



FISHERY MANAGEMENT PLANS

2019 FMP REVIEW

BAY SCALLOP FMP UPDATE

KINGFISHES FMP UPDATE

FIVE-YEAR FMP REVIEW SCHEDULE



ROY COOPER
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July 31, 2020

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Catherine Blum, Fishery Management Plan and Rulemaking Coordinator
Fisheries Management Section

SUBJECT: Fishery Management Plan Update and Schedule Review

Issue

Update the N.C. Marine Fisheries Commission on the status of ongoing North Carolina fishery management plans.

Overview

2019 Fishery Management Plan Review

The briefing materials include a separate publication entitled “[2019 Fishery Management Plan Review](#).” This document is a compilation of annual updates about state-managed, federally-managed, and Atlantic States Marine Fisheries Commission-managed species for which there are fishery management plans for North Carolina. The updates are based on data through the previous calendar year. Staff provides the document to the commission annually at its August business meeting. It is a useful resource document, especially as a means of providing fishery management plan schedule recommendations based on the latest data. The document also provides a comprehensive list of research recommendations for all fishery management plans.

The 2019 Fishery Management Plan Review is an invaluable reference document for information about the latest status of fisheries occurring in North Carolina. The document is organized into two primary sections: state-managed species and interstate-managed species, including species managed by the Atlantic States Marine Fisheries Commission and federal fishery management councils. The latter section is further divided into species with and without North Carolina indices. If a species has a North Carolina index, it means North Carolina data were used by the federal management councils or the Atlantic States Marine Fisheries Commission in their respective plans.

Each update in the Fishery Management Plan Review contains information about the:

- History of the plan;
- Management unit;
- Goal and objectives;

- Status of the stock;
- Status of the fishery, including current regulations and commercial and recreational landings;
- Monitoring program data, including fishery-dependent and fishery-independent data;
- Management strategy;
- Management and research needs; and
- Recommendation on the timing for the next review of state plans.

Five-year Fishery Management Plan Review Schedule

As stated above, the annual updates for the state-managed species include a recommendation on the timing for the next review of state fishery management plans. These recommendations inform the draft “[N.C. Fishery Management Plan Review Schedule \(July 2020-June 2025\)](#)” presented for the commission’s consideration and preliminary approval. The schedule reflects the status of the individual plans in regards to the statutorily mandated plan reviews. Per N.C. General Statute 113-182.1(d), each plan shall be reviewed at least once every five years. Upon the commission’s approval, the schedule will be forwarded to the secretary of the Department of Environmental Quality for final approval, per G.S. 113-182.1(d).

The schedule is introduced by a short [summary of the status of the fishery management plans](#). This is a document staff provides to the commission annually at its August business meeting. The document provides background information on the authority and process for fishery management plans, a description of recent changes to the fishery management plan process, as well as the status of each individual plan. Prior to the commission’s vote on the five-year schedule, staff leads for the [Bay Scallop Fishery Management Plan](#) and the [Kingfishes Fishery Management Plan](#) will provide updates to the commission and request the commission’s approval of the annual update to complete the scheduled review of each plan. Supporting information for each plan is included in the briefing materials.

Action Needed

At its August 2020 business meeting the commission is scheduled to vote on preliminary approval of the “N.C. Fishery Management Plan Review Schedule (July 2020-June 2025)”.

Annual Fishery Management Plan Update
N.C. Division of Marine Fisheries and Marine Fisheries Commission
July 31, 2020

Authority and Process

The Fisheries Reform Act of 1997 and its subsequent amendments established the requirement to create fishery management plans (FMPs) for all of North Carolina's commercially and recreationally significant species or fisheries. The contents of the plans are specified, advisory committees are required, and reviews by the Department of Environmental Quality secretary, Joint Legislative Oversight Committee on Agriculture and Natural and Economic Resources, Joint Legislative Commission on Governmental Operations, and legislative Fiscal Research Division are mandated.

All initial FMPs identified on the priority list have been developed. Annually, the division reviews all state FMPs, as well as all federally-managed and Atlantic States Marine Fisheries Commission (ASMFC)-managed species for which there are FMPs for North Carolina. Upon review, amendment of a state plan is required when changes to management strategies are necessary. An information update for a plan, which includes changes in factual and background data only, may be completed if there are no management changes.

At the MFC 's August 2019 business meeting, staff first provided an update on changes being implemented designed to achieve efficiencies in the FMP process. Changes include the timing of the steps in initial development of draft FMPs, how the division works with the FMP advisory committee and how the committee operates, and what the FMP documents look like. Before the initial development of a draft FMP, a scoping period is held to notice the public the review of the FMP is underway, inform the public of the stock status (if applicable), solicit input from the public on the list of potential management strategies to be developed, and recruit advisers to serve on the FMP advisory committee. These changes are being incorporated beginning with Amendment 3 to the Southern Flounder FMP and Amendment 2 to the Shrimp FMP.

Status of State FMPs

The review of six of 13 state plans is currently underway. These plans are the Southern Flounder, Shrimp, Estuarine Striped Bass, and Spotted Seatrout FMPs. Review of the Striped Mullet and N.C. FMP for Interjurisdictional Fisheries is just beginning.

Amendment 2 to the **Southern Flounder FMP** began with a coast-wide (North Carolina to the east coast of Florida) stock assessment for Southern Flounder that determined the stock is overfished (stock size is too small) and overfishing (excessive fishing mortality) is occurring. Reductions in total removals of southern flounder are required by state law to achieve a sustainable harvest, end overfishing within two years and recover the stock from an overfished condition within 10 years. At its August 2019 business meeting the MFC approved Amendment 2 to the Southern Flounder FMP. Upon adoption, Amendment 2 authorized the division to immediately begin development of Amendment 3 where more comprehensive management strategies and measures are being developed based on the results of the 2019 coast-wide stock assessment.

Development of Amendment 3 is underway and may augment management with more comprehensive strategies, but will not restart the rebuilding timeframe identified through Amendment 2. Consistent with the recent changes to the FMP process, a scoping document outlining potential management strategies for Amendment 3 was drafted and a scoping period for Amendment 3 was held in December 2019. The MFC received a summary of the public input from the scoping period at its February 2020 meeting, provided input to the division on management strategies, and approved the goal and objectives for Amendment 3. The division is considering input from the scoping period and the MFC and is drafting Amendment 3. The division plans to work with the Southern Flounder FMP AC to further develop draft Amendment 3 later this year. Amendment 3 is expected to be completed in 2021.

The division is continuing with the development of the **Shrimp FMP** Amendment 2, which began in 2019. Consistent with the recent changes to the FMP process, a scoping document outlining potential management strategies for Amendment 2 was drafted and a scoping period for Amendment 2 was held in January 2020. The MFC received a summary of the public input from the scoping period at its February 2020 meeting, provided input to the division on management strategies, and approved the goal and objectives for Amendment 2. The division is considering input from the scoping period and the MFC and is drafting Amendment 2. An advisory committee for the FMP will be appointed later in 2020. The division plans to work with the FMP AC to further develop draft Amendment 2 later this year.

The division is continuing with the development of the **Estuarine Striped Bass FMP** Amendment 2, which is being jointly developed with the N.C. Wildlife Resources Commission. Results from a peer-reviewed benchmark stock assessment utilizing data through 2017 are expected in 2020. Consistent with the recent changes to the FMP process, a scoping document outlining potential management strategies for Amendment 2 will be drafted and a scoping period for Amendment 2 will tentatively be held in November 2020.

A benchmark stock assessment for the **Spotted Seatrout FMP** is underway coinciding with the scheduled FMP review. The prior stock assessment from 2014 indicated the stock is not overfished and is not experiencing overfishing. The division decided to include data through 2019 in the stock assessment to be more reflective of recent fishing activity.

Amendment 1 to the **Striped Mullet FMP** was approved in November 2015. Review of the FMP is just beginning; a benchmark stock assessment will be undertaken. The 2013 stock assessment indicated overfishing was not occurring, but it could not determine the overfished status. Though commercial landings and abundance from independent indices in 2017 were near historic lows, an update of the 2013 stock assessment model with data through 2017 indicated overfishing is not occurring. The striped mullet commercial fishery primarily targets mature females during the fall when they are migrating to the ocean to spawn, which could lead to poor recruitment. Review of 2019 commercial landings indicated neither the maximum (2.76 million pounds) nor minimum (1.13 million pounds) triggers had been exceeded.

The N.C. **FMP for Interjurisdictional Fisheries** Information Update was approved in November 2015. No change in management strategies was necessary, so the plan was updated with the most current factual and background data. The goal of the FMP for Interjurisdictional Fisheries is to adopt FMPs, consistent with N.C. law, approved by the federal Councils or the ASMFC by reference and implement corresponding fishery regulations in North Carolina to provide compliance or compatibility with approved FMPs and amendments, now and in the future. The review of this plan is just beginning.

The N.C. **River Herring FMP** Amendment 2 was adopted by the MFC in 2015. An Atlantic coast-wide stock assessment update for river herring was completed in August 2017, with data through 2015, by the ASMFC. Results indicate river herring remain depleted and at near historic lows on a coast-wide basis¹. The division recommends the next review of the River Herring FMP begin in 2021, one year later than originally planned. This will provide additional time to submit to the ASMFC an updated N.C. Sustainable FMP for River Herring and evaluate the need to preserve both a state and ASMFC river herring plan, the potential for achieving efficiencies by addressing any redundancy in management, and the possibility of retiring the state FMP while continuing to manage river herring via the N.C. FMP for Interjurisdictional Fisheries and the ASMFC's Interstate FMP for Shad and River Herring.

¹ Atlantic States Marine Fisheries Commission (ASMFC). 2017. River herring stock assessment update, Volume II. 682 pp.

The **Hard Clam FMP** Amendment 2 and the **Eastern Oyster FMP** Amendment 4 were approved in February 2017 and the implementing rules became effective May 1, 2017. Stock assessments cannot be conducted due to limited data; therefore, population size and the rate of removals from each population are unknown. For the Hard Clam FMP, harvest fluctuates, often in response to changes in demand, improved harvesting methods, and increases in polluted shellfish area closures. For the Oyster FMP, commercial landings from public bottom have been variable, and landings from private bottom in the past few years have increased significantly due to more interest in aquaculture. Work is underway with N.C. State University and the Nature Conservancy to develop methodologies to determine stock status for eastern oysters. The next review of both FMPs will begin in 2022.

The management program currently in place for the N.C. **Red Drum FMP** has resulted in a stock that has met ongoing management targets. Therefore, at its August 2017 business meeting, the MFC approved the division recommendation for the 2016 annual FMP update to fulfill the scheduled review of the N.C. Red Drum FMP. All management strategies that have led to management targets being met will be maintained as outlined in both the state FMP and the ASMFC FMP. Stock conditions will be monitored and reported through each subsequent annual FMP update and the MFC will continue to receive the FMP review schedule annually. The next scheduled review of this plan will begin in 2022.

The division is continuing to implement Amendment 3 to the **Blue Crab FMP**, which was adopted by the MFC in February 2020 to address the overfished status and end overfishing. Results of the 2018 benchmark stock assessment indicate the blue crab stock is overfished and overfishing is occurring. An update to the 2018 benchmark stock assessment will begin no sooner than 2023 and will include data through the previous year. The next scheduled review of this plan will begin in 2025.

The division recommends the 2020 annual FMP update fulfill the scheduled review of the **Bay Scallop FMP**. Bay scallop abundances have remained at historically low levels since the last scheduled review. This has not allowed a commercial or recreational harvest season to be opened, thus no stricter changes in management can be enacted. All management strategies that have been in place will be maintained as outlined in the state FMP. Stock conditions will be monitored and reported through each subsequent annual FMP update and the MFC will continue to receive the FMP review schedule annually. The next scheduled review of this plan will begin in 2025.

The division recommends the 2020 annual FMP update fulfill the scheduled review of the **Kingfishes FMP**. The management program currently in place for kingfishes has resulted in a stock that has met ongoing management targets. All management strategies that have been in place will be maintained as outlined in the state FMP. Stock conditions will be monitored and reported through each subsequent annual FMP update and the MFC will continue to receive the FMP review schedule annually. The next scheduled review of this plan will begin in 2025.

DRAFT DOCUMENT – SUBJECT TO CHANGE

DRAFT N.C. FISHERY MANAGEMENT PLAN REVIEW SCHEDULE (July 2020 – June 2025) Revised July 31, 2020					
SPECIES (Date of Last Action)	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
SOUTHERN FLOUNDER (8/19) †*					
SHRIMP (2/15) †					
ESTUARINE STRIPED BASS (5/13) **					
SPOTTED SEATROUT (2/12) ***					
INTERJURISDICTIONAL (11/15)					
STRIPED MULLET (11/15)					
RIVER HERRING (2/15) ****					
HARD CLAM (2/17)					
OYSTER (2/17)					
RED DRUM (8/17)					
BLUE CRAB (2/20)					
BAY SCALLOP (8/20) ‡					
KINGFISHES (8/20) ‡					

† The schedule assumes no rulemaking is required to implement the amendment.

‡ The management program currently in place has resulted in a stock that has met ongoing management targets (kingfishes) or the species is impacted by factors beyond fishing mortality (bay scallop); therefore, the 2020 annual fishery management plan update based on data through 2019 will fulfill the scheduled review.

* Adoption of Amendment 2 included the immediate development of Amendment 3 to implement more comprehensive, long-term management measures based on the 2019 coast-wide stock assessment update that indicated the stock is overfished and overfishing is occurring.

** The stock assessment process that began in 2017 for the Central Southern Management Area stocks and the Albemarle Sound-Roanoke River Management Area stock is nearing completion. Supplement A to the Estuarine Striped Bass Fishery Management Plan was developed and adopted during 2018-2019.

*** A 2015 stock assessment indicated the spotted seatrout stock in North Carolina and Virginia was not overfished and overfishing was not occurring in the terminal year (2012) of the assessment. Due to staff workload for the review of other plans occurring in 2017 and since the stock was at a viable level and removals were considered sustainable for the long-term benefit of the stock, the next review of the plan was moved to 2019. Additionally, the division decided to include data through 2019 in the stock assessment to be more reflective of recent fishing activity. The stock assessment process is underway.

**** The schedule reflects a one-year delay to provide additional time to submit an updated N.C. Sustainable Fishery Management Plan for River Herring to the Atlantic States Marine Fisheries Commission (ASMFC) and to evaluate the need to preserve both a state and ASMFC river herring plan.



BAY SCALLOP FISHERY MANAGEMENT PLAN



ROY COOPER
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Director

July 31, 2020

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Jeffrey Dobbs, Bay Scallop Fishery Management Plan Lead

SUBJECT: N.C. Bay Scallop Fishery Management Plan Scheduled Review

Issue

Review of the N.C. Bay Scallop Fishery Management Plan (FMP) is scheduled to begin this year. The division requests the N.C. Marine Fisheries Commission (MFC) approve the 2020 Bay Scallop FMP annual update to fulfill the scheduled review of the Bay Scallop FMP.

Findings

Bay scallops are a short-lived species sensitive to environmental change and may experience high levels of predation, which can heavily impact the population. The sensitivity of the bay scallop population to environmental change is exemplified by the red tide event of late autumn 1987 and early 1988 that significantly reduced the population, and from which the population has not fully recovered. Relative abundance, or number of bay scallops, is monitored by the Division of Marine Fisheries (DMF) via a fishery-independent sampling program. The program monitors sites in Back, Bogue, Core and Pamlico Sounds during the months of January, April, July, and October. Open seasons may only occur from the last Monday in January through April 1 (at a maximum) to ensure spawning is complete and the economic yield is at an optimum.

There are insufficient data to conduct a traditional stock assessment for bay scallop, so management decisions are instead based on annual relative abundance in comparison to the pre-red tide relative abundance. The current management strategy for the bay scallop fishery is to allow limited harvest by proclamation when relative abundance targets are met. Progressive triggers are defined in the current management strategy and allow for increased harvest if relative abundance is higher. Bay scallop relative abundances have remained at historically low levels since the last scheduled review in 2015. The continuing low relative abundances have not allowed a commercial or recreational harvest season to be opened, thus no stricter changes in management can be enacted. In the [2020 Bay Scallop FMP annual update](#) the DMF has identified research needs and updated the list of research recommendations needed moving forward.

Action Needed

At its August 2020 business meeting the MFC is scheduled to vote on approval of the 2020 Bay Scallop FMP annual update to complete the scheduled review of the N.C. Bay Scallop FMP.

Recommendation

The division recommends the 2020 Bay Scallop FMP annual update serve as the scheduled review of the North Carolina Bay Scallop FMP. All management strategies that have been in place will be maintained as outlined in the state FMP, including the continued monitoring of the bay scallop relative abundance as described above. Stock conditions will continue to be monitored and reported through each subsequent annual FMP update and the MFC will continue to receive the FMP review schedule annually.

The full documents are provided for review in the briefing materials and are linked below:

[N. C. Bay Scallop Fishery Management Plan Update \(2020\)](#)

[N. C. Bay Scallop Fishery Management Plan Amendment 2 \(2015\)](#)

**FISHERY MANAGEMENT PLAN UPDATE
BAY SCALLOP
AUGUST 2020**

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 concerns of limited abundance August 2020 – This update satisfies the formal review of Amendment 2 to the North Carolina Bay Scallop Fishery Management Plan. The next scheduled formal review will begin July 2025.
Next Benchmark Review:	July 2025

The N.C. Bay Scallop Fishery Management Plan (FMP) was adopted in November 2007. 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 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 a red tide (toxic dinoflagellate) event of late autumn 1987 and early 1988 in Core, Back, and Bogue sounds that decimated the fishery. 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) evaluation of sampling results in this region. Expanded sampling is to occur in all areas including areas south of Bogue Sound and improving 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. The Shellfish Research Hatchery in Wilmington, N.C. will establish a pilot program to distribute cultured bay

STATE-MANAGED SPECIES – BAY SCALLOP

scallop seed on private bottom, and depending on the results potentially expand the pilot program to include enhancement for 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

Life History

Bay scallops are estuarine-dependent mollusks found in grass beds. Bay scallops are hermaphroditic (contain both sex cells) bivalves and mature and spawn in a year (Brousseau 2005). Their lifespan is only 12-26 months. In North Carolina, bay scallops spawn predominantly from August through January and again in March through May (Gutsell 1930). The larvae go through several swimming stages before attaching to a suitable substrate such as seagrass. Upon reaching a size of approximately 1 inch (20-30 mm), bay scallops drop to the bottom. Although other benthic structures can be used for attachment, bay scallops use seagrass beds almost exclusively, and are therefore highly dependent on this habitat for successful recruitment (Thayer and Stuart 1974). Bay scallops are filter feeders and feed on benthic diatoms (Davis and Marshall 1961). Predators of the bay scallop include cownose rays, blue crabs, starfish, whelks, and sea birds.

Stock Status

There are insufficient data to conduct a traditional stock assessment for bay scallop in North Carolina. Bay scallop in North Carolina are a species of concern because of population declines,

caused by previous red tide events and the additive impacts from environmental factors and predation. 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. Bay scallops are vulnerable to overharvest because of the multiple factors affecting their survival.

Stock Assessment

Fishery independent data on bay scallop have been collected by the NCDMF since 1975, 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 fishery 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 Bay Scallop FMP, a prohibited take on harvest went into effect to rebuild the stock and until a standardized catch per unit effort measure could be determined (NCDMF 2007). Therefore, using landings data is no longer an effective tool to indicate population size.

Data on bay scallop abundance from fishery independent sampling are evaluated annually and standardized bay scallop population level indicators were first established as progressive triggers for opening the harvest season in Amendment 1 of the Bay Scallop FMP 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). These triggers allow for flexibility to open the fisheries as the bay scallop population recovers and determines harvest limits based on 50 percent, 75 percent, and 125 percent of the natural log of the Catch Per Unit Effort (lnCPUE) target (Tables 2 and 3).

Fishery independent data shows most samples 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. 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 10 years show bay scallop abundance is very low in all regions, which is also reflected 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 opened during three years in specific regions, and 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 scallop abundances expand and retract from year to year, broader sampling 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 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 2019 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 percent of the adult bay scallops in Bogue and Back sounds and reduced recruitment of juvenile bay scallops the following spring to only two percent 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 bay scallop stocks to recover after the red tide event, fishing pressure, and predation.

A prohibited take 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 were landed commercially) (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 were landed commercially) (Figure 4).

Recreational Landings

The state's recreational shellfish survey has recently added a question about bay scallop harvest, but no open season has occurred since the question's introduction. Due to this, no estimation of recreational harvest can be made.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

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 20 stations to seasonal monitoring at fewer locations.

Currently sampling occurs four times a year in Pamlico, Core, Back, and Bogue sounds and areas south of Bogue Sound during the second or third week of the month in January, April, July, and October. Standardized sampling occurs in Pamlico Sound using a meter-square (m^2) quadrat and a bay scallop dredge is towed in Core, Back, and Bogue sounds, and areas south of Bogue Sound. A fixed set of eight stations are towed three times for two minutes with a scallop dredge in Core, Back, and Bogue sounds and additional stations are also sampled three times for two minutes where scallops have historically been found. A set of three fixed stations, two in New River and one in Topsail Sound, are towed three times for two minutes with a scallop dredge beginning in 2009 in areas south of Bogue Sound. Sampling also occurs at five fixed stations and five non-core stations off Hatteras Island. Bay scallops are collected with a rake or by hand for 10 m^2 samples within the station in Pamlico Sound. The PVC 1 m^2 quadrat is randomly placed 10 separate times within the area. Catch per unit effort (CPUE) is defined as the number of bay scallops (juvenile and adult combined) per one-minute tow if a dredge is used or per quadrat. Additional stations (non-fixed) are sampled in most areas dependent on bay scallop abundance at the given time of year. The natural log (ln) of the catch per unit effort (lnCPUE), measured as the number of bay scallops per minute (dredges) and number of bay 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. All tows/quadrats taken at a station are averaged to get a single value for each station and are referred to as a sample. 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 10 years show bay scallop abundance is very low in all regions which is reflected in the limited open areas to harvest in the past decade (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 1984-1985 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). Trip limits and fishing days will progressively increase if sampling shows bay scallop abundance is at 75 percent

STATE-MANAGED SPECIES – BAY SCALLOP

or 125 percent of 1984-85 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. See Table 5 for current management strategies and the status on the implementation of each.

RESEARCH NEEDS

The list below is presented in order as it appears in Amendment 2 of the Bay Scallop FMP and the section or issue paper they come from is identified. 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, the research recommendations include:

- Develop better methods to quantify the population including the means to have more precise measures of spatial and temporal variability both within and between sound scales- HIGH
- Identify viable stock enhancement techniques- HIGH
- Continue to identify strategic coastal habitats that will enhance protection of bay scallops and accelerate mapping of all shell bottom in North Carolina- MEDIUM
- Develop surveys of recruitment and spat settlement and identify critical areas for these- MEDIUM
- Identify role water quality and nutrient loading has in failed recruitment and develop methods for improvement- MEDIUM

FISHERY MANAGEMENT PLAN RECOMMENDATION

Bay scallop abundances have remained at historically low levels since the last benchmark review. This has not allowed a commercial or recreational harvest season to be opened, thus no stricter changes in management can be enacted. Consequently, the division recommends the 2020 annual FMP update serve as the scheduled review of the North Carolina Bay Scallop FMP. All management strategies that have been in place will be maintained as outlined in the state FMP. Stock conditions will be monitored and reported through each subsequent annual FMP update and the Marine Fisheries Commission will continue to receive the FMP review schedule annually. The next scheduled review of this plan will begin in July 2025.

LITERATURE CITED

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STATE-MANAGED SPECIES – BAY SCALLOP

TABLES

Table 1. Target and progressive triggers based on the lnCPUE (natural log of the number of bay scallops per 1-minute tow) for the October – December 1984-1985 period for Back, Bogue, and Core sounds. Target and progressive triggers based on the lnCPUE (natural log of the number of bay 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	-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 lnCPUE Jan 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

STATE-MANAGED SPECIES – BAY SCALLOP

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 lnCPUE Jan 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			
50% or greater of target	1/2 bushel per person per day not to exceed 1 bushel per recreational fishing operation	Seven days a week	By hand, hand rakes, hand tongs, dip net, and scoops	Last Monday in January to April 1st

Table 4. Fishery Independent sampling annual lnCPUE and standard error. Pamlico Sound sampling is conducted in January with a 1m² quadrat, all other areas are sampled in October with a scallop dredge.

Year	Pamlico Sound		Core Sound		Back Sound		Bogue Sound		South	
	lnCPUE	Standard Error	lnCPUE	Standard Error	lnCPUE	Standard Error	lnCPUE	Standard Error	lnCPUE	Standard Error
2006			-2.30	0.00	-1.54	0.50	-1.02	0.34		
2007			-1.24	0.50	-2.00	0.30	-1.57	0.34		
2008			2.94	0.35	-1.41	0.40	1.21	0.57		
2009	-0.18	0.79	-1.01	0.42	-1.31	0.45	1.34	0.27	0.94	0.75
2010	0.32	0.67	-0.54	0.39	-1.10	0.54	-1.12	0.54	-2.30	0.00
2011	-1.99	0.13	-0.63	0.57	0.83	0.26	0.38	0.34	-1.77	0.37
2012	-1.66	0.26	-1.71	0.38	-0.56	0.78	1.18	0.25	-0.91	0.36
2013	-1.21	0.11	-2.30	0.00	-2.30	0.00	-0.41	0.71	-1.19	0.42
2014	-1.54	0.31	-2.00	0.30	-1.01	0.42	-2.00	0.20	-1.64	0.34
2015	-1.86	0.39	-2.14	0.16	-2.06	0.16	-1.80	0.19	-1.69	0.16
2016	-2.29	0.01	-1.93	0.25	-1.94	0.19	-1.87	0.16	-2.00	0.20
2017	-2.30	0.00	-2.18	0.12	-1.55	0.25	-1.97	0.14	-0.75	0.26
2018	-2.21	0.08	-1.61	0.75	-2.10	0.46	-2.30	0.00	-2.30	0.00
2019	-2.26	0.24	-1.79	0.16	-2.30	0.00	-1.79	0.11	-2.21	0.09
2020	-2.26	0.24								

STATE-MANAGED SPECIES – BAY SCALLOP

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	
<i>Status quo</i> (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 the CHPP
Identify and designate SHAs that will enhance protection of the bay scallop	Ongoing through CHPP implementation plan
Remap and monitor SAV coverage in North Carolina to assess distribution and change over time.	Ongoing through CHPP implementation plan
Restore coastal wetlands to compensate for previous losses and enhance water quality conditions for the bay scallop	Ongoing 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	Ongoing 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	Ongoing 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	Ongoing 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	Ongoing through CHPP implementation plan
Shallow areas where trawling is currently allowed should be re-examined to determine if additional restrictions are necessary	Ongoing through CHPP implementation plan
Accelerate and complete mapping of all shell bottom in coastal North Carolina	Ongoing through CHPP implementation plan
Improve methods to reduce sediment and nutrient pollution from construction sites, agriculture, and forestry	Ongoing through CHPP implementation plan
Reduce impervious surfaces and increase on-site infiltration of storm water through voluntary or regulatory measures	Ongoing through CHPP implementation plan
Provide more incentives for low-impact development	Ongoing 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	Ongoing 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	Ongoing through CHPP implementation plan
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	Ongoing through CHPP implementation plan
Discourage use of detergents in coastal waters, especially detergents with antimicrobial components	Ongoing through CHPP implementation plan
INSUFFICIENT DATA	
Support improving the reliability of the data for the recreational scallop harvest	Incomplete
MANAGEMENT	

STATE-MANAGED SPECIES – BAY SCALLOP

Management Strategy	Implementation Status
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.

STATE-MANAGED SPECIES – BAY SCALLOP

FIGURES

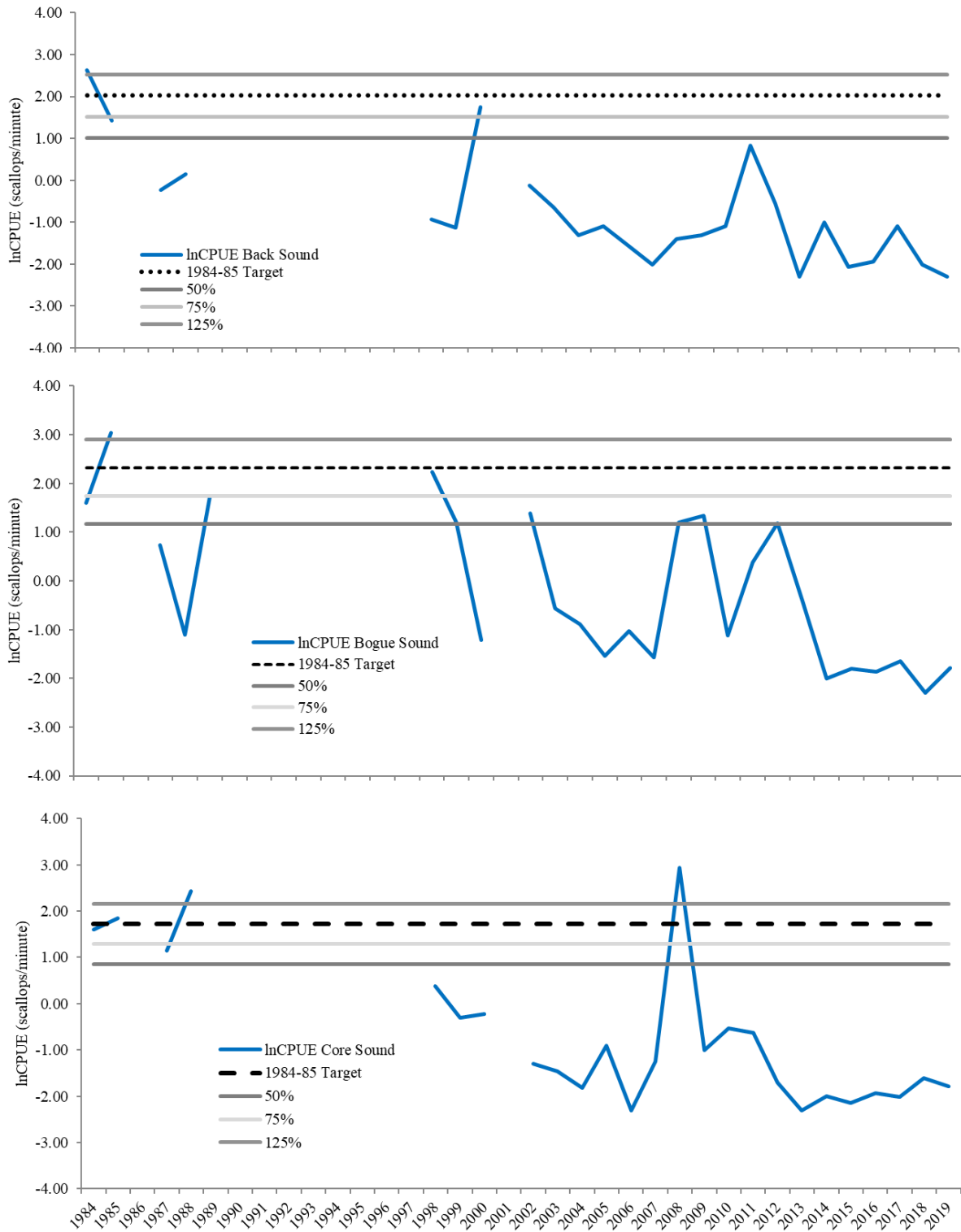


Figure 1. The mean number of bay scallops (lnCPUE)(bay scallops/minute) for Back, Bogue, and Core sounds during the October-December sampling time period and average lnCPUE (target) for the 1984-1985 period showing progressive triggers at 50 percent, 75 percent, and 125 percent of the target. Year indicates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

STATE-MANAGED SPECIES – BAY SCALLOP

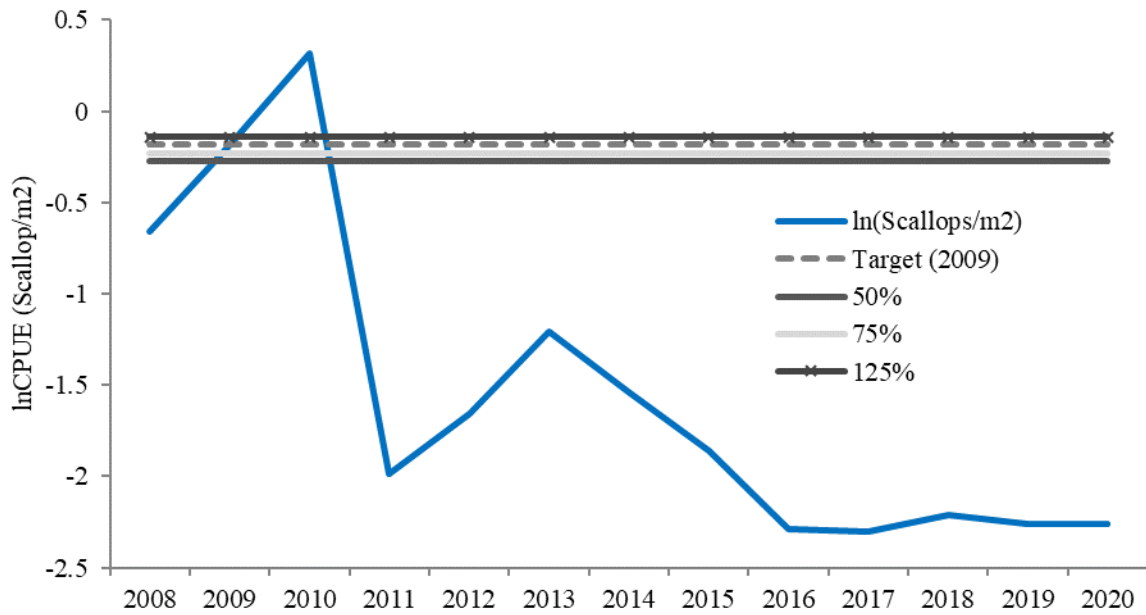


Figure 2. The mean number of bay scallops, lnCPUE (ln(bay scallops/m²)), for Pamlico Sound during the January sampling time period and target for the January 2009 period showing progressive triggers at 50 percent, 75 percent, and 125 percent of the target. Year indicates the sampling year which is used to determine the harvest season for the same calendar year.

STATE-MANAGED SPECIES – BAY SCALLOP

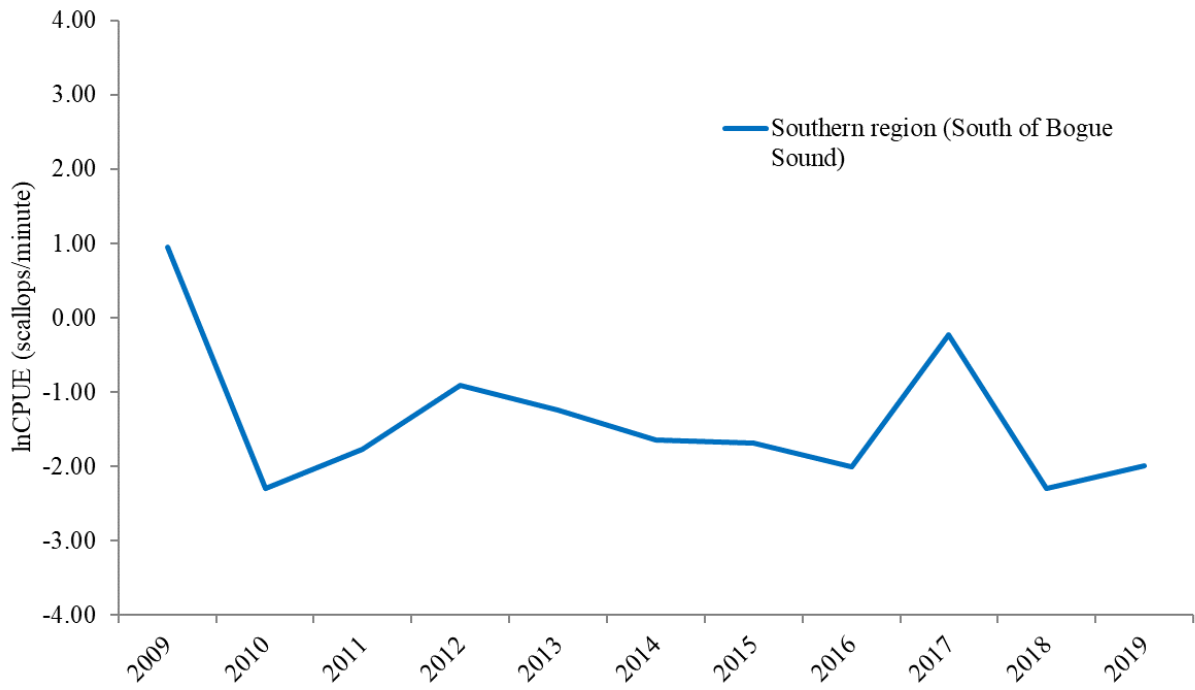


Figure 3. The mean number of bay scallops (lnCPUE)(bay scallops/minute) for areas south of Bogue Sound in October, 2009-2019. Target opening estimates and progressive triggers are not defined for this region until sampling is expanded and a longer time series is established.

STATE-MANAGED SPECIES – BAY SCALLOP

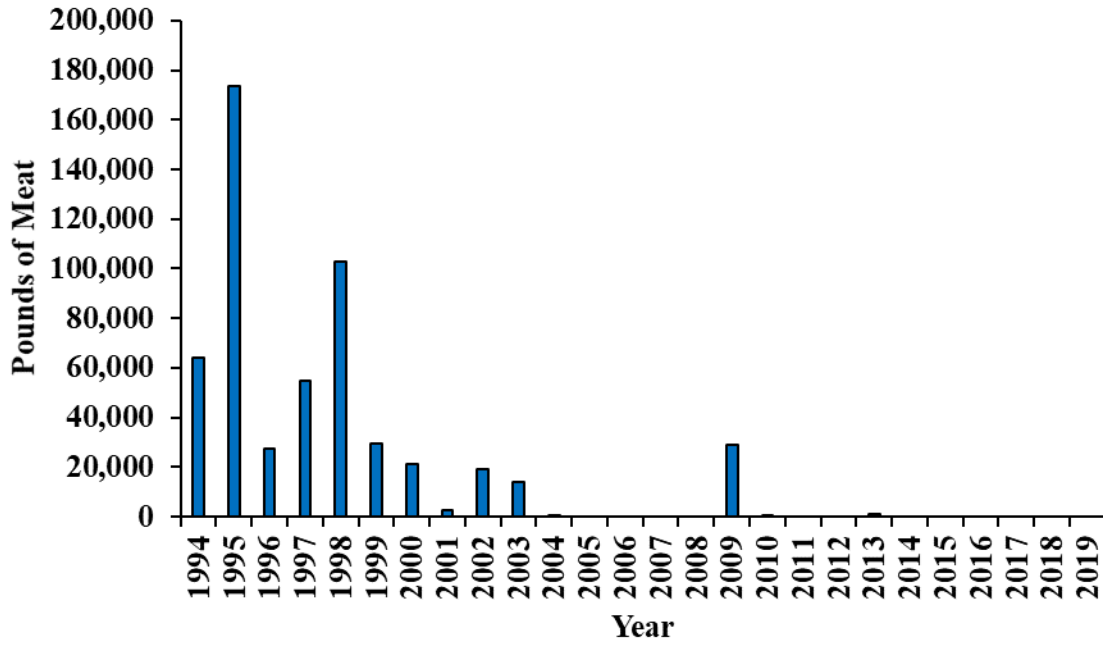


Figure 4. Bay scallop landings (pounds of meat) in North Carolina, 1994-2019. Landings occurred in 2010 and 2013 but are not evident in the figure due to the scale required to show the range of landings for the time series.



KINGFISHES FISHERY

MANAGEMENT PLAN



ROY COOPER
Governor

MICHAEL S. REGAN
Secretary

STEPHEN W. MURPHEY
Director

July 31, 2020

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Kevin Brown, Kingfishes Fishery Management Plan Lead

SUBJECT: N.C. Kingfishes Fishery Management Plan Scheduled Review

Issue

Review of the N.C. Kingfishes Fishery Management Plan (FMP) is scheduled to begin this year. The division requests the N.C. Marine Fisheries Commission (MFC) approve the 2020 Kingfishes FMP annual update to fulfill the scheduled review of the Kingfishes FMP.

Findings

The Kingfishes FMP includes the three species of kingfishes, southern (*Menticirrhus americanus*), Gulf (*M. littoralis*), and northern (*M. saxatilis*) found in the coastal fishing waters of North Carolina. However, because of its predominance, southern kingfish is used as the indicator species for this assemblage. A state-specific stock assessment could not be conducted, primarily because the North Carolina management unit does not encompass the entire stock range for any of the three species of kingfishes. A regional stock assessment approach is recommended as the most appropriate mechanism for determining the stock status and the long-term viability of these stocks.

Kingfishes in North Carolina are monitored through fisheries-independent and fisheries-dependent data collection programs. Fisheries-independent data are collected through several ongoing survey programs, including the Division of Marine Fisheries' (DMF) Pamlico Sound Survey and Independent Gill Net Survey, and the regional Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) Coastal Survey. Fisheries-dependent data are collected in the form of landings. The DMF collects commercial landings data through the Trip Ticket Program, while the recreational harvest of kingfishes are estimated from the Marine Recreational Information Program (MRIP).

The 2007 Kingfishes FMP selected the use of trend analysis with management triggers as the management strategy to monitor the viability of the kingfish stocks in North Carolina. During the 2015 review of the Kingfishes FMP the best available data and techniques used for the trend analysis and management triggers were refined and modified to better assess population trends. The trend analysis incorporates management triggers to alert DMF and MFC 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 evaluation of the data and potential management action.

The analysis is updated each year and all trends relative to management triggers are provided as part of the annual FMP update.

The management program currently in place for kingfishes has resulted in a stock that has met ongoing management targets. Table 1 below shows the occurrences of management trigger activation since 2007. While individual triggers have been activated over the years, the activation of two triggers two years in a row has not occurred. For a more thorough description of the management triggers and the management strategy overall, please refer to the full [2020 Kingfishes FMP Update](#) included in your briefing materials.

Action Needed

At its August 2020 business meeting the MFC is scheduled to vote on approval of the 2020 Kingfishes FMP Update to complete the scheduled review of the Kingfishes FMP.

Recommendation

The division recommends the 2020 annual FMP update serve as the scheduled review of the North Carolina Kingfishes FMP. All management strategies outlined in the state FMP will remain in place. Stock conditions will continue to be monitored and reported through the annual FMP update for consideration by the MFC. If approved, the next scheduled review of this plan will begin in July 2025.

Table 1. Management trigger activation is indicated by a black dot (●). Shaded headers indicate the trigger type, non-shaded headers identify the data source(s) for the trigger. The combination of the two identify a single trigger for a total of seven triggers. The activation of any two management triggers (regardless of trigger category) two years in a row warrants further evaluation of the data and potential management action.

Year	Proportion of Adults Mature (≥L50)			Young-of-Year Index		Adult Index	Relative F
	Pamlico Sound Survey	Independent Gill Net Survey	SEAMAP	Pamlico Sound Survey	SEAMAP	SEAMAP	Trip Ticket Program, MRIP, SEAMAP
2007	●					●	
2008					●	●	
2009					●		●
2010				●			
2011							
2012			●		●		
2013							
2014							
2015							
2016	●		●	●			
2017				●		●	
2018					●		
2019					●		

**FISHERY MANAGEMENT PLAN UPDATE
KINGFISHES
AUGUST 2020**

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 2007
Amendments:	None
Revisions:	None
Supplements:	None
Information Updates:	November 2015
Schedule Changes:	August 2020 – This update satisfies the formal review of the North Carolina Kingfish Fishery Management Plan. The next scheduled formal review will begin July 2025.
Next Benchmark Review:	July 2025

The original 2007 Kingfish Fishery Management Plan (FMP) developed management strategies that ensure a long-term sustainable harvest for recreational and commercial fisheries of North Carolina. The plan established the use of trend analysis and management triggers to monitor the viability of the stock. The N.C. Marine Fisheries Commission (NCMFC) also approved a rule which included proclamation authority for the North Carolina Division of Marine Fisheries (NCDMF) director the flexibility to impose restrictions on season, areas, quantity, means and methods, or size of kingfish (NCMFC Rule 15A NCAC 03M .0518), if needed. An Information Update was completed for the Kingfish FMP in November of 2015. The best available data and techniques used for the trend analysis and management triggers were refined and modified to better assess population trends as part of this FMP Information Update.

Management Unit

The North Carolina Kingfish FMP includes the three species of kingfishes (southern *Menticirrhus americanus*, Gulf *M. littoralis*, and northern *M. saxiatis*) in all coastal fishing waters of North Carolina. Southern kingfish is designated as the indicator species for this assemblage. The management unit identified in this plan does not encompass the entire unit stock range for any of the three species of kingfishes inhabiting North Carolina. This is the primary reason a quantified state-specific stock assessment could not be conducted and further, why a regional stock assessment approach is recommended as the most appropriate mechanism for determining the stock status and the long-term viability of this stock (NCDMF 2007).

Goal and Objectives

The goal of the 2007 Kingfish Fishery Management Plan is to determine the health of the stocks and ensure the long-term sustainability of the kingfish stocks in North Carolina (NCDMF 2007). 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 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

Life History

Three species of kingfishes occur in North Carolina: southern (*Menticirrhus americanus*), Gulf (*M. littoralis*), and northern kingfishes (*M. saxatilis*). Kingfish refers to a single species while kingfishes refers to multiple species. Kingfishes are demersal (live near and feed on the bottom) members of the drum family. Southern kingfish is the most abundant kingfish species from North Carolina to the east coast of Florida and Gulf of Mexico with a range extending as far as Cape May, New Jersey southward to Buenos Aires, Argentina. Northern kingfish is the most abundant kingfish species from Massachusetts to North Carolina, with a range extending from the Gulf of Maine into the Gulf of Mexico. Gulf kingfish is the most abundant kingfish species in the surf zone south of Cape Hatteras, North Carolina, and has a range extending from Virginia to Rio Grande, Brazil. The northern and southern kingfishes prefer mud or sand-mud bottom types while Gulf kingfish prefer the sandy bottoms of the surf zone. Kingfishes move from estuarine and nearshore ocean waters to deeper offshore waters as water temperature cools. Spawning takes place in the ocean from April to October. The kingfishes have several regional names including sea mullet, king whiting, king croaker, sea mink, roundhead, hard head, whiting, hake, Carolina whiting, and Virginia mullet.

Stock Status

The stocks of kingfish is unassessed, thus overfishing/overfished status cannot be determined. However, results from the 2019 trend analysis suggests there are no concerns with the stock and

no need for management at this time. A coast-wide stock assessment is a high research priority that needs to be addressed before biological reference points relative to overfished and overfishing can be determined.

Stock Assessment

The 2007 Kingfish FMP selected the use of trend analysis with management triggers as the management strategy to monitor the viability of the kingfish stocks in North Carolina (NCDMF 2007). During the review of the 2007 Kingfish FMP as part of the 2015 FMP Information Update, best available data and techniques used for the trend analysis and management triggers were refined and modified to better assess population trends. 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 evaluation of the data 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. Current management triggers are based on fishery independent indices of abundance for Young-of-Year (YOY), adult fish, the proportion of catch greater than size at 50% maturity (L_{50}) and a relative fishing mortality index. YOY fish includes new 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.

A formal quantitative stock assessment is not available for kingfishes 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 kingfishes along the Atlantic coast including North Carolina. In 2008 and 2014, Atlantic States Marine Fisheries Commission (ASMFC) South Atlantic Board met to consider regional management by reviewing data on kingfishes. However, due to no major concerns with kingfish stocks, it was decided no further action was necessary. As a result, kingfishes management in North Carolina continues to fall solely within the framework of the state FMP process.

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 (NCMFC Rule 15A NCAC 03J .0202 (5)). No other harvest limits are in place specific to kingfishes in any other fisheries.

Commercial Landings

Commercial landings for kingfishes include southern, northern, and Gulf kingfishes combined. Landings have fluctuated historically but have been on an increasing trend since 2011. In 2019, landings (702,234 lbs) increased 58 percent from 2018 (Figure 1). Most kingfishes landed are

STATE-MANAGED SPECIES – KINGFISHES

from the ocean gill net fishery. The average landings from 2010 to 2019 were 719,992 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 of kingfishes are estimated from the Marine Recreational Information Program (MRIP). Recreational estimates across all years have been updated and are now based on the Marine Recreational Information Program (MRIP) new Fishing Effort Survey-based calibrated estimates. For more information on MRIP see <https://www.fisheries.noaa.gov/topic/recreational-fishing-data>.

Recreational landings for kingfish include southern, northern, and Gulf kingfishes. Total recreational landings had been on an increasing trend from 1983 – 2014. In 2015, 2016 and 2017, recreational landings declined, with 2017 having the lowest landings (267,234 lbs) since 1999. In 2019 recreational landings (881,104 lbs) increased 54% from 2018 (Figure 1). Most kingfishes are landed from the ocean and the majority of the fish are caught 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 most fish harvested during the spring and the fall, and lowest during the summer. Most of the recreational catch consists of kingfish from 8 to 12 inches (Figure 12).

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 gill net, estuarine gill net and ocean beach seine fisheries in N.C. A total of 30,771 kingfishes were measured from 2010 to 2019 (26,060 southern, 2,596 northern and 2,115 Gulf; Table 1; Figure 9). Mean length for southern kingfish ranged from 11.4 to 12.1 inches, with a minimum of 6.5 inches and a maximum of 24.8 inches. Mean length for northern kingfish ranged from 12.1 to 13.9 inches, with a minimum of 7.8 inches and a maximum of 17.7 inches. Mean length for Gulf kingfish ranged from 12.2 to 13.2 inches with a minimum of 6.1 inches and a maximum of 18.3 inches.

Recreational lengths are collected as part of Marine Recreational Informational Program (MRIP) by recreational port agents. A total of 7,029 kingfishes were measured from 2010 to 2019 (5,016 southern, 213 northern and 1,800 Gulf; Table 2). Mean length for southern kingfish ranged from 10.4 to 11.7 inches, with a minimum of 6.1 inches and a maximum of 19.9 inches. Mean length for northern kingfish ranged from 9.2 to 13.2 inches, with a minimum of 6.2 inches and a maximum of 16.0 inches. Mean length for Gulf kingfish ranged from 10.4 to 12.1 inches, with a minimum of 5.9 inches and a maximum of 18.2 inches. The length composition and modal length of kingfish caught in the commercial fishery has been stable from 1989 to 2019 (Figure 11).

Fishery-Independent Monitoring

Fishery-independent data are collected through the NCDMF Pamlico Sound Survey (Program 195), the Southeast Area Monitoring and Assessment Program – South Atlantic (SEAMAP-SA) Coastal Survey and the NCDMF Independent Gill Net Survey (Program 915). The Pamlico Sound Survey catches the most kingfishes of any of the NCDMF fishery independent sampling programs, and the majority of those are southern kingfishes. This survey has been running uninterrupted since 1987. 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. Tow duration is 20 minutes at 2.5 knots using the R/V Carolina Coast pulling double rigged demersal mongoose trawls. 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. The September portion of the Pamlico Sound Survey is used to calculate a YOY index of relative abundance because there are more southern kingfish collected in the fall, and more YOY are present in the catch at this time. The relative index derived from Programs 195 survey was calculated using a stratified generalized linear model (GLM) approach. The Program 195 YOY relative abundance index peaked in 2009, but has been on a decreasing trend since 2013, and remained low in 2018 (Figure 2; Table 4).

The Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) Coastal Survey is conducted by the South Carolina Department of Natural Resources-Marine Resources Division, and provides long-term fishery independent data on the distribution and relative abundance of coastal species (Cowen and Zimney 2016). SEAMAP-SA Coastal Survey cruises are conducted each year in spring (mid-April to the end of May), summer (mid-July to mid-August), and fall (the first of October to mid-November). The summer portion of SEAMAP-SA Coastal Survey is used to calculate an adult index of abundance and the fall portion of SEAMAP-SA Coastal Survey is used as a young of year index of abundance. The indices derived from the SEAMAP-SA Coastal Survey were computed using standard (non-stratified) GLMs. After a peak in 2012, the SEAMAP-SA Coastal Survey adult index of relative abundance has been on a declining trend, which continued in 2018 (Figure 3; Table 4). The YOY index of relative abundance increased to well above the average in 2015 and has since returned to approximately the average in 2018 (Figure 4; Table 4). 2019 SEAMAP data is currently unavailable.

The Independent Gill Net 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. Gill net sets are determined using a random stratified survey design, based on area and water depth. The L_{50} management trigger is based on a conservative proportion of adults in the population. This is the length at which 50 percent of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in total length. One of the data sources for this management trigger comes from the Independent Gill Net Survey and has been stable () over the time series, ranging from 0.947% to 1.00% (Figure 5).

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Table 3 summarizes the age data for kingfishes (southern, northern, and Gulf), collected from 2010 through 2019. The majority of kingfish age samples came from Independent Gill Net Survey (Program 915), followed by the commercial ocean gill net fishery. Southern kingfish ages ranged from 0 to 7 years old. Northern kingfish ages ranged from 0 to 4 years old. Gulf kingfish ages ranged from 0 to 6 years old. The modal age has ranged from 1 to 3 years for southern, Gulf, and northern kingfishes.

MANAGEMENT STRATEGY

The 2007 Kingfish FMP selected the use of trend analysis and management triggers as the management strategy to monitor the viability of the southern kingfish stock in North Carolina (NCDMF 2007). A second management strategy promotes work to enhance public information and education. The trend analysis and management triggers are updated annually, and results are presented to the NCMFC as part of the annual FMP Update. The trend analysis incorporates triggers to alert managers to the potential need for management action based on stock conditions. The activation of any two management triggers two years in a row (regardless of category) warrants further data evaluation and potential management action. The NCMFC will be notified should this criterion be met. The Pamlico Sound Survey, the Independent Gill Net Survey and the SEAMAP-SA Coastal Survey data are currently used for management triggers for kingfishes in North Carolina.

The L_{50} management trigger is based on a conservative proportion of adults in the population. This is the length at which 50 percent of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in total length. Data sources for this management trigger come from three fisheries-independent surveys: the summer component of the SEAMAP-SA Coastal Survey, the July-September component of independent gill net survey, and the June component of the Pamlico Sound Survey.

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

The kingfish management triggers are summarized as follows:

Biological Monitoring

Proportion of adults \geq length at 50 percent maturity (L_{50}) for NCDMF Program 195 June (Figure 6)

Proportion of adults $\geq L_{50}$ for NCDMF Program 915 (Figure 5)

Proportion of adults $\geq L_{50}$ for SEAMAP-SA Coastal Survey summer (Figure 7)

→ 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.

Fisheries-Independent Surveys—Juvenile and Adult

NCDMF Program 195 September index of YOY relative abundance (Figure 2)

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SEAMAP-SA Coastal Survey summer index of adult relative abundance (Figure 3)

SEAMAP-SA Coastal Survey fall index of YOY relative abundance (Figure 4)

→ If a fisheries-independent survey falls below 2/3 of the average abundance for the time series (through 2017), then the trigger will be considered tripped.

Other

Relative fishing mortality rate (F) (Figure 8)

→ If relative F rises above the average +1/3 of relative F for the time series (through 2017), the trigger will be considered tripped.

A summary of the various management triggers by year is provided in Table 4. Bold values indicate years when a particular management trigger was activated. In 2019, one management trigger was activated and only one trigger (the YOY index from the fall portion of SEAMAP Survey) was below the management trigger threshold.

RESEARCH NEEDS

The division reviewed and prioritized the research recommendations during the 2015 FMP Information Update (NCDMF 2015). The prioritization of each research recommendation is designated as a high, medium, or low priority. 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 kingfishes resource cannot occur until some of these research needs are met. The research recommendations include:

- 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 (NCDMF has observers collecting data at sea for the shrimp fishery, 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 for 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 nearshore ocean waters – MEDIUM (No action)
- Continue bycatch reduction device studies in the shrimp trawl fishery to decrease bycatch – MEDIUM (Ongoing research through NCDMF and various federal agencies)

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- Determine stock structure using genetics of kingfishes along North Carolina and the Atlantic Coast – LOW (Grant approved for UNCW and NCDMF to use genetic markers to delineate the population structure)
- 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 (NCDMF currently collecting histology samples in order to validate and update maturity schedules)
- Conduct an age validation study 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)
- 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 N.C. 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)
- 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)
- Update information on the participants in the recreational kingfish fishery – LOW (Socioeconomic study was conducted by NCDMF on piers)

FISHERY MANAGEMENT PLAN RECOMMENDATION

The management program currently in place for kingfishes has resulted in a stock that has met ongoing management targets. Consequently, the division recommends the 2020 annual FMP update serve as the scheduled review of the North Carolina Kingfishes FMP. All management strategies that have been in place will be maintained as outlined in the state FMP. Stock conditions will be monitored and reported through each subsequent annual FMP update and the Marine Fisheries Commission will continue to receive the FMP review schedule annually. The next scheduled review of this plan will begin in July 2025.

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TABLES

Table 1. Summary of length data (total length, inches) sampled from the kingfish commercial fishery, 2010 - 2019.

Southern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2010	11.6	6.7	22.0	2,466
2011	11.7	8.1	18.1	2,102
2012	11.5	7.0	17.0	2,947
2013	12.1	6.5	16.1	1,390
2014	11.9	8.3	20.9	2,880
2015	11.9	7.7	15.8	3,286
2016	12.0	7.1	17.2	3,107
2017	11.6	7.9	16.1	2,504
2018	11.4	6.8	16.1	1,264
2019	11.4	8.0	24.8	4,114
Northern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2010	12.6	9.0	16.0	189
2011	12.7	8.6	17.0	275
2012	12.8	7.8	17.5	370
2013	13.1	8.6	16.0	815
2014	13.4	9.5	16.7	216
2015	12.7	10.0	16.6	100
2016	12.4	8.8	17.0	227
2017	13.3	9.8	17.4	177
2018	13.9	9.7	17.7	64
2019	12.1	8.1	16.1	163
Gulf Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2010	12.5	10.2	16.2	136
2011	13.2	6.1	17.9	314
2012	12.6	9.2	16.0	151
2013	12.9	8.3	17.4	470
2014	12.2	8.6	15.5	182
2015	12.7	9.2	16.3	168
2016	12.4	8.1	18.3	193
2017	12.3	9.4	16.7	257
2018	12.5	9.0	18.0	161
2019	12.6	10.3	16.9	83

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Table 2. Summary of length data (fork length, inches) sampled from the kingfish recreational fishery, 2010 - 2019.

Southern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2010	11.2	6.3	16.3	968
2011	11.0	7.2	16.5	583
2012	10.9	6.1	16.1	828
2013	10.4	6.1	15.8	370
2014	11.7	7.8	19.9	383
2015	10.7	6.4	18.7	258
2016	11.2	7.8	16.5	490
2017	11.0	7.8	15.4	472
2018	11.5	7.8	15.2	290
2019	10.9	6.3	15.7	374
Northern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2010	11.1	8.7	15.4	20
2011	12.2	7.1	16.0	70
2012	11.3	8.3	15.1	58
2013	10.9	6.2	14.8	26
2014	11.2	9.3	13.5	2
2015	10.9	8.5	14.1	7
2016	10.8	7.9	11.8	3
2017	13.2	9.8	14.4	24
2018	9.2	6.4	13.1	2
2019	10.9	10.9	10.9	1
Gulf Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2010	10.8	5.9	18.2	363
2011	11.9	7.5	16.9	223
2012	10.4	6.4	17.2	406
2013	10.4	6.0	17.2	180
2014	11.5	6.5	17.2	203
2015	11.3	8.5	16.0	63
2016	10.7	6.9	14.1	81
2017	12.1	7.5	15.8	126
2018	11.6	6.5	17.0	83
2019	11.1	6.2	15.0	72

STATE-MANAGED SPECIES – KINGFISHES

Table 3. Kingfish age data collected from all sources (commercial and recreational fisheries and fishery independent sampling programs) combined, 2010 - 2019.

Southern Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
2010	2	1	5	163
2011	2	0	6	243
2012	1	1	6	228
2013	2	1	5	298
2014	3	0	5	269
2015	2	0	5	353
2016	1	0	7	530
2017	2	0	6	413
2018	1	0	7	308
2019	2	1	7	386
Northern Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
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
2015	2	0	2	40
2016	1	1	4	49
2017	2	1	3	13
2018	3	3	3	1
2019	-	-	-	0
Gulf Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
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
2015	2	0	4	78
2016	1	0	5	116
2017	2	0	5	167
2018	2	0	6	95
2019	1	0	6	183

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Table 4. Summary of management trigger organized by category. Bold indicates values that activate a trigger.

Year	BIOLOGICAL MONITORING			FISHERIES-INDEPENDENT SURVEYS			OTHER
	Proportion of Adults >= L50			YOY Indices		Adult Index	Relative <i>F</i>
	Program 195 June	Program 915 July-September	SEAMAP Summer	Program 195 September	SEAMAP Fall	SEAMAP Summer	Relative <i>F</i>
1987	0.611			0.73			
1988	0.450			0.97			
1989	0.300		0.585	1.41	65.4	19.7	10,608
1990	0.563		0.463	2.55	48.9	45.3	60,847
1991	0.667		0.894	3.94	36.9	64.6	16,169
1992	0.429		0.622	1.88	26.7	53.7	15,390
1993	0.543		0.456	0.10	14.4	40.6	40,051
1994	0.794		0.917	4.44	42.4	9.00	60,212
1995	0.440		0.486	7.03	18.0	15.2	24,635
1996	0.872		0.780	0.34	34.5	10.9	28,013
1997	0.589		0.373	0.41	20.7	27.4	9,453
1998	1.000		0.769	0.22	35.8	12.1	6,625
1999	0.920		0.608	4.05	40.1	75.4	16,282
2000	0.733		0.929	9.32	32.2	19.8	58,890
2001	0.660	0.983	0.303	4.33	27.3	40.3	22,634
2002	0.704	0.978	0.882	5.98	47.1	25.4	17,928
2003	0.872	0.978	0.645	6.36	18.7	31.3	4,538
2004	0.513	0.971	0.284	3.27	58.8	80.9	4,724
2005	0.594	0.971	0.666	2.20	34.5	42.2	8,541
2006	0.541	0.980	0.423	21.22	33.1	51.7	11,901
2007	0.343	0.976	0.521	7.89	52.9	18.4	24,465
2008	0.488	0.978	0.577	10.98	33.9	9.61	21,221
2009	0.586	1.000	0.389	35.84	15.3	37.5	33,226
2010	0.529	0.983	0.786	1.79	38.9	27.9	15,217
2011	0.432	1.000	0.507	17.08	95.5	34.2	20,457
2012	0.511	1.000	0.368	4.73	31.0	100	5,365
2013	0.659	0.947	0.558	16.09	48.5	61.8	6,715
2014	0.422	0.982	0.548	7.04	71.4	68.5	19,818
2015	0.534	0.981	0.550	8.13	557	56.5	9,208
2016	0.358	0.950	0.345	2.17	79.8	61.0	2,698
2017	0.503	0.958	0.684	3.99	49.2	23.9	1,946
2018	0.639	1.000	0.404	6.16	34.3	32.1	4,294
2019	0.525	0.971	0.447	7.42	36.9	70.3	4,565
Threshold	<0.390	<0.652	<0.382	<4.24	<38.3	<27.3	>25,231
Total Years	33	19	31	33	31	31	31
Years Trigger Activated	3	0	5	17	16	10	6

STATE-MANAGED SPECIES – KINGFISHES

Table 5. Summary of the N.C. Marine Fisheries Commission management strategies and their implementation status for the 2007 Kingfish Fishery Management Plan.

Management Strategy	Implementation Status
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.	Accomplished
Recommend ASMFC conduct a coastwide stock assessment on sea mullet.	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.	Ongoing
Implement rule giving NCDMF director proclamation authority to manage kingfish.	Accomplished. Rule 15A NCAC 3M .0518 in effect since October 1, 2008
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).	Endorsed through the Coastal Habitat Protection Plan (CHPP)
To ensure protection of kingfish nursery areas, fish-friendly alternatives to vertical stabilization should be required around primary and secondary nursery areas.	Endorsed through the CHPP
The location and designation of nursery habitats should be continued and expanded by the NCDMF.	Endorsed through the CHPP
No trawl areas and mechanical harvest prohibited areas should be expanded to include recovery/restoration areas for subtidal oyster beds and SAV.	Endorsed through the 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.	Endorsed through the CHPP
Any proposed stabilization project threatening the passage of kingfish larvae through coastal inlets should be avoided.	Endorsed through the 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.	Endorsed through the CHPP
Efforts to implement phase II stormwater rules must be continued.	Endorsed through the CHPP
The EEP process should be extended to other development projects.	Endorsed through the CHPP
Reduce sediment and nutrient loading by addressing multiple sources, including: <ul style="list-style-type: none"> • improvement and continuation of urban and agricultural BMPs, • more stringent sediment controls on construction projects, and • implementation of additional buffers along coastal waters. 	Endorsed through the CHPP

STATE-MANAGED SPECIES – KINGFISHES

FIGURES

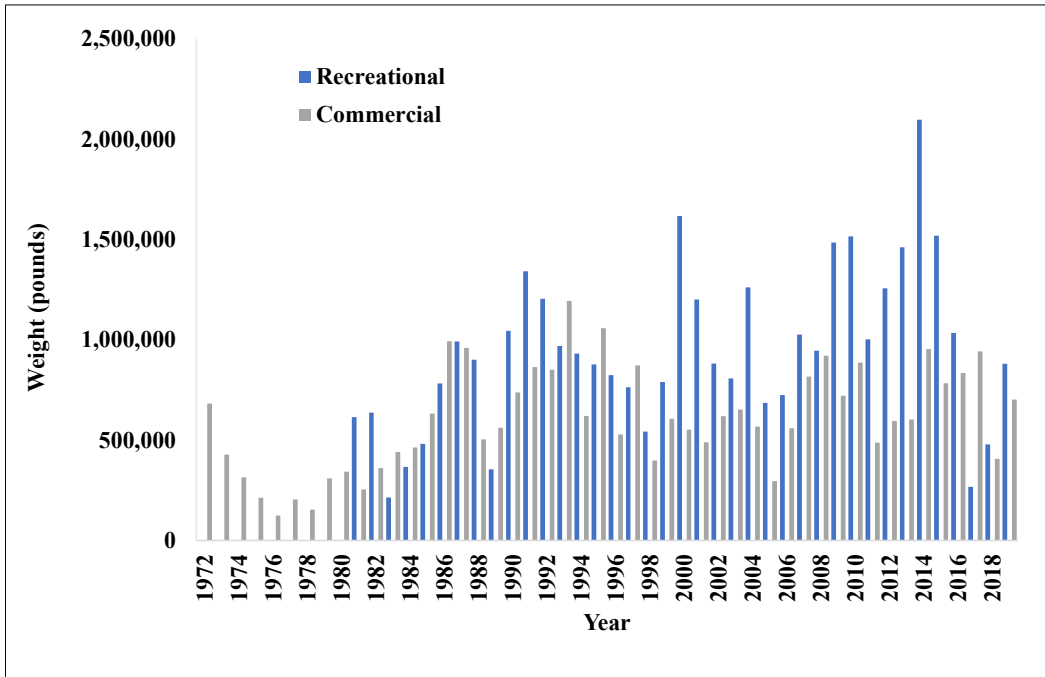


Figure 1. Commercial and recreational landings of kingfishes (southern, northern, and Gulf combined), 1972 - 2019.

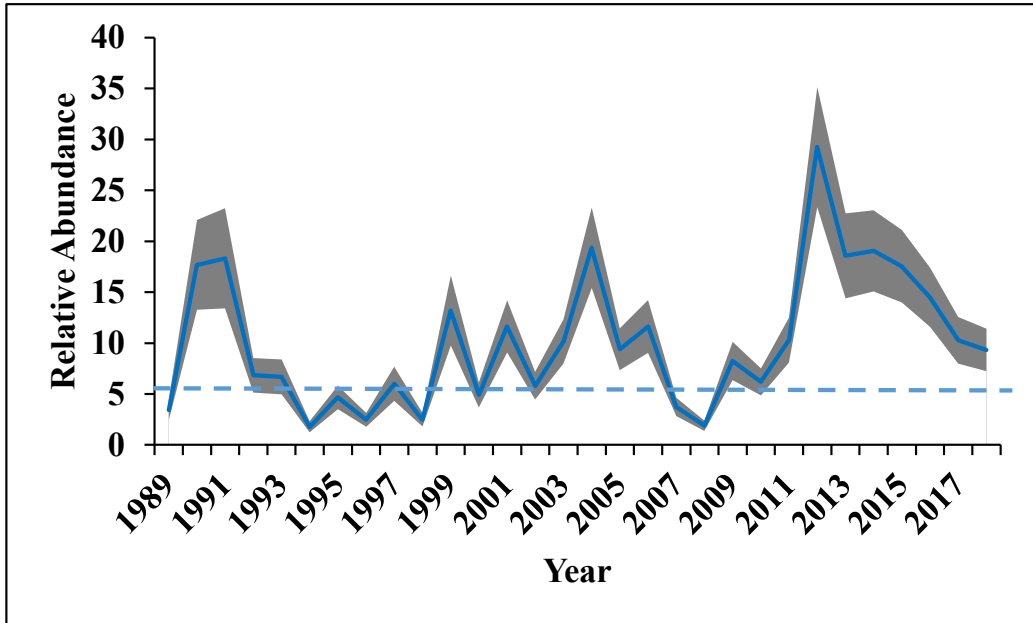


Figure 2. Annual index of relative YOY abundance for southern kingfish derived from the September component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 1987–2019. Dotted line represents 2/3 of the average of the time series.

STATE-MANAGED SPECIES – KINGFISHES

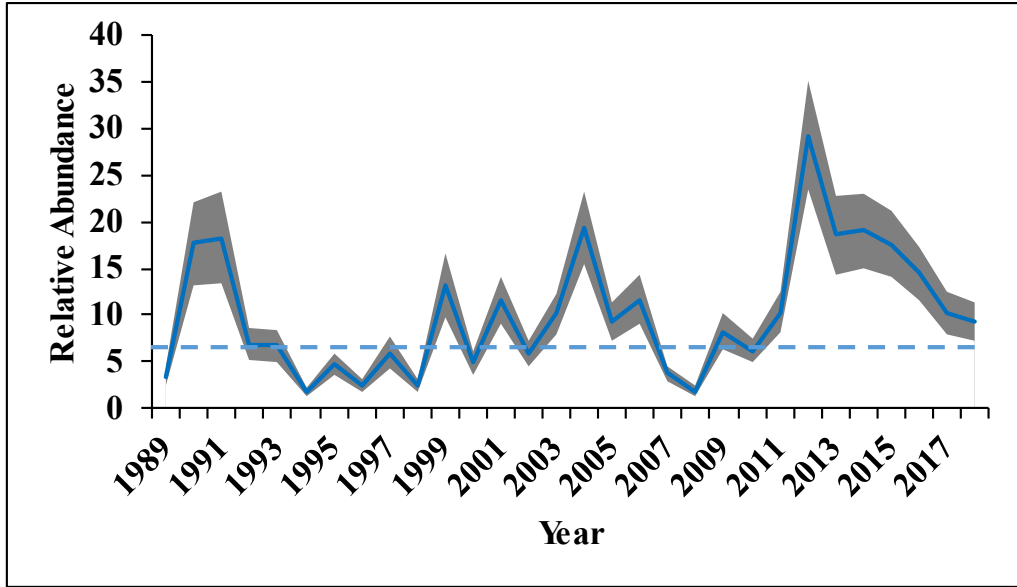


Figure 3. Annual index of relative adult abundance for southern kingfish derived from the summer component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2018, 2019 data is not available. Dotted line represents 2/3 of the average of the time series.

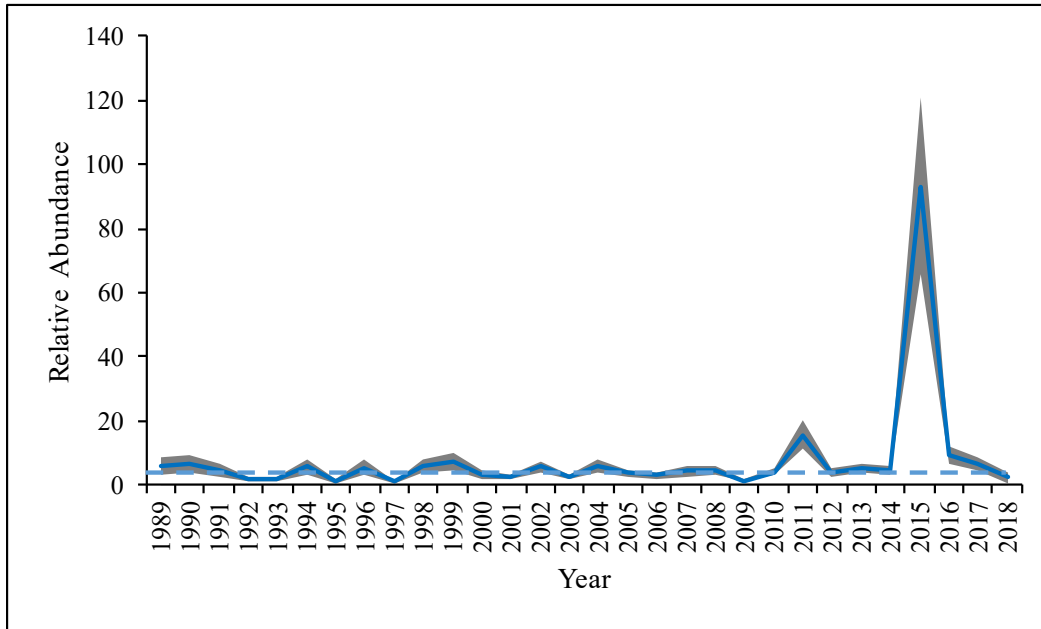


Figure 4. Annual index of relative YOY abundance for southern kingfish derived from the fall component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2018, 2019 data is not available. Dotted line represents 2/3 of the average of the time series.

STATE-MANAGED SPECIES – KINGFISHES

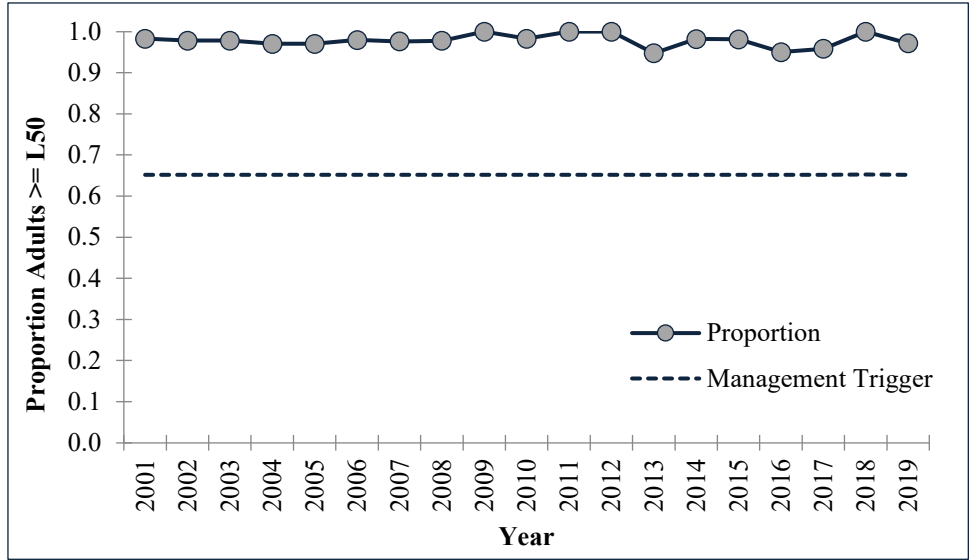


Figure 5. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the July through September component of the NCDMF Program 915 survey (Pamlico Sound, deep strata only), 2001–2019. Dotted line represents 2/3 of the average of the time series.

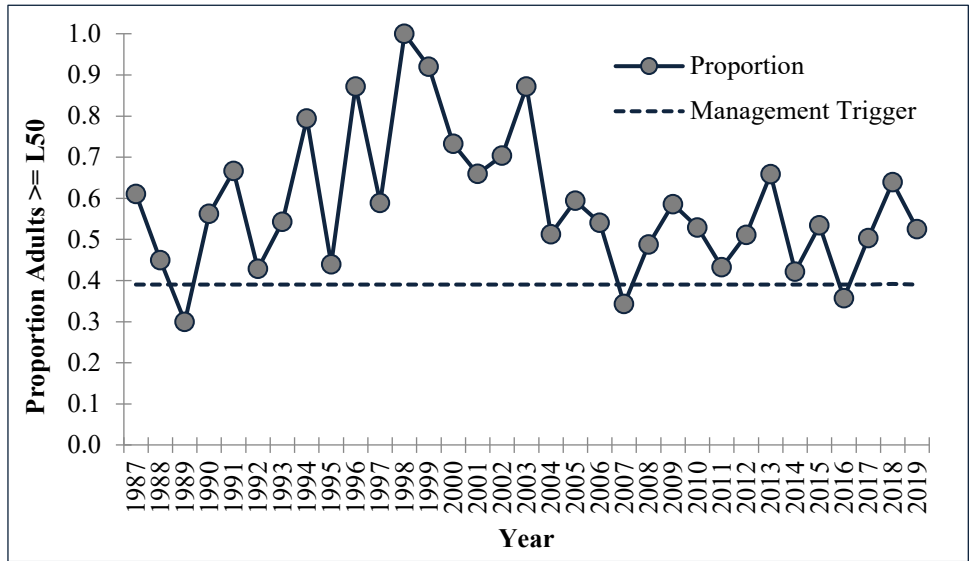


Figure 6. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the June component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 1987–2019. Dotted line represents 2/3 of the average of the time series.

STATE-MANAGED SPECIES – KINGFISHES

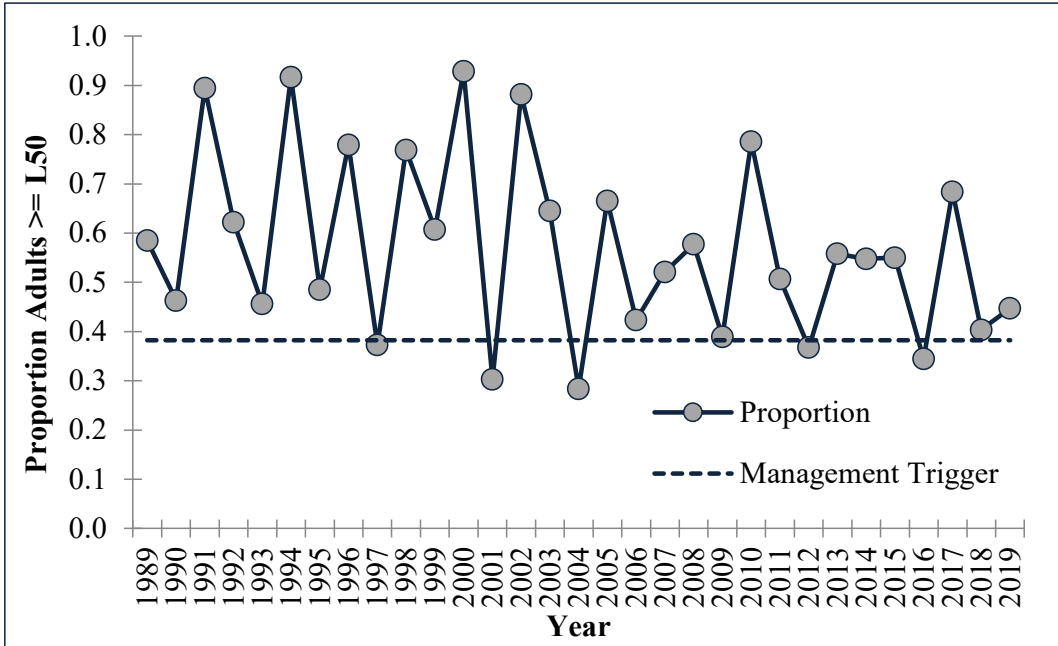


Figure 7. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the summer component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2019. Dotted line represents 2/3 of the average of the time series.

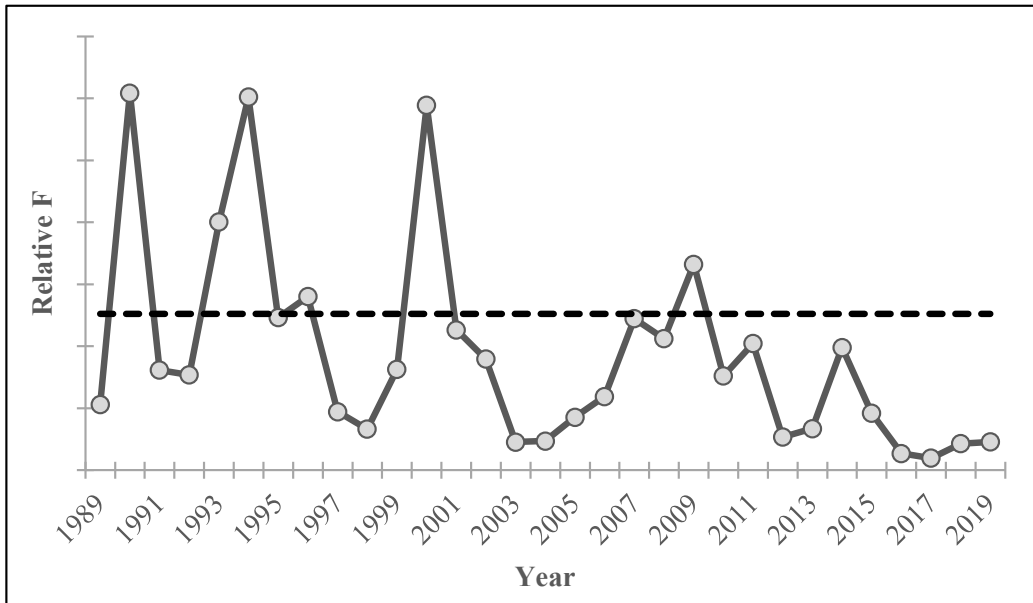


Figure 8. Relative F , as estimated as harvest (commercial and recreational) divided by the SEAMAP-SA Coastal Survey spring index (Onslow, Raleigh, and Long bays, inner—shallow—strata) of relative abundance, 1989–2019. Dotted line represents 2/3 of the average of the time series.

STATE-MANAGED SPECIES – KINGFISHES

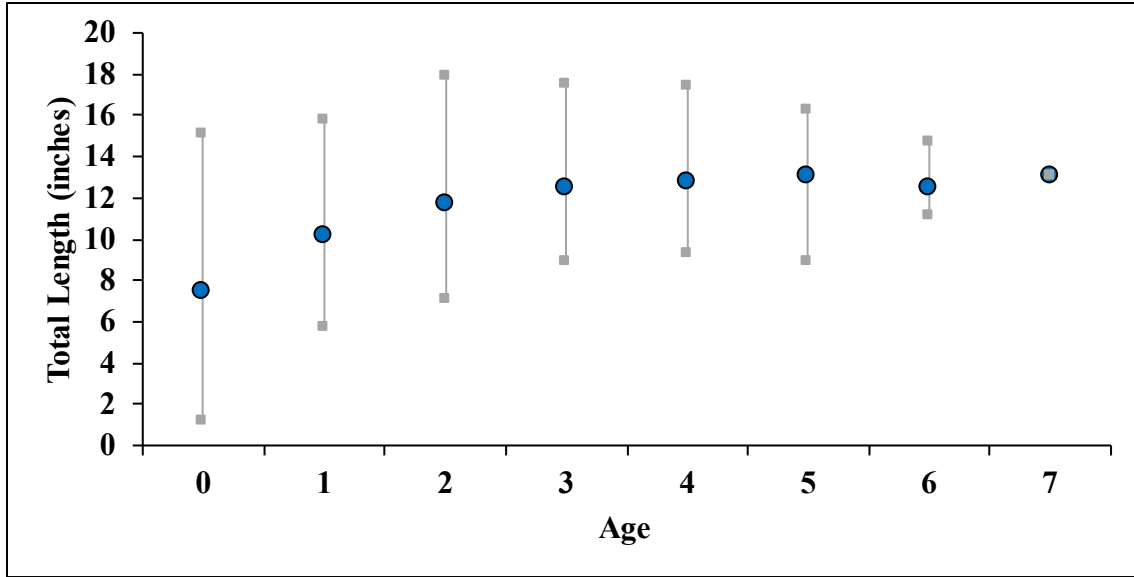


Figure 9. Kingfish total length at age based on all samples collected, 1997 - 2019. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed for each age.

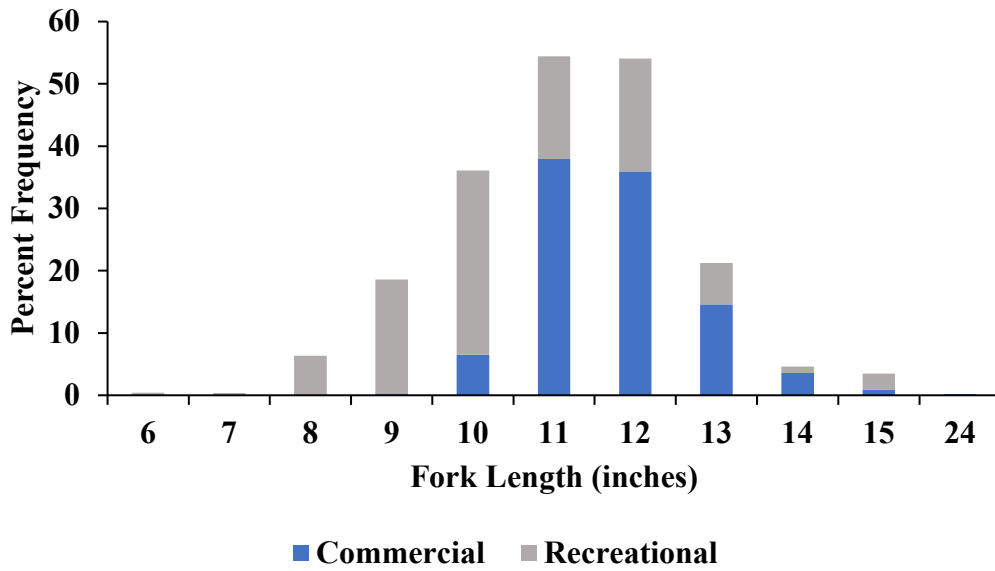


Figure 10. Commercial total length and recreational fork length frequency distribution of Kingfish harvested in 2019.

STATE-MANAGED SPECIES – KINGFISHES

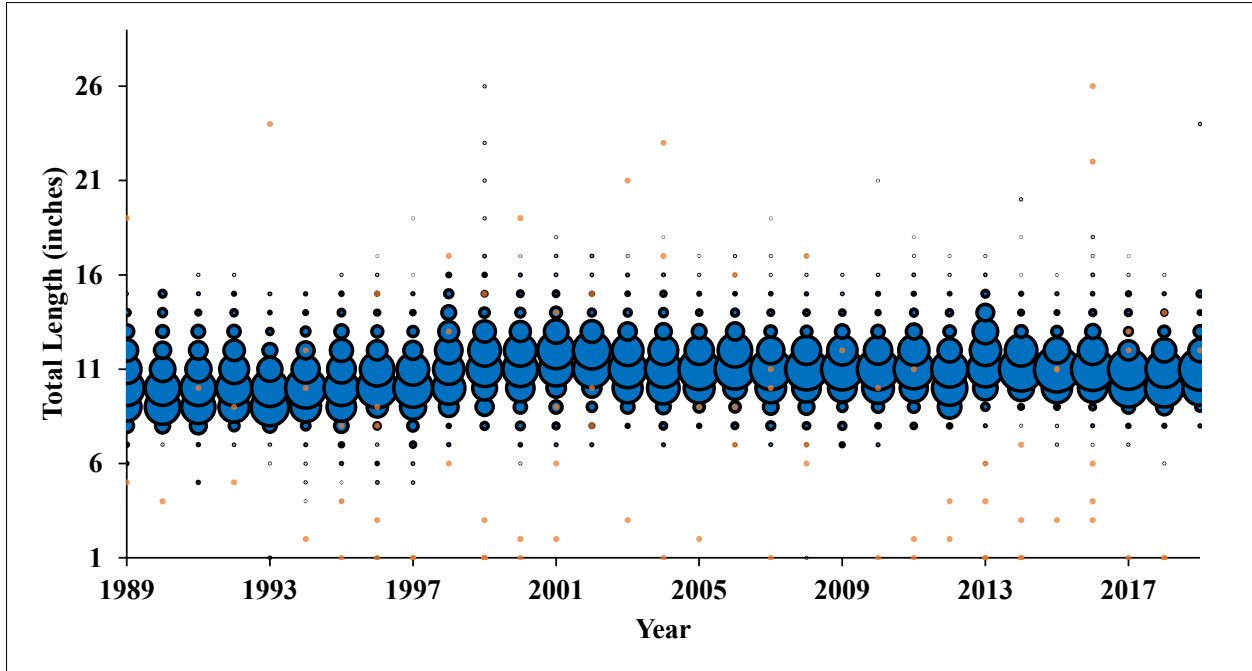


Figure 11. Commercial total length frequency of Kingfish harvested, 1989-2019. Bubble represents the proportion of fish at length.

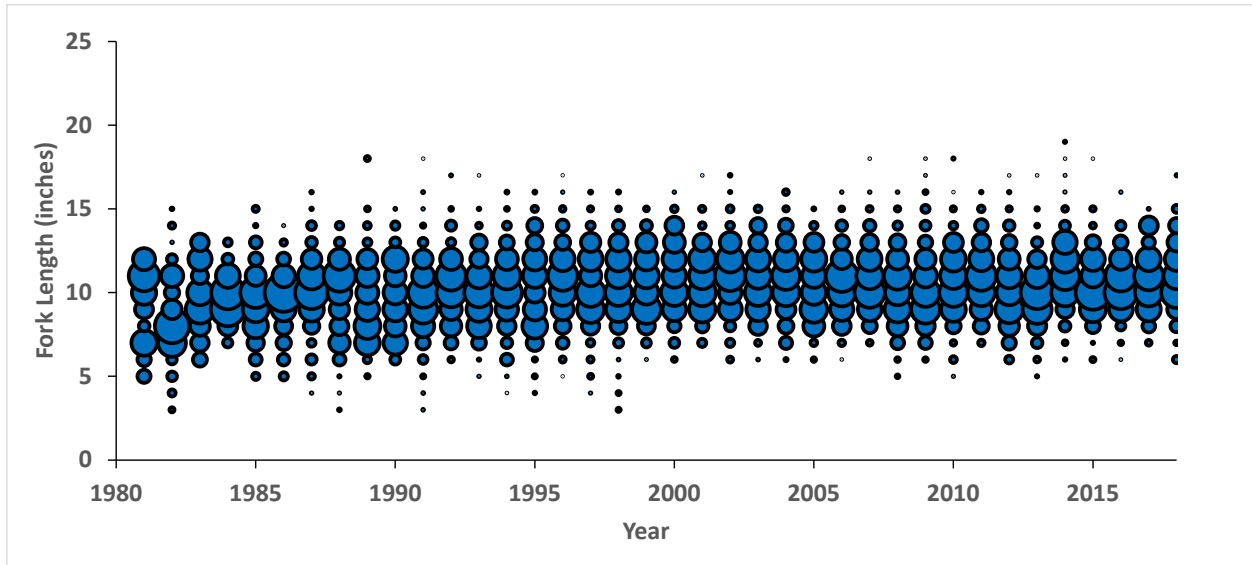


Figure 12. Recreational fork length frequency of Kingfish harvested, 1981-2019. Bubble represents the proportion of fish at length.