North Carolina received thanks and appreciation from their colleagues during a farewell cookout.

Next Meeting

August 10 - 13, 2015: New York City

Holiday Inn Midtown
440 West 57th Street, New York City, New York 10019
Telephone: 212-581-8100

MID-ATLANTIC
FISHERY MANAGEMENT COUNCIL

PRESS RELEASE

FOR IMMEDIATE RELEASE
June 11, 2015

PRESS CONTACT: Mary Clark
(302) 674-2331 (ext. 261)

Mid-Atlantic Council Approves Deep Sea Corals Amendment

VIRGINIA BEACH, VA – This week the Mid-Atlantic Fishery Management Council approved an amendment to protect deep sea corals from the impacts of bottom-tending fishing gear in the Mid-Atlantic. If approved by the Secretary of Commerce, the amendment will create "deep sea coral zones" in areas where corals have been observed or where they are likely to occur. Within these zones, fishermen will not be allowed to use any type of bottom-tending fishing gear such as trawls, dredges, bottom longlines, and traps. In total, the areas proposed for deep sea coral zone designation encompass more than 38,000 square miles – an area nearly the size of Virginia.

Most deep sea corals are slow-growing and fragile, making them vulnerable to damage from certain types of fishing gear that come in contact with the sea floor. Under the Magnuson-Stevens Act, regional fishery management councils have the authority to designate zones where, and periods when, fishing may be restricted in order to protect deep sea corals. This provision has been in place since 2007, but the Mid-Atlantic Council will be the first of the eight councils to exercise this authority to designate deep sea coral zones.

"This historic action by the Council was made possible by the cooperation of a broad group of fishermen, advisors, coral researchers, conservation groups, Council members, and staff," said Council Chairman Rick Robins. "Many people deserve credit for their collaborative efforts to refine the coral protection areas in a way that protects deep sea corals in our region while accommodating current fishing practices."

The measures approved by the Council on Wednesday include the designation of fifteen "discrete coral zones," which are areas of known or highly likely coral presence. Most of these areas are located around underwater canyons or slope areas along the continental shelf edge. The boundaries for the discrete coral zones were developed cooperatively by members of the Council's advisory panels, deep sea coral experts, industry members, and other stakeholders. In addition, the Council voted to establish a "broad coral zone" encompassing a much larger area beginning around the 450 meter depth contour and extending out to the 200-mile limit of the Exclusive Economic Zone.

The prohibition on all types of bottom-tending gear would apply in both the broad and discrete deep sea coral zones. The amendment includes a provision to allow vessels to transit through coral zones if fishing gear is stowed and not available for immediate use.

Although the amendment will modify the fishery management plan for Atlantic Mackerel, Squid, and Butterfish, the restrictions would apply to any federally regulated fishing activity occurring within the proposed areas in the Mid-Atlantic Council region.

During the meeting the Council considered potential exemptions for federally managed fisheries and voted to exempt the red crab fishery from the proposed gear restrictions. The fishery, which only includes two full-time vessels, would be exempt from gear restrictions in discrete coral zones for at least two years and in broad zones indefinitely.

Secretarial review of the amendment will involve a thorough review of the proposed measures by NOAA Fisheries, including further opportunities for public comment.

Additional information, updates, and background materials related to this amendment are available on the Deep Sea Corals Amendment page at http://www.mafmc.org/actions/msb/am16.

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

MEMORANDUM

TO: Sammy Corbett, Marine Fisheries Commission Chairman
Dr. Louis B. Daniel III, Director, Division of Marine Fisheries

FROM: Michelle Duval

DATE: July 31, 2015

SUBJECT: South Atlantic Fishery Management Council Meeting (June 8-12, 2015)

The South Atlantic Fishery Management Council (Council) met in Key West, Florida. Following is a summary of actions taken by the Council. The next meeting will be held in Hilton Head Island, South Carolina, Sept. 14-18, 2015. The next series of public hearings will be in Jacksonville, NC on August 12 and in Morehead City, NC on August 13. Please see the following link for public information documents as well as locations and times: http://safmc.net/meetings/public-hearing-and-scoping-meeting-schedule.

Snapper Grouper Visioning Workshop

The Council continued its work developing a vision for the future of the snapper grouper fishery. The Council approved the draft Vision Blueprint goals, objectives and strategies for the four major focus areas of Management, Science, Communication and Governance for public input and review. Because stakeholder needs and perceptions can vary widely, the Council has not excluded any input from the draft. There are no prioritized or preferred items in the draft Vision Blueprint as comments received during the summer will inform the Council's decisions regarding items that remain in the Blueprint versus those that are removed.

The Council also reviewed the informational flier being sent to all South Atlantic commercial and for-hire federal permit holders with the schedule of public input opportunities and multiple methods available for stakeholders to provide input:

- Daytime/evening informational webinars on each of the four focus areas (July 6-8)
- Facilitated in-person local comment stations/live webinars in each state (July 28-30 in North Carolina)
- Council website comment form
- Email, mail, phone, fax

The Council will review all input received at its September visioning workshop and begin planning for its two-day visioning council meeting, to be held the second week of October, where it will discuss prioritizing short-term and long-term actions based on public input.

Ecosystem/Habitat Committee

The Council received an update on the February 2015 Ecosystem Modeling Workshop, designed to inform the revision of the Council's Fishery Ecosystem Plan, which is scheduled for completion in 2016. The workshop covered a number of topics, and participants acknowledged the need for ecosystem modeling efforts to inform the Council's decisions regarding managed species. The Council also received an overview of the Oculina Experimental Closed Area 10-year review Evaluation Team Report, which tracks progress toward meeting the objectives of the closed area. Finally, the Council reviewed a request from the rock shrimp industry to determine if additional bottom near the boundary of the Oculina Experimental Closed Area could be re-opened based on Vessel Monitoring System data from 2013 and 2014.

Protected Resources Committee

The Council received an update on the Atlantic sturgeon Section 7 consultation for the Coastal Migratory Pelagics fishery (mackerels, cobia), which has been delayed until September 2015, as well as an update on the *Acropora* coral recovery plan. Council staff reviewed a draft Endangered Species Act/Magnuson-Stevens Act integration agreement, which outlines a tiered approach for the Council's involvement in the formal consultation process. The agreement specifies the responsibilities of Council staff and NOAA Fisheries Southeast Regional Office Protected Resources staff with regard to communications standards, the role of Protected Resources staff in the fishery management plan amendment process, and status updates for the Council's Protected Resources Committee. Suggested changes included adding criteria to determine which informal consultations would be reviewed by the Council and/or Council staff.

Shrimp Committee

The Council received an update from the Shrimp and Deepwater Shrimp Advisory Panel Chair regarding the recent biological opinion on the southeastern shrimp fishery, the results from the 2014 shrimp procedural workshop (that reviewed bycatch estimation methods for managed species), and the industry request to consider a rock shrimp access area within the northern expansion of the Oculina Habitat Area of Particular Concern. The Council discussed changes in the fishery due to environmental and economic factors. Based on the discussions, a motion was made to develop an amendment to change the eastern boundary of the northern extension and develop allowable fishing areas for the rock shrimp fishery.

Southeast Data, Assessment, and Review (SEDAR) Committee

This is the name of the stock assessment process in the southeast, and each Southeast, Data, Assessment and Review, or "SEDAR" is given a number. The Council received updates on the following stock assessment activities:

- The red grouper assessment update, originally due for completion in January 2016, will be delayed until January 2017 due to scheduling difficulties. Blueline tilefish continues to be on the schedule for an update in 2016.
- The Council received an update on the transition from the old Marine Recreational Information Program effort survey (conducted by telephone) to the new mail-based survey. New estimates of recreational catch are expected to be available for assessments occurring in 2017, which will need to be incorporated into the timing of stock assessment updates for recreationally important species.
- The Council discussed modifications to the structure of its annual research plan in order to increase its utility as a resource for federal grant opportunities. Namely, research priorities will be separated from monitoring, and more specific descriptions of research projects will be included.
- A deepwater survey design workshop was conducted at the NOAA Fisheries Beaufort Lab in early April, with the goal of building a framework for a cooperative deepwater snapper grouper monitoring program. The workshop brought together scientists and industry representatives from across the region, including five fishermen from North Carolina. The Council received an update that funding to conduct sampling aboard industry vessels according to the methods discussed at the workshop has been made available, and is expected to occur later this year.

Golden Crab

The Council discussed research from the mid-1980s by the S.C. Department of Natural Resources regarding potential golden crab fishing grounds. Based on a recommendation from the advisory panel, the Council directed staff to begin development of an amendment that would expand the allowable northern golden crab fishing zone.

Snapper Grouper Committee

The committee received updates on the status of the following amendments under review:

- *Amendment 29 (Only Reliable Catch Stocks and gray triggerfish):* The final rule published June 2, 2015 and regulations became effective July 1, 2015. The amendment updates the Council's Allowable Biological Catch control rule to include the use of a data-limited approach, establishes a minimum size limit for gray triggerfish (12 inches fork length), a commercial split season and a commercial trip limit of 1,000 pounds.
- *Regulatory Amendment 20 (snowy grouper):* The final rule for this amendment published July 21, 2015 with regulations effective Aug. 20, 2015. The amendment increases the annual catch limit for snowy grouper, increases the commercial trip limit from 100 to 200 pounds (gutted weight), maintains the existing one fish per vessel per day recreational bag limit and restricts recreational harvest to May through August.

- *Comprehensive Accountability Measures/Dolphin-Wahoo Amendment 8*: This amendment would standardize the Council's accountability measures across its managed species. It also establishes a 10 percent commercial/90 percent recreational allocation of the Annual Catch Limit for dolphin. The proposed rule published July 14 and comments are due by Sept. 14, 2015
- *Regulatory Amendment 22 (gag and wreckfish)*: This amendment updates the annual catch limits for both gag and wreckfish based on recent stock assessment updates.
- *Snapper Grouper Amendment 33/Dolphin-Wahoo Amendment 7*: This amendment extends an exemption currently allowed in the snapper grouper fishery to the dolphin-wahoo fishery that allows fish legally harvested in the Bahamas to be transported aboard a recreational fishing vessel as fillets. It also closes loopholes in the existing snapper grouper exemption and establishes consistent rules across both fisheries. The proposed rule package is under review.

Red snapper 2105 harvest
The Council received an update from NOAA Fisheries staff regarding total removals (harvest and dead discards) of red snapper in 2014. The current approach for determining if a red snapper season will occur for a particular year relies on the previous year's total removals remaining within the allowable biological catch. Because the total removals in 2014 exceeded the 2014 allowable biological catch (by 100,000 fish due mostly to dead discards from the private recreational sector), there will be no red snapper season in 2015.

Marine Recreational Information Program "Rare Event" Sampling Presentation
Dr. David VanVorhees gave a presentation on various approaches that could be used in the South Atlantic to improve recreational catch estimates for "rare event" or "rarely intercepted" species such as snowy grouper, blueline tilefish and golden tilefish. Such approaches included increasing sample size in the intercept survey, adjusting weighting of sample units, stratification (e.g., creation of a deepwater stratum), specialized survey design, and multi-year annual catch limits. The Council requested that some of these approaches be explored further to determine whether they could be implemented in the South Atlantic region.

Regulatory Amendment 16 (black sea bass pot closure): This amendment contains a range of alternatives to modify the existing November through April prohibition on the use of black sea bass pots due to concerns regarding risk to right whales. The Council was required to implement this closure in late 2013 in order to double the annual catch limit based on a stock assessment update. In March, the Council had selected a preferred alternative (Alternative 9, Sub-Alternative 9a) that would maintain a prohibition on the use of black sea bass pot gear inshore of 20 meters depth off the Carolinas, and the area that encompasses the 75th percentile of sightings off Georgia and Florida, annually from Nov. 1 through April 15.

Based on additional concerns on the part of Protected Resources, the Council added two new alternatives: one modifies the closure to apply from Nov. 1 through April 30 inshore of the 27 meter depth contour; the second modifies the closure to apply in depths 25 meters and shallower from Nov. 1-30 and April 1-30, and in depths 30 meters and shallower from Dec. 1-March 30. The Council approved the amendment for public hearings, and removed its selection of a preferred alternative for the seasonal pot closure. The amendment also includes actions to enhance the existing gear-marking, weak link and line breaking-strength requirements of the Atlantic Large Whale Take Reduction Plan.

Amendment 35 (removal of species and golden tilefish endorsements): This amendment contains actions to remove species from the fishery that are primarily caught in south Florida (black snapper, mahogany snapper, dog snapper and schoolmaster snapper), and address a loophole in the golden tilefish longline endorsement that has allowed endorsement holders to fish on the 25 percent of the annual catch limit set aside for hook-and-line fishermen that did not receive endorsements. The Council approved the amendment for secretarial review.

Amendment 36 (spawning Special Management Zones (SMZs)): The Council reviewed the draft amendment and reduced the sizes of several of the candidate spawning special management zones; most candidate sites are one square mile to five square miles in area. The candidate sites being considered in North Carolina are the 780 bottom, an area south of Cape Lookout and the Malchase Wreck. The Council added a transit provision as well as a sunset clause for any spawning special management zones established on natural bottom. The Council approved the amendment for public hearings in August 2015.

Amendment 37 (hogfish): This amendment contains actions related to hogfish in response to the recent stock assessment (2014) that determined there were two hogfish stocks: one from Georgia through North Carolina, and a second along the east coast of Florida through the Florida Keys. The amendment includes actions to establish maximum sustainable yield, annual catch limits and accountability measures for each stock. It also includes actions to modify the minimum size limit and establish a recreational bag limit and commercial trip limit for each stock. It also establishes a rebuilding plan for the Florida east coast/Florida Keys stock. The Council approved the amendment for scoping during August public meetings.

Regulatory Amendment 23 (golden tilefish hook-and-line fishing year; black sea bass bag limit; jacks complex commercial trip limit): This amendment was restructured to include only the following actions: modification of the fishing year start date for the hook-and-line component of the commercial golden tilefish fishery (currently Jan. 1); an increase in the black sea bass recreational bag limit; and a commercial trip limit for the jacks complex (almaco jack, lesser amberjack, banded rudderfish). The Council approved the amendment for August public hearings and is scheduled to consider final action in September 2015.

Blueline tilefish management:
The Council's Scientific and Statistical Committee recommended that the future catch projections for blueline tilefish be recalculated as they are no longer considered best scientific information given the significant increases in harvest both within and outside the Council's jurisdiction since the stock assessment was completed. Projections with varying levels of recruitment were requested, similar to the king mackerel stock assessment. The committee will review the new projections in early September, and the Council will receive the Scientific and Statistical Committee's updated allowable biological catch projections during its September meeting week.

The Mid-Atlantic Fishery Management Council request for emergency action to apply a 300 pound (whole weight) commercial trip limit and seven fish per person per day recreational bag limit was implemented just prior to the June South Atlantic Council meeting. The South Atlantic Council's request for emergency action that would apply the management measures implemented under Snapper Grouper Amendment 32 throughout the Atlantic Coast (100 pound commercial trip limit and 1 fish per vessel per day recreational bag limit) is still under consideration by NOAA Fisheries, pending updated catch projections.

Mackerel Committee
Amendment 26 (king mackerel annual catch limits and stock boundary): This amendment would adjust the king mackerel annual catch limits based on the SEDAR 38 stock assessment. It includes actions to adjust the boundary between Gulf and South Atlantic stocks; allow for sale of king mackerel incidentally caught in the shark gill net fishery; maintain a Florida east coast commercial sub-zone, but adjust the boundaries of sub-zone; and establish a quota and trip limits for the Florida east coast subzone. The Council will review the modified document in September and approve the document for public comment in June.

Amendment 28 (separation of permits/separation of management plan): This amendment considers separation of commercial permits as part of establishing separate fishery management plans. There is a desire on the part of many king mackerel commercial fishermen in the Gulf of Mexico to prevent permit holders on the Florida east coast from fishing in the Gulf, and this amendment is viewed as an opportunity to do so. Currently, the species in the plan are managed jointly with the Gulf of Mexico Fishery Management Council and each council must approve the others actions. This amendment was taken out for scoping, but the Council voted to discontinue work on this amendment based on discussions at the Gulf Council January 2015 meeting. However, the Gulf Council has elected to move forward with development of the amendment, despite the South Atlantic Council's position. This presents a difficult situation in that, at some point, the South Atlantic Council will need to approve any actions for the amendment to move forward.

Data Collection Committee
Commercial Electronic Reporting: The Council received an update on the development of an electronic version of the existing commercial logbook form that fishermen could voluntarily use to submit catch information. The Atlantic Coastal Cooperative Statistics Program is working with the Southeast Fisheries Science Center to implement this product. The form should be operational by late summer 2015. Additionally, the commercial electronic logbook pilot program is underway, with several commercial fishermen in North Carolina participating in the testing of weatherproof tablets and laptops for recording commercial harvest and discard data onboard vessels.

Joint Gulf/South Atlantic Charterboat Electronic Reporting: The Council reviewed the actions and alternatives in the draft amendment in a joint session with the Gulf of Mexico Fishery Management Council. The South Atlantic Council requested that sample data forms with the minimum required elements currently being reported electronically by headboats be included in the draft amendment. The South Atlantic Council is interested in implementing electronic charter vessel reporting on the same schedule as headboats, applying the same standards, reporting mechanism and data elements, while the Gulf Council is interested in having charter vessels reporting electronically prior to arriving at the dock. The South Atlantic Council requested an alternative be added to allow charter vessels to report fishing location manually via a logbook grid, rather than by a geographic positioning system-enabled device. Both Councils will review the modifications to the draft amendment at their next meeting and approve for public hearings.

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

MEMORANDUM

TO: Dr. Louis B. Daniel III, Division of Marine Fisheries Director
Sammy Corbett, Marine Fisheries Commission Chairman

FROM: Randy Gregory
Division of Marine Fisheries, NCDENR

DATE: May 1, 2015

SUBJECT: Highly Migratory Species Update

The Highly Migratory Species Advisory Panel's fall meeting will be held September 9 - 10, 2015 in Silver Spring, Maryland. The National Marine Fisheries Service Highly Migratory Species Fishery Management Division staff will discuss the proposed rule to implement draft Amendment 9 and Amendment 6 to the 2006 Consolidated Highly Migratory Species Fishery Management Plan. Amendment 9 considers management measures in the shark fisheries and could affect fishermen who fish for smoothhound sharks (e.g., smooth dogfish, Florida smoothhound, and Gulf smoothhound) and fishermen who fish for sharks with gillnet gear. Amendment 6 proposes a range of management measures for the commercial shark fisheries.

Sharks

The first stock assessment for Atlantic smooth dogfish (Mustelus canis) was conducted by the Southeast Data, Assessment, and Review (SEDAR) process. Tagging and genetics data support the existence of two distinct stocks of smooth dogfish stocks, one in the Atlantic region and one in the Gulf of Mexico. Since smooth dogfish are the only species of smoothhound sharks occurring in the Atlantic region, the stock assessment was only for this species in the Atlantic region. Based on the results of SEDAR 39, the status of the Atlantic smooth dogfish is not overfished and no overfishing is occurring.

Year	Month	Species	Pounds	Dealers	Trips	Average (2007-2009)
2013	1	SOUTHERN FLOUNDER	2,942	42	276	7,713
2013	2	SOUTHERN FLOUNDER	896	37	254	4,617
2013	3	SOUTHERN FLOUNDER	4,387	57	682	23,512
2013	4	SOUTHERN FLOUNDER	16,697	93	1,177	68,389
2013	5	SOUTHERN FLOUNDER	49,629	123	1,778	122,514
2013	6	SOUTHERN FLOUNDER	79,203	137	2,127	154,090
2013	7	SOUTHERN FLOUNDER	119,720	150	2,839	170,387
2013	8	SOUTHERN FLOUNDER	124,177	147	2,685	201,862
2013	9	SOUTHERN FLOUNDER	416,097	161	3,631	396,301
2013	10	SOUTHERN FLOUNDER	883,476	172	5,512	781,717
2013	11	SOUTHERN FLOUNDER	483,762	121	2,589	392,150
2013	12	SOUTHERN FLOUNDER	5,288	12	27	37,303
2014	1	SOUTHERN FLOUNDER	2,978	29	183	7,713
2014	2	SOUTHERN FLOUNDER	1,823	29	285	4,617
2014	3	SOUTHERN FLOUNDER	3,430	43	677	23,512
2014	4	SOUTHERN FLOUNDER	18,997	71	933	68,389
2014	5	SOUTHERN FLOUNDER	16,001	93	681	122,514
2014	6	SOUTHERN FLOUNDER	80,142	123	1,988	154,090
2014	7	SOUTHERN FLOUNDER	84,702	141	2,148	170,387
2014	8	SOUTHERN FLOUNDER	105,208	137	2,204	201,862
2014	9	SOUTHERN FLOUNDER	404,143	153	3,588	396,301
2014	10	SOUTHERN FLOUNDER	634,514	146	3,436	781,717
2014	11	SOUTHERN FLOUNDER	320,773	121	1,991	392,150
2014	12	SOUTHERN FLOUNDER	800	5	7	37,303
2015	1	SOUTHERN FLOUNDER	1,987	29	235	7,713
2015	2	SOUTHERN FLOUNDER	495	21	93	4,617
2015	3	SOUTHERN FLOUNDER	5,886	61	766	23,512
2015	4	SOUTHERN FLOUNDER	20,754	88	1,067	68,389
2015	5	SOUTHERN FLOUNDER	41,479	113	1,230	122,514
2015	6	SOUTHERN FLOUNDER	32,232	49	937	154,090
2015	7	SOUTHERN FLOUNDER	2,681	6	76	170,387

***2015 data are preliminary and only complete through May.

Conf

Red Drum Landings 2014-2015

Landings are complete through May 31, 2015
2014 Landings are final; 2015 landings are preliminary

Year	Month	Species	Pounds	2009-2011 Average	2012-2014 Average
2014	9	Red Drum	34,775	28,991	35,471
2014	10	Red Drum	36,425	43,644	59,757
2014	11	Red Drum	16,375	14,318	28,619
2014	12	Red Drum	2,995	3,428	3,401
2015	1	Red Drum	1,961	5,885	1,364
2015	2	Red Drum	3,009	3,448	3,176
2015	3	Red Drum	3,913	5,699	2,957
2015	4	Red Drum	12,680	7,848	3,945
2015	5	Red Drum	9,779	13,730	9,222
2015	6	Red Drum	5,629*	12,681	7,432
2015	7	Red Drum	229*	13,777	15,555
Fishing Year (Sept 1, 2014 - Aug 31, 2015) Landings			**127,769**		

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