

Fishery Management Plans

August 2026 Quarterly Business Meeting

Documents

FMP Annual Update Report

Eastern Oyster Amendment 5
Update Memo

FMP Review Schedule

FMP Development Tracker

Kingfishes Stock Indicators Report



JOSH STEIN
Governor

D. REID WILSON
Secretary

KATHY B. RAWLS
Director

July 31, 2026

MEMORANDUM

TO: N.C. Marine Fisheries Commission

FROM: Charlton Godwin, Biologist Supervisor, Elizabeth City; Biological Review Team Chair (BRT)
Jeffrey Dobbs, FMP Coordinator
Daniel Zapf, FMP Coordinator

SUBJECT: 2025 Annual Fishery Management Plan Review

Authority and Process

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

Annually, the Division of Marine Fisheries (division) reviews all State, federal (Fishery Management Councils), and Atlantic States Marine Fisheries Commission (ASMFC) managed FMPs where North Carolina is directly involved. Stock conditions and management are monitored and reported through annual FMP Reviews. Any recommended changes to the annual State FMP Schedule are informed by this review process for the DEQ Secretary's consideration.

Status of State FMPs

Out of 13 State FMPs, the Southern Flounder, Kingfishes, and Red Drum plans are currently under review. In 2024, the DEQ Secretary approved the division request to delay review of the Blue Crab and Bay Scallop FMPs and the FMP for Interjurisdictional Fisheries by one year, as explained below. Recommendations for maintaining or changing the schedule are shown in italics.

Currently Under Review

Southern Flounder (under review): At the August 2024 Marine Fisheries Commission (MFC) business meeting, the MFC passed a motion "to ask the DMF Director to ask the DEQ Secretary to modify the FMP Review Schedule to amend the Southern Flounder FMP for the review of the plan to begin in 2024. The intent is to allow for more recreational access while maintaining the rebuilding requirements of [the Southern Flounder FMP] Amendment 3". The DEQ Secretary approved the schedule change in November 2024, which included development of a focused amendment (Amendment 4) to give the MFC the

opportunity to consider implementing the 50/50 sector allocation shift in 2025 instead of 2026 as prescribed in Amendment 3. Additionally, the Secretary approved concurrent development of a more comprehensive amendment (Amendment 5) to explore long-term solutions to the issue of recreational access while maintaining Amendment 3 rebuilding requirements. Additionally, the DEQ Secretary approved the division's request to broaden the scope of Amendment 5 to allow for consideration of a range of management options based on results of NC-specific quantitative analyses. Amendment 4 (the focused amendment) was adopted by the MFC in August 2025 and the 50/50 sector allocation shift was implemented for the 2025 recreational and commercial flounder seasons. Amendment 5 (the comprehensive amendment) is in development and is anticipated to be adopted in late 2027.

Kingfishes (under review): Management strategies continue to be maintained as outlined in the State FMP. Stock conditions are monitored via management triggers and reported through the annual FMP Review. The Kingfishes FMP prescribes that if two or more triggers are activated in two consecutive years then data will be evaluated further and the need for management changes will be considered. While three management triggers were activated for two consecutive years in 2023 and 2024, survey changes likely affected indices of Southern Kingfish relative abundance. Additionally, trigger analysis in 2025 indicated none of the triggers activated. Scheduled review of the plan began in 2025 and includes a comprehensive review of available data and reevaluation of management triggers.

Red Drum (under review): A benchmark stock assessment was completed by ASMFC in 2024 with data through fishing year 2021. Results indicate the northern Red Drum stock (which includes North Carolina) is not overfished and overfishing is not occurring. However, an increasing trend in fishing mortality associated with increased fishing effort in the Chesapeake Bay was noted as a concern. In response to stock assessment results, Addendum II to Amendment 2 was adopted by the ASMFC Sciaenid's Management Board in October 2025. For the northern stock, Addendum II provides consistent regulations across the Chesapeake Bay region, encompassing Maryland, the Potomac River Fisheries Commission, and Virginia. Addendum II does not require North Carolina to change current management. Scheduled review of the plan began in 2025 and includes an evaluation of stock assessment results, North Carolina fishery trends, and other available data.

Blue Crab (under review): Amendment 3 was adopted in February 2020 to address the overfished status and end overfishing, as indicated by the 2018 benchmark stock assessment. Following full implementation of Amendment 3 management measures in 2021, division monitoring programs continued to observe historically low commercial landings, coupled with continued low abundance of all Blue Crab life stages. An update to the 2018 stock assessment was completed in 2023, but concerns raised by external peer reviewers informed the division's decision to not approve the updated stock assessment for management purposes. In 2024, the DEQ Secretary approved the division request to delay the plan review one year to afford time to implement Amendment 3 adaptive management. To address continued stock declines, in 2025 the division developed a draft revision with management options to further address the requirements to end overfishing and achieve sustainable harvest, but the MFC did not vote on adoption of the revision. A benchmark stock assessment is underway with completion tentatively scheduled for late 2026. *No schedule change is recommended.*

Review Begins After 2026

Bay Scallop (review begins 2027 contingent on DEQ Secretary approval): After many years of low abundance, the Bay Scallop season was opened, consistent with requirements of the FMP, in specific regions in 2021, 2022, and 2023 at the lowest allowed harvest levels but was not opened in 2024 or 2025. In 2024, the DEQ Secretary approved the division request to delay the plan review one year to reduce overlap in ongoing plan reviews and upon identification of no immediate need for management changes. As a result, the next comprehensive plan review is scheduled to begin in 2026. *However, the division is*

requesting an additional one-year delay in the comprehensive review of the Bay Scallop FMP, such that the comprehensive review would begin in 2027. Doing so aligns review of the Bay Scallop FMP with the comprehensive review of the Shrimp FMP and development of an MFC rulemaking issue paper for protection of habitat within the MFC's authority, consistent with the N.C. Coastal Habitat Protection Plan (CHPP). The Bay Scallop FMP and the Shrimp FMP have historically addressed habitat issues, specifically protection of Submerged Aquatic Vegetation (SAV).

Shrimp FMP (review begins 2027): Amendment 2 was adopted by the MFC at its February 2022 business meeting to further reduce bycatch of non-target species and minimize ecosystem impacts, including adaptive management for future action to address issues related to SAV. The May 2024 Revision to Amendment 2 documents supporting data and the MFC's rationale for not taking further action to address SAV protection under the Shrimp FMP Amendment 2, instead directing the division to develop more comprehensive management options to protect SAV habitat from all activities under the authority of the MFC, consistent with the CHPP. The draft 2026 CHPP is expected to include a framework for development of MFC rules for protection of habitats, including SAV, which if adopted would begin in 2027 and align with the next comprehensive review of the Shrimp FMP and the Bay Scallop FMP. *No schedule change is recommended.*

Estuarine Striped Bass (review begins 2027): Amendment 2 was jointly developed with the Wildlife Resources Commission (WRC) and adopted by the MFC at its November 2022 business meeting. The 2022 Albemarle-Roanoke (A-R) stock assessment update indicated the stock continued to decline since the previous assessment and remains overfished with overfishing occurring. Based on stock assessment results, the January 2024 Revision to Amendment 2 implemented a harvest moratorium in the Albemarle Sound and Roanoke River Management Areas. No stock status is available for the three stocks that occur in the Central Southern Management Area; however, a population model indicates the stocks are depressed to a level where sustainability is unlikely. As prescribed in Amendment 2, in 2025 the division reviewed the Tar-Pamlico and Neuse rivers Striped Bass data through 2024 and determined the harvest and gill net closures were ineffective at increasing adult abundance, expanding the age structure, and promoting natural recruitment. The Striped Bass stocks in the Tar-Pamlico and Neuse rivers are currently not sustainable and factors other than fishing mortality and inadequate spawning stock abundance are preventing sustainability. The March 2026 Revision to Amendment 2 documents the adaptive management measures implemented to allow limited recreational and commercial Striped Bass harvest in the Tar-Pamlico and Neuse rivers in April 2026 with restrictions in place to focus harvest on stocked fish while providing protection of wild spawned A-R fish that use those systems. The next comprehensive plan review is scheduled to begin in 2027. *No schedule change is recommended.*

River Herring (review contingent on DEQ Secretary approval): The 2024 Atlantic coast-wide stock assessment update indicated River Herring remain depleted and at near historic lows coast-wide. River Herring in North Carolina are managed under three FMP's: two separate N.C. FMPs, Amendment 2 to the N.C. River Herring FMP and the N.C. FMP for Interjurisdictional Fisheries (IJ FMP), and the ASMFC Amendment 2 to the Interstate FMP for Shad and River Herring. The next comprehensive review of the N.C. River Herring FMP is scheduled to begin in 2027. *However, the division is requesting the DEQ Secretary approve transitioning River Herring management from Amendment 2 to the N.C. River Herring FMP exclusively to the N.C. IJ FMP, which adopts, by reference, FMPs approved by the ASMFC or federal councils (e.g., the ASMFC Amendment 2 to the Interstate FMP for Shad and River Herring). Transitioning management solely to the N.C. IJ FMP does not alter the current approach to River Herring management, nor the authority delegated to the MFC or further delegated to the division director to manage River Herring. Transitioning management creates efficiencies by removing redundancies between the ASMFC Interstate FMP and two separate N.C. FMPs. Additionally, any future plans to allow river herring harvest in N.C. must be developed through an ASMFC Sustainable Fishery Plan, (e.g. the NCDMF Sustainable Fishery Plan for American Shad) so the additional state FMP for River Herring is no longer needed. If the*

DEQ Secretary approves the division request to transition River Herring management, review of the River Herring FMP will no longer appear on the FMP Review Schedule.

Interjurisdictional Fisheries (review begins 2028): An Information Update to the N.C. FMP for Interjurisdictional Fisheries (IJ FMP) was adopted in May 2022. An information update incorporates changes in factual and background data since the last review of the plan and does not alter management strategies or management measures or introduce and address new management issues not previously included in the FMP. The goal of the IJ FMP is to adopt FMPs, consistent with N.C. law, approved by the ASMFC or federal councils 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. In 2024, the DEQ Secretary approved the division request to delay the plan review one year to reduce overlap in ongoing plan reviews. As a result, the next comprehensive plan review is scheduled to begin in 2028. *No schedule change is recommended.*

Striped Mullet (review begins 2029): Amendment 2 was adopted by the MFC at its May 2024 business meeting. The MFC adopted regulations intended to reduce Striped Mullet harvest with a goal of ending overfishing and rebuilding the stock. The regulations included commercial day of week harvest closures and recreational possession limits. Adaptive management allows for adjustment to season closures, day of week closures, trip limits, and gill net yardage and mesh size restrictions to ensure management targets are being met, based on results of stock assessment updates, concerning stock conditions, or fishery trends. While commercial landings remained high in 2025, fishery-independent indices also showed continued high abundance suggesting increased landings are related to increased stock abundance. In addition, the length and age structures of the population do not indicate cause for concern. The Amendment 2 adaptive management framework specifies the stock assessment be updated at least once between full reviews of the FMP. Until a stock assessment can be scheduled, the division plans to conduct further review and analysis of available Striped Mullet data to explore recent trends and stock characteristics. Results will be presented at a future MFC meeting. The next comprehensive plan review is scheduled to begin in 2029. *No schedule change is recommended.*

Spotted Seatrout (review begins 2030): Amendment 1 to the Spotted Seatrout FMP was adopted by the MFC in March 2025. The MFC adopted regulations intended to reduce Spotted Seatrout harvest and end overfishing of the stock, including commercial day of week harvest closures (that mirror Striped Mullet closures), a recreational slot limit, and a lower recreational bag limit. Adaptive management allows for adjustment to season closures, day of week closures, size limits, trip, bag or vessel limits, and gear restrictions to ensure management targets are being met. Amendment 1 also changed the adaptive management framework for cold stun events. In May 2026 the division presented information to the MFC about the effects of a cold stun that occurred in 2025 on the Spotted Seatrout stock and did not recommend any management changes. Information about the effects of the 2026 cold stun on the Spotted Seatrout stock is scheduled to be presented to the MFC in 2027. The Amendment 1 adaptive management framework specifies the stock assessment be updated at least once between full reviews of the plan to gauge success in maintaining sustainable harvest and to monitor changes in fishing mortality (F). Given current stock assessment priorities, an update to the Spotted Seatrout stock assessment will occur at the discretion of the division. The next comprehensive plan review is scheduled to begin in 2030. *No schedule change is recommended.*

Eastern Oyster and Hard Clam (review begins 2030): Amendment 5 to the Eastern Oyster FMP and Amendment 3 to the Hard Clam FMP were adopted by the MFC in May 2025. Previous FMP reviews have addressed issues unique to private aquaculture of oysters and clams on shellfish leases and franchises. The expansion of the aquaculture industry, recent management implemented by the MFC and division, and the minimal connection to wild stocks have eliminated the need to consider aquaculture in the FMPs. As a result, Amendment 5 to the Eastern Oyster FMP and Amendment 3 to the Hard Clam FMP focus solely on

management of N.C.'s wild oyster and clam stocks. Stock assessments have not been completed for these species due to data limitations; therefore, population size and rate of removals are unknown. Amendment 5 to the Eastern Oyster FMP balances the value of oysters as a fishery resource and essential habitat by implementing deep-water oyster recovery areas (DORAs), cultch supported harvest, and rotational harvest cultch sites. Amendment 3 to the Hard Clam FMP phases out the use of mechanical harvest methods by 2028. Both plans adopted a strategy for the division to further explore options to estimate recreational shellfish participation and landings, and to distribute Shellfish Sanitation and Recreational Water Quality health and safety information. The next comprehensive review of both plans is scheduled to begin in 2030. *No schedule changes are recommended.*



JOSH STEIN
Governor

D. REID WILSON
Secretary

KATHY B. RAWLS
Director

July 29, 2026

MEMORANDUM

TO: North Carolina Marine Fisheries Commission

FROM: McLean Seward, Oyster Co-Lead (Fisheries Science Section)
Bennett Paradis, Oyster Co-Lead (Habitat and Enhancement Section)

SUBJECT: Mechanical Oyster Fishery Participation Metrics and Adaptive Management in Amendment 5

Issue

Clarification of mechanical oyster fishery participation metrics in Amendment 5 of the Eastern Oyster FMP.

Action

No action is needed.

Background

Pursuant to the adaptive management framework in Amendment 5 of the Eastern Oyster Fishery Management Plan (FMP), participation in the mechanical oyster harvest fishery is monitored annually through the annual FMP Update. The three-year running average of participation is compared to the average participation observed from 2018–2023 and increases or decreases exceeding 25% of the 2018–2023 average trigger a review of oyster sampling data to determine whether adjustments to fixed season lengths should be considered. During preparation of the 2026 FMP Update, division staff identified an apparent data discrepancy within Amendment 5 regarding participation in the commercial fishery. Page 18 of Amendment 5 states that "in the last five years (2018–2023) there were 60 or fewer participants in the mechanical oyster fishery." However, the adaptive management threshold trigger example on page 75 of Amendment 5 used an average of 93 participants that landed oysters using mechanical gear between 2018 and 2023. Using this value, fewer than 70 or greater than 116 participants would trigger an examination of oyster sampling data and subsequently, a potential adjustment to fixed season lengths established for the Cultch Supported Harvest management strategy.

The actual average number of participants with landings in the mechanical oyster fishery from November 2018 through March 2023 was 46 participants. This value is consistent with page 18 of Amendment 5, which indicates participation remained at or below 60 participants during this period. As a result, the 93-participant baseline used in Amendment 5 warranted further review and

clarification. The existing trigger range of 70 to 116 participants was derived from a baseline of 93 participants with a $\pm 25\%$ threshold. However, applying a $\pm 25\%$ threshold to a baseline of 46 participants results in a trigger range of approximately 35 to 58 participants. Using the corrected baseline average of 46 participants, the three-year running average for November 2023 through March 2026 was 61 participants, approximately 33% greater than the 2018–2023 average, exceeding the existing 25% review threshold. However, participation during the Fall 2025–Spring 2026 season was 50 participants, 37% lower than the previous two seasons and comparable to the longer-term average observed from 2018–2026.

Given the discrepancy in the number of participants used to calculate the adaptive management threshold trigger, the division will correct the participation metric in Amendment 5 and publish the corrected document to the website following the Commission’s August 2026 business meeting. The thresholds will be re-evaluated during the next comprehensive review of the plan currently scheduled to begin in 2030. Additionally, the management measures adopted through Amendment 5 were first implemented during the Fall 2025–Spring 2026 season. Therefore, no changes to the fixed season lengths for the 2026–2027 mechanical harvest season will occur. The current fixed season lengths for the 2026–2027 mechanical harvest season will be maintained while additional years of data are collected under the Amendment 5 management framework, and the participation baseline is evaluated.

DRAFT FOR DEQ SECRETARIAL REVIEW

DRAFT N.C. FISHERY MANAGEMENT PLAN REVIEW SCHEDULE (July 2026–June 2031) Revised August 1, 2026					
SPECIES (Date of Last Action)	2026–2027	2027–2028	2028–2029	2029–2030	2030–2031
SOUTHERN FLOUNDER (8/25)					
RED DRUM (8/17)					
KINGFISHES (8/20)					
BLUE CRAB (5/23)					
BAY SCALLOP (8/20) ^					
SHRIMP (5/24)					
ESTUARINE STRIPED BASS (3/26)					
RIVER HERRING (8/22) =					
INTERJURISDICTIONAL (6/22) -					
STRIPED MULLET (5/24)					
SPOTTED SEATROUT (3/25)					
EASTERN OYSTER (5/25)					
HARD CLAM (5/25)					

- ^ In 2024 the DEQ Secretary approved the division request to delay the plan review one year to reduce overlap in ongoing plan reviews. **Schedule assumes a follow-up request to the DEQ Secretary is approved to delay one additional year whereby the plan review would begin in 2027. Doing so would align with the comprehensive review of the Shrimp FMP and MFC rule development for protection of habitat within the MFC's authority, consistent with the N.C. Coastal Habitat Protection Plan.**
- In 2024 the DEQ Secretary approved the division request to delay the plan review one year to reduce overlap in ongoing plan reviews.
- = The division will be requesting that the DEQ Secretary approve transitioning River Herring management from Amendment 2 to the N.C. River Herring FMP exclusively to the N.C. FMP for Interjurisdictional Fisheries, which adopts, by reference, FMPs approved by the ASMFC or federal councils (e.g., the ASMFC Amendment 2 to the Interstate FMP for Shad and River Herring). If the DEQ Secretary approves this request, the final FMP schedule will not include River Herring

This schedule assumes no rulemaking is required to implement plan amendments.

FMP Development Tracker - August 2026

Fishery Management Plans	Division forms Plan Development Team	Division discuss issues and Goals and Objectives	Hold Scoping Meetings and Scoping Period	Division drafts FMP	Hold FMP Advisory Committee Workshop	Division revises FMP	MFC Approve Draft FMP for Public Review	Public and Committee Review of Plan	MFC Select Preferred Management Options	MFC Final Adoption of FMP
Southern Flounder					TBD					
Red Drum			Oct 2026							
Kingfishes			Sept 2026							
Bay Scallop	Division requesting schedule change from DEQ Secretary									
Blue Crab	Opened July 1, 2026									

Legend

	Step Completed
	Step In-Progress
	Step Upcoming



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Review of North Carolina Kingfishes (Sea Mullet) Stock Complex Data

July 2026



Report Prepared by:

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Background

The 2007 North Carolina Kingfishes Fishery Management Plan (FMP) developed management strategies that ensure a long-term sustainable harvest for recreational and commercial fisheries in North Carolina (NCDMF 2007). 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 adopted a rule which included proclamation authority for the North Carolina Division of Marine Fisheries (NCDMF) Director 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 Kingfishes FMP in November 2015 (NCDMF 2015). An Information Update only incorporates changes in factual and background data that do not alter management strategies or management measures contained in the FMP and does not introduce or address new management issues. 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 the 2015 Information Update. The trend analysis incorporates management triggers to alert the NCDMF and NCMFC to the potential need for management action based on stock conditions. In 2020, the annual FMP Update served as the formal review of the Kingfishes FMP (NCDMF 2020).

The scheduled 5-year review of the Kingfishes FMP began in 2025. The Kingfishes FMP designated seven management triggers used to monitor the stock. The triggers are updated annually and if two triggers exceed or fall below established thresholds two years in a row (regardless of trigger category), further evaluation of available data will occur, and potential management will be considered. The analysis is updated each year and all trends relative to management triggers are provided as part of the annual FMP Review. Current management triggers based on Southern Kingfish use fishery-independent indices of relative abundance for young-of-year (YOY) and adult fish, the proportion of adults greater than size at 50% maturity (L_{50} , 8.25 inches), and a relative fishing mortality (F) index. Young-of-year fish includes new fish that enter the population that year. Relative fishing mortality is the rate of fish death associated with harvest as opposed to natural mortality factors, calculated by dividing total North Carolina recreational and commercial harvest by the SEAMAP Spring adult abundance index. In 2024, three management triggers exceeded or fell below established thresholds for two consecutive years, mandating further review of available data. As the prescribed data review aligns with the scheduled 5-year FMP review, the two processes are taking place concurrently.

Management Trigger Effectiveness

A description of triggers with notes about effectiveness is shown in Table 1. Internal surveys are conducted by NCDMF and include the Pamlico Sound Survey (P195) and the Independent Gill Net Survey (P915). The SEAMAP Coastal Trawl Survey (SEAMAP) is an external survey conducted by the South Carolina Department of Natural Resources (SCDNR). In summary, most management triggers were either set too conservatively, survey changes have limited effectiveness, or survey changes have eliminated the ability to use specific triggers moving forward.

P195 thresholds are set at 2/3 of the average of the base years 1987–2017, the P915 threshold is set at 2/3 of the average of the base years 2001–2017, SEAMAP thresholds are set at 2/3 of the average of the base years 1989–2017, and the relative F threshold is set at 1/3 of the average of the base years 1990–2017. Southern Kingfish is designated as the indicator species for the current management triggers. In 2023, SEAMAP changed from three sampling seasons: Spring (April–May), Summer (July–August), and Fall (late September–November) to two sampling seasons: Spring/Summer (April–June) and Summer/Fall (August–October).

The SEAMAP Fall young-of-year (YOY) trigger, the SEAMAP Summer adult trigger, and relative F all triggered in 2023 and 2024 (Table 2). The P195 September YOY index triggered in 2024 but did not trigger in 2023.

Table 1. Description of the seven management triggers from the Kingfishes FMP including notes about why triggers may no longer be effective to monitor the Kingfishes stock complex.

Internal Surveys (P195, P915)	External Survey (SEAMAP)
P195 June proportion of adults Program ended, triggers will no longer be informative	Spring abundance index used to calculate relative F Sampling can extend into June when abundance tends to be lower
P195 September juvenile index Program ended, triggers will no longer be informative	Summer adult index Sampling no longer occurs during the summer
P915 proportion of adults - Threshold is too conservative and will likely never trigger - Proportions are not informative without a sample size minimum	Summer proportion of adults Sampling no longer occurs during the summer
	Fall juvenile index Sampling no longer occurs in November, the month when abundance is highest

Proportion mature from P915 is a very conservative trigger. There are no bounds with this trigger including minimum sample size limitations. If one Kingfish is captured at a size greater than L_{50} , the proportion of mature adults would be 100%. The minimum threshold is set at 65% mature with the lowest value ever observed being 95%.

SEAMAP has undergone methodology changes which affect management triggers. In 2017, SEAMAP reduced the number of samples, and some regions are now sampled more than others. In addition, the survey design was changed in 2023 reorganizing sampling seasons from spring, summer, and fall to longer spring and fall seasons and eliminating the summer months. The spring season now extends into June and in recent years has only occurred in June.

Because of SEAMAP survey changes, the summer adult index is now calculated using only data from August. The change in SEAMAP sampling seasons has altered fall sampling to end in October, excluding November, which is the month Kingfish abundance in the survey is typically highest.

An updated analysis of current Kingfish triggers is included in the 2026 FMP Review report (NCDMF 2026). Updated trigger analysis indicates none of the seven triggers, including those calculated using SEAMAP data would have triggered in 2025 (Pamlico Sound Survey sampling did not occur in 2025). The updated analysis also indicates the SEAMAP summer adult index would not have triggered in 2022, 2023, or 2024. This discrepancy highlights the issue of using model-based indices in the trigger exercise in that inclusion of new data can change previous estimates.

Table 2. Kingfish management trigger values, 2015–2024. Shaded cells are values that fell below or above thresholds.

Year	Biological Monitoring			Fisheries-Independent Surveys			Other
	Proportion Adults $\geq L_{50}$			YOY Indices		Adult Index	
	P195 June	P195 Sept	SEAMAP Summer	P195 Sept	SEAMAP Fall	SEAMAP Summer	
2015	0.53	0.98	0.56	7.81	325.06	24.56	12,124
2016	0.36	0.95	0.34	1.88	28.45	22.01	3,790
2017	0.5	0.95	0.68	3.75	26.23	10.84	2,468
2018	0.64	1	0.4	5.39	6.6	11.99	5,765
2019	0.53	0.97	0.45	5.45	32.91	34.22	6,417
2020	*	*	*	*	*	*	*
2021	*	1	*	*	32.6	*	*
2022	0.79	1	0.77	4.43	35.58	8.95	15,256
2023	0.47	1	0.73	5.31	2.97	7.98	156,027
2024	0.73	0.98	0.75	1.6	1.3	1.5	1,009,650
Threshold	< 0.39	< 0.65	< 0.39	< 3.48	< 17.73	< 10.36	>40,723

* Sampling did not occur

Biological Profile

Three species of Kingfishes occur in North Carolina waters: Southern *Menticirrhus americanus*, Gulf *Menticirrhus littoralis*, and Northern *Menticirrhus saxatilis*. Kingfish refers to a single species, while Kingfishes refers to multiple species. 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. 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 (Welsh & Breder 1923; Hildebrand & Cable 1934; Bearden 1963; Clardy et al. 2014). Northern Kingfish is the most abundant Kingfish species from Massachusetts to North Carolina, with a range extending from the Gulf of Maine to Brazil (Welsh & Breder 1923; Bearden 1963). 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 (Welsh & Breder 1923; Braun & Fontoura 2004; Anderson et al. 2012). The Northern and Southern Kingfishes prefer mud or sand-mud bottom types while Gulf Kingfish prefer the sandy bottoms of the surf zone (Reid 1954; Bearden 1963; Crowe 1984; Chao 2002; Clardy et al. 2014; Collier 2017).

Spawning takes place in the ocean from April to October, and individuals will spawn multiple times throughout the season (Hildebrand & Cable 1934; McDowell & Robillard 2013; Clardy et al. 2014). Prior to the spawning season, Kingfishes move closer to shore and northward (Hildebrand & Cable 1934; Collier 2017). Following the spawning season and as water temperatures cool, Kingfishes move from estuarine and nearshore ocean waters to deeper offshore waters (Hildebrand & Cable 1934; Bearden 1963; Fritzsche & Crowe 1981; Lagarde 1981; Crowe 1984; Clardy et al. 2014). All Kingfishes have been noted to show rapid growth rates in the first few months of life and generally reach maturity by their second summer (Collier 2017). Using Southern Kingfish as a proxy, about 50% of Kingfish will reach maturity by 8.25 inches total length (L_{50} ; NCDMF 2020) while all should reach maturity by 10 inches total length (L_{100} ; NCDMF 2007). Kingfishes are sexually dimorphic with females growing larger than males. In North Carolina, Southern Kingfish up to 8 years of age have been observed, but Kingfish from ages 0 to 4 years are most common.

Stock Assessment

An attempt to complete a stock assessment during development of the 2007 FMP was not successful, primarily due to limited data. All assessment reviewers noted a lack of migration (mixing) data to determine the movement patterns of Kingfishes along the North Carolina coast 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, the Atlantic States Marine Fisheries Commission (ASMFC) South Atlantic Board met to consider regional management by reviewing data on Kingfishes. 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.

As part of the current data review, attempts were made to fit two stock assessment model frameworks to available data. First, the Stock Assessment Continuum (SAC) tool (Cope 2024) was used to fit a length-based statistical catch-at-age model in Stock Synthesis 3.0 (SS3) to commercial landings, Marine Recreational Information Program (MRIP) landings, fishery-dependent composition information, the P195 survey, the combined NEAMAP/SEAMAP survey indices of relative abundance, and the associated fishery-independent (FI) composition information. Second, JABBA-Select (Winker et al. 2018, 2020) was fit to total landings summed over sectors, and the two indices of relative abundance.

Both models were fit using a simple to complex approach. Using SS3, the model was fit using only commercial landings and composition information, then commercial landings and P195 data, then commercial landings and recreational landings, then commercial landings, recreational landings, and P195. Attempts were also made to fit the model to commercial landings, recreational landings, and the NEAMAP/SEAMAP combined index. For JABBA-Select, data used included commercial and recreational landings, P195, the NEAMAP/SEAMAP index, selectivity by fleet, and life history parameters. Neither model produced estimates or reference points that would be suitable for use in management.

While attempts to develop a stock assessment model for the Kingfishes stock complex were not successful, the process of reviewing data and attempting to fit stock assessment models was beneficial for identifying data needs and research recommendations. All models were sensitive to life history parameters, specifically growth. Kingfish growth is sexually dimorphic, and ideally sexes should be modeled separately with sex-specific composition, landings, and growth data, or with a sex ratio, sex specific growth models, and combined composition data.

The NCDMF does not currently conduct a sampling program to provide a fishery-independent index of abundance for the Kingfishes stock complex. Program 915 has very low Kingfish catch and does not sample areas considered to be Kingfish habitat. Program 195 samples a different size distribution than the commercial and recreational fisheries and selectivity from this program was difficult to model. In general, the mismatch between growth parameters and the size of fish caught in P195 caused issues with model fitting using SS3 (Jason Cope, Northwest Fisheries Science Center, personal communication). Pending replacement of P195 and/or an assessment model with an alternate growth sub-model, data from this survey is questionable for use in a future stock assessment.

NEAMAP and SEAMAP provide a better index for fitting SS3 models, but age composition data for Kingfish are not collected in these surveys, though length composition data from these surveys are still informative. If a stock assessment is pursued in the future, a statistical catch-at-age model capable of being fit to age and length composition data and using an alternate growth model is recommended.

The exploratory stock assessment work resulted in a prioritized list of research recommendations that should be addressed to complete a stock assessment.

Stock Assessment Priorities

- Fishery-independent sampling for catch-per-unit-effort (CPUE), sex-specific age and length data
 - Consider full range of SEAMAP

- Prioritize collection of immature Kingfish
- Movement data, migration timing, duration, distance (with intent of moving toward defining a relevant stock boundary for N.C.)
 - Better understanding of composition of species complex throughout the year
- Growth models
 - Biphasic – best model requires age and maturity to be estimated in a single model
 - Timing of spawning by species
- Commercial fishing: landings, sex-specific age and size composition, effort
- Relevant market effects of fishing

Data Review

To further investigate status of the Kingfishes stock complex recreational and commercial landings data, fishery-independent indices, and age and length composition data were explored. Data from several fishery-independent programs were explored including the Juvenile Anadromous Survey (P100), the Estuarine Trawl Survey (P120), the Red Drum Seine Survey (P123), and the Beaufort Ichthyoplankton Survey, all of which were ultimately not considered further because of very few Kingfish observations (Table 3). Programs including the Independent Gill-Net Survey (P915/P916), the Southeast Fishery Observer Program (SEFOP), and the Northeast Fishery Observer Program (NEFOP) were also explored but it was ultimately concluded these programs did not produce enough consistent Kingfish stock complex data to be informative.

Table 3. Fishery-independent and fishery-dependent sampling programs considered for analysis of the Kingfish stock complex but not included, with notes about reason for exclusion.

Program	Notes
<u>Fishery-Independent</u>	
Juvenile Anadromous (P100)	<1% of samples with Kingfish
Estuarine Trawl Survey (P120)	<1% of samples with Kingfish
Red Drum Seine Survey (P123)	<5% of samples with Kingfish; cannot standardize based on time
Beaufort Ichthyoplankton	10 Kingfish in 37 years
Independent Gill-Net Survey (P915/P916)	P915: ~10% of samples with Kingfish; catch is inconsistent, flat trend in catch rate P916: ~41% of samples with Kingfish; but program discontinued in 2015
<u>Fishery-Dependent</u>	
Estuarine Gill-Net Observer Program (P466)	~14% of samples with Kingfish; not a priority species for program because rarely discarded
Shrimp Trawl Observer Program (P570)	4,187 lengths, but limited spatially and temporally
Southeast Fishery Observer Program (SEFOP)	92% of samples with Kingfish; primarily provides discard data
Northeast Fishery Observer Program (NEFOP)	~30% of samples with Kingfish; primarily provides discard data; did not provide unique information

The following fishery-independent surveys were identified as potentially providing useful Kingfish stock complex information: the Pamlico Sound Survey (P195), the Northeast Area Monitoring and Assessment Program (NEAMAP), and the Southeast Area Monitoring and Assessment Program (SEAMAP). Various fish house sampling programs, MRIP, N.C. Trip Ticket, and Comprehensive Life History Sampling (P930) were also identified as potentially providing useful Kingfish information.

Index Standardization and Weighted Quantile Analysis

Methods

Data from P195, SEAMAP, and NEAMAP were identified for further evaluation. For P195, years modeled included 1987–2024 and CPUE was calculated as number caught divided by tow duration in minutes (number caught/minute trawled). Units for CPUE are selected such that data could be combined in the index standardization modelling. The years modeled for SEAMAP were 1989–2024 and 2007–2024 for NEAMAP. Both NEAMAP and SEAMAP data were limited to samples collected in North Carolina waters. Samples from both programs record counts and area swept, and CPUE was calculated as number caught divided by area swept in hectares (number caught/hectare). Samples with missing latitude and longitude from any survey were excluded, and samples with incorrect coordinates were visually identified by plotting and removed from subsequent analyses.

Modelling Approach

Models were built and fit using the sdmTMB package (Anderson et al. 2025) in R (R Core Team 2025). This modeling framework allows for the combination of multiple surveys (Thompson et al. 2022), and standardization to generate an index of relative abundance (Freshwater et al. 2024). The spatiotemporal modeling framework assumes that CPUE is spatially autocorrelated, allowing estimation of a surface that represents spatial variation in CPUE. Models successfully converged if the Hessian matrix was positive definite and the maximum gradient of the likelihood estimation was less than 0.0001. For reference, these spatiotemporal models are essentially delta-generalized linear mixed model (GLMMs) that model random effects as Gaussian Markov Random Fields (GMRFs).

Model Configuration

The index models (P195 and combined NEAMAP/SEAMAP) were fit as sex aggregated with an annual timestep. Year was modeled as a fixed effect, while spatial and spatiotemporal variation were modeled as independent and identically distributed (IID) random effects. The fit of each model was evaluated with DHARMA residuals using the sdmTMB package in R (Anderson et al. 2025). Delta/hurdle model configurations were fit for both indices, but the combined index did not converge. The Tweedie distribution provided a better fit for both indices after evaluating residual diagnostics. Delta models consist of two linear predictors, one for positive encounters and one for positive catches. Both the delta model and Tweedie distribution are approaches meant to handle zero-inflated data and recent research suggests the Tweedie distribution can be sufficient over delta models (Zheng et al. 2023). In general, the delta model and Tweedie distribution are more common in spatiotemporal index standardization than other distributions such as the negative binomial.

Weighted Quantile Analysis

The weighted length quantiles track the size distribution of the fish caught in the respective program over time: this can be a useful exercise to determine the effect of fishing on the size distribution of the population. Trends in size of catch provide a valuable indicator of the health of the stock as declines and condensing of

length quantiles indicate smaller fish are available, likely as a function of fishing. Conversely, larger and expanding length quantiles indicate larger fish are available. Differences in sample sizes across length bins are controlled in the weighting to create more robust estimates of the length quantiles. For an in-depth explanation, see Akinshin (2023). The weighted quantile method was implemented with the cNORM package (Lenhard et al. 2018) in R (R Core Team 2025). Length composition data were taken from the following sampling programs, P195, NEAMAP, SEAMAP, MRIP, and commercial fish house sampling programs. For MRIP, only observed lengths were used and imputed lengths were excluded. All programs were evaluated individually except for NEAMAP and SEAMAP, which were combined to match the index model for these two sources. Weighted quantiles were also calculated for NEAMAP and SEAMAP individually to explain the effect of more recent data on estimates of earlier quantiles. Similar analyses were conducted for age compositions from commercial and recreational fisheries and P195. Kingfish ages are not available from the NEAMAP or SEAMAP surveys.

Recreational Fishery

Most Kingfish harvested recreationally come from fishing structures like piers, jetties, or bridges, but also from surf fishing (Figure 1). A smaller number are captured from vessels in estuarine waters. Harvest was generally low early in the time series but has been increasing since the early 2000s (Figure 2). Recently, the recreational fishery has harvested around two million pounds per year with around six million pounds harvested in 2021 and over three million pounds harvested in 2022.

Pounds of Kingfish harvested in 2021 is noticeably higher than in any other year. MRIP estimates are the summed product of angler's landing and fishing effort estimates, meaning high estimates could be products of a large number of interviews, an average number of interviews with large numbers of fish captured, high fishing effort estimates or interactions of any of the previously listed reasons. The high estimates in 2021 were linked back to interviews conducted by a single interviewer on Veterans Day 2021. The interviewer recorded 15 interviews with high landings documented as well as high effort, and when estimates were expanded this led to pronounced Kingfish harvest estimates, greatly inflating estimates for 2021 as a whole. These estimates were also from interviews where the interviewer was not granted access to the fish, meaning the high numbers documented could not be visually confirmed. Removal of these fifteen interviews brings the 2021 estimates back to a peak more consistent with other successful fishing years like 2014 (Figure 3). Evaluation of Kingfishes harvest data found that the circumstances leading to the high harvest estimate in 2021 were highly unusual. Similar situations will continue to be evaluated on a case-by-case basis. Discards of Kingfishes exhibited a pattern similar to harvest, with relatively higher estimates occurring in 2009, 2010, 2013, and 2014 (Figure 4).

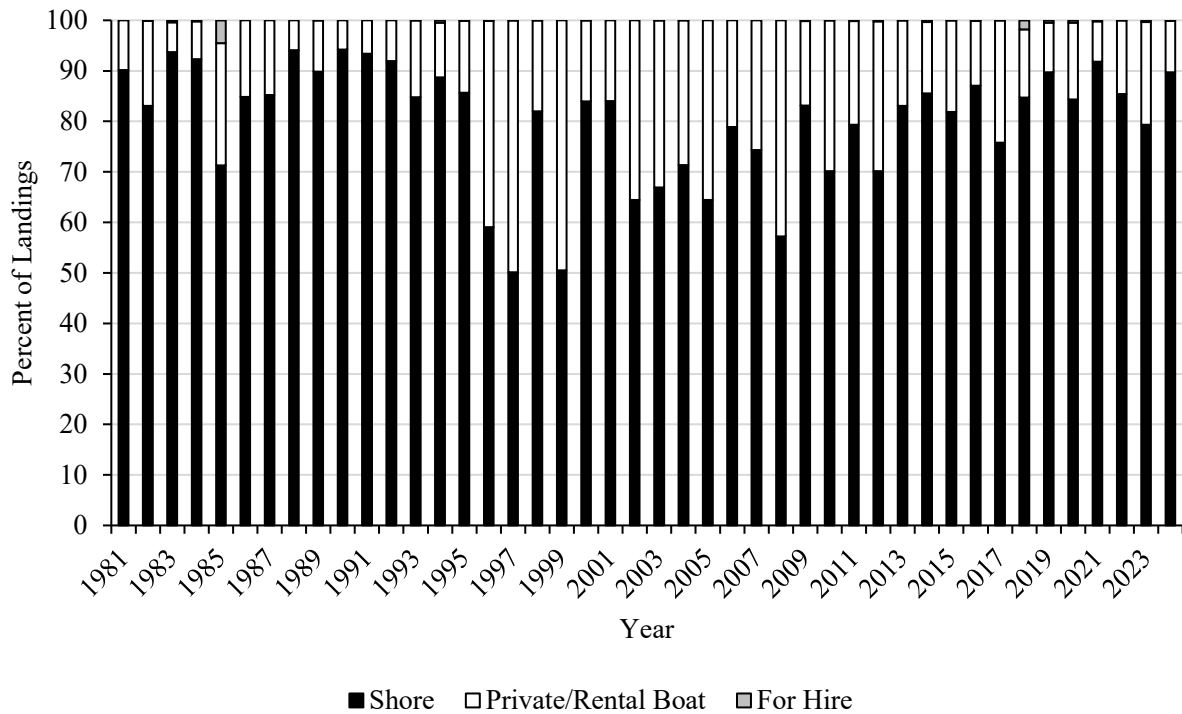


Figure 1. North Carolina Kingfishes stock complex recreational harvest by year and percent landings by fishing mode, 1981- 2024.

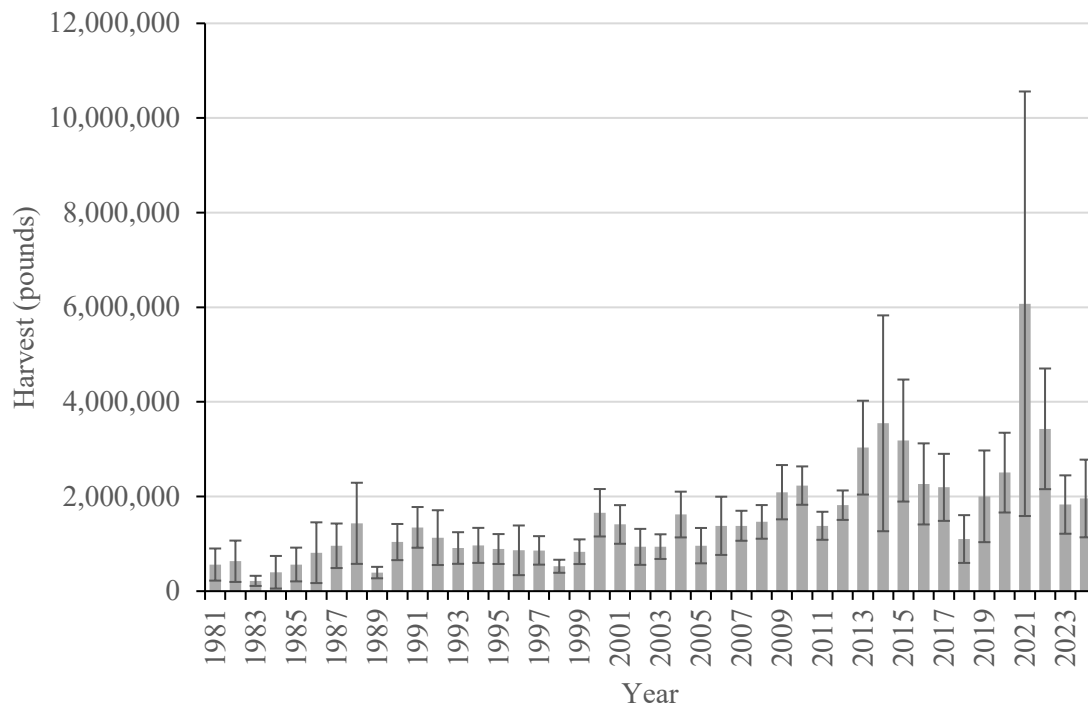


Figure 2. North Carolina Kingfishes stock complex total recreational harvest by year, 1981–2024. The lines through each bar indicate the 95% confidence interval for the harvest estimate.

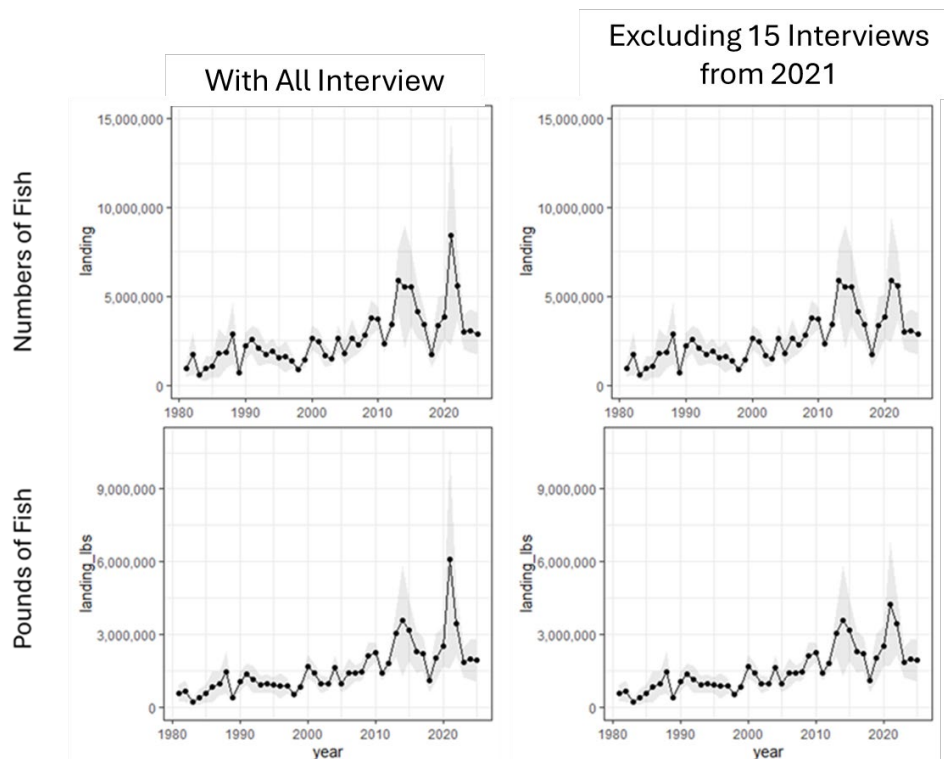


Figure 3. Marine Recreational Information Program estimates of numbers of fish and pounds of fish harvested showing data with and without the fifteen interviews with high Kingfish harvest from 2021. The shaded area represents the 95% confidence intervals around the value.

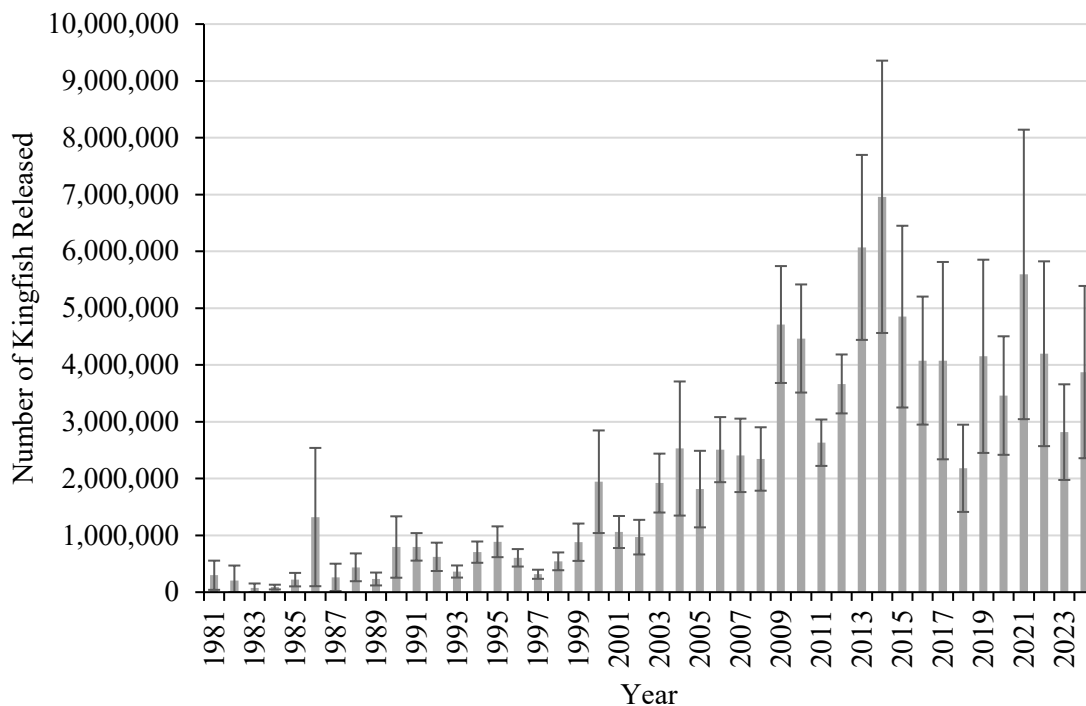


Figure 4. North Carolina Kingfishes stock complex total recreational discards by year, 1981-2024. The lines through each bar indicate the 95% confidence interval for the discard estimate.

Recreational length composition is consistent throughout the time series from 1994 through 2024 (Figure 5). Overall, the 50th and 75th quantiles are lower than the commercial fishery, and the 75th quantile in the recreational fishery is comparable to the 50th quantile in the commercial fishery (Figure 10). This means smaller fish are captured in the recreational fishery than in the commercial fishery. Recreational age composition shows an increasing trend throughout the time series from 1994 to 2024, indicating more older fish were sampled over time (Figure 6). Overall, the 50th and 75th quantiles for ages follow the same generally increasing trend as the commercial fishery (Figure 11).

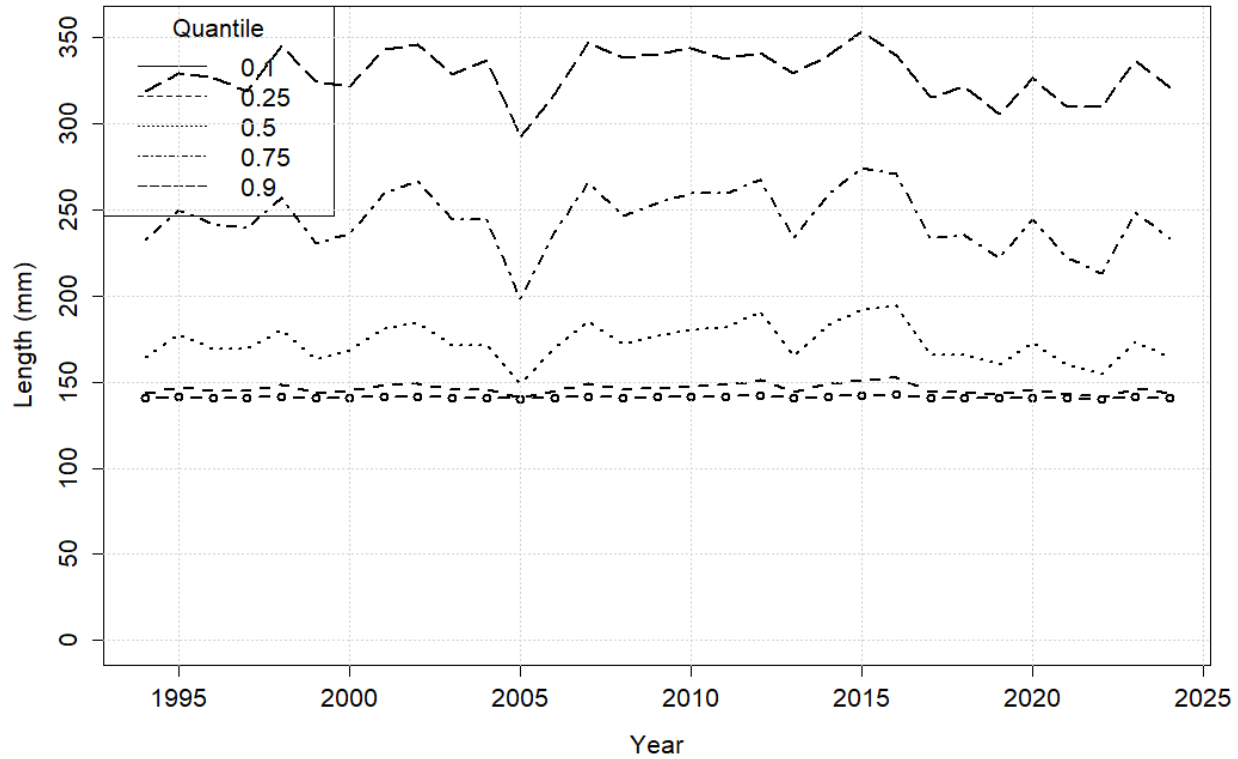


Figure 5. Recreational weighted length quantiles (mm) for the Kingfishes stock complex from the Marine Recreational Information Program, 1994–2024.

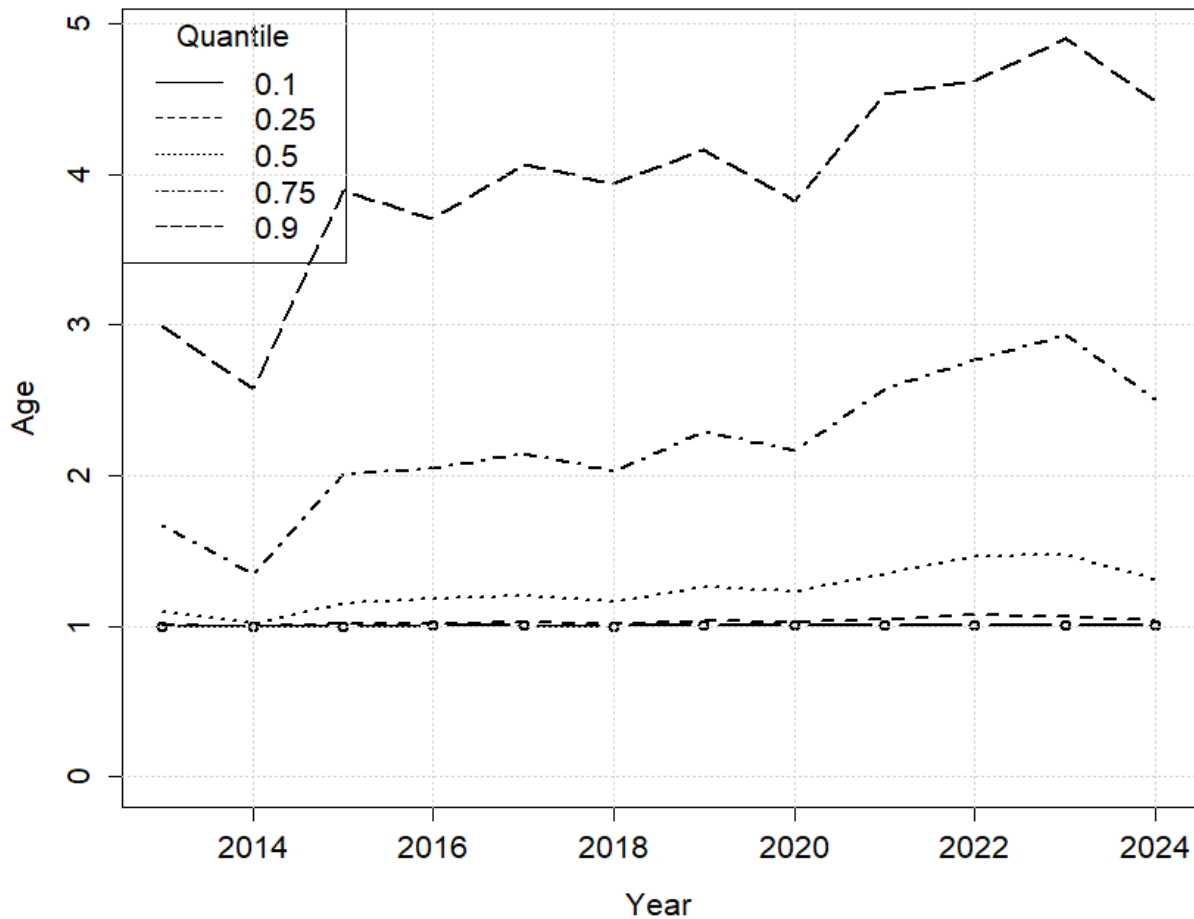


Figure 6. Quantile analysis for ages of the Kingfishes stock complex from the recreational hook-and-line fishery, 2013–2024 (ages from 2005–2012 currently unavailable).

Trends in recreational harvest were also examined by fishing mode (e.g., charter boat, head boat, private/rental boat, and shore; Figure 1). Of the charter boat interviews conducted through the Access Point Angler Intercept Survey (APAIS), only 0.3% have intercepted Kingfish, while 9% of interviews of shore-based fishermen intercept Kingfish.

Commercial Fishery

Commercial landings ranged from roughly 200,000 to 1.2 million pounds from 1981 through 2024 but recently have been around 600,000 to 800,000 pounds (Figure 7). This trend has occurred alongside long-term declines in both the number of commercial trips catching Kingfishes (Figure 8) and the number of commercial participants on those trips (Figure 9).

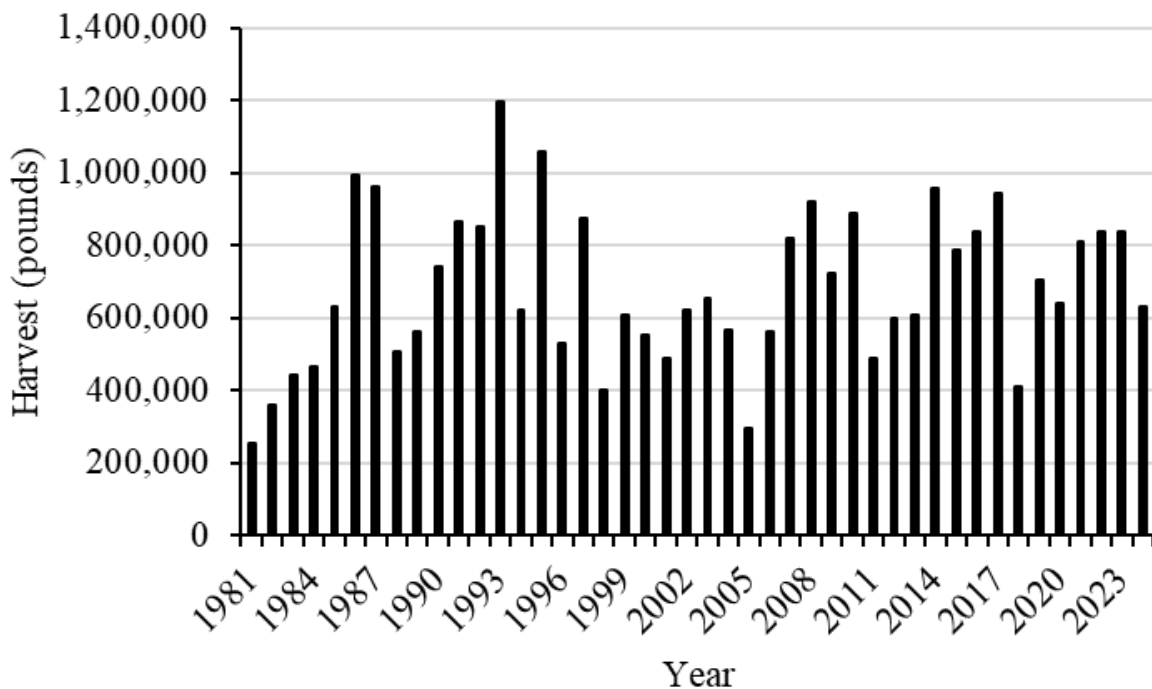


Figure 7. North Carolina commercial Kingfishes stock complex harvest (pounds) by year, 1981–2024.

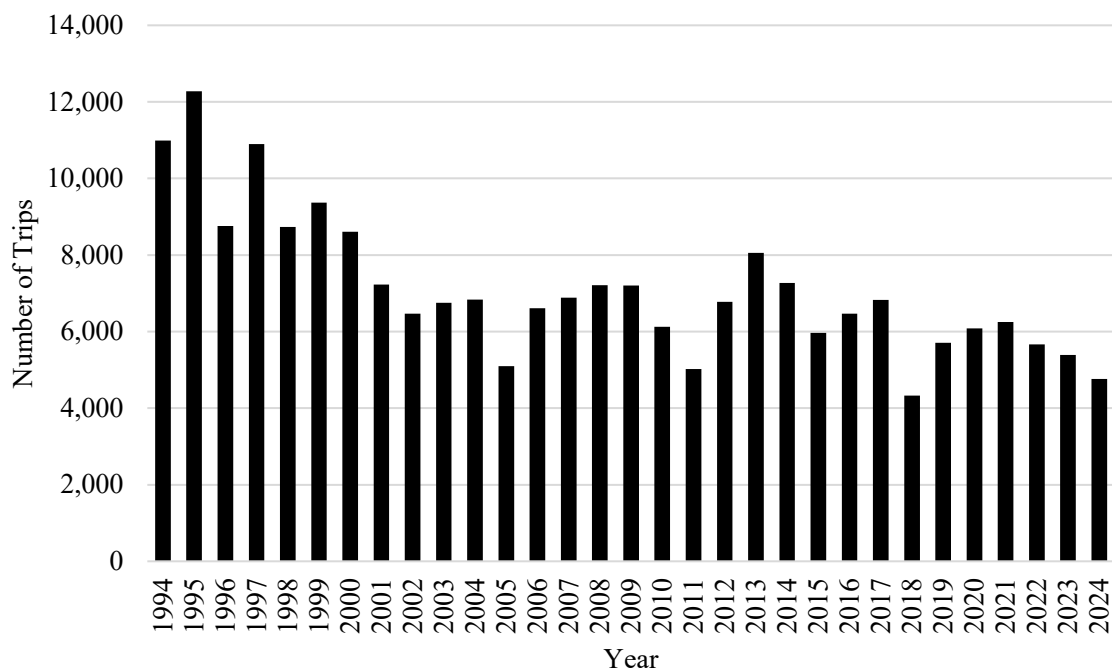


Figure 8. North Carolina commercial trips that caught Kingfishes by year, 1994-2024.

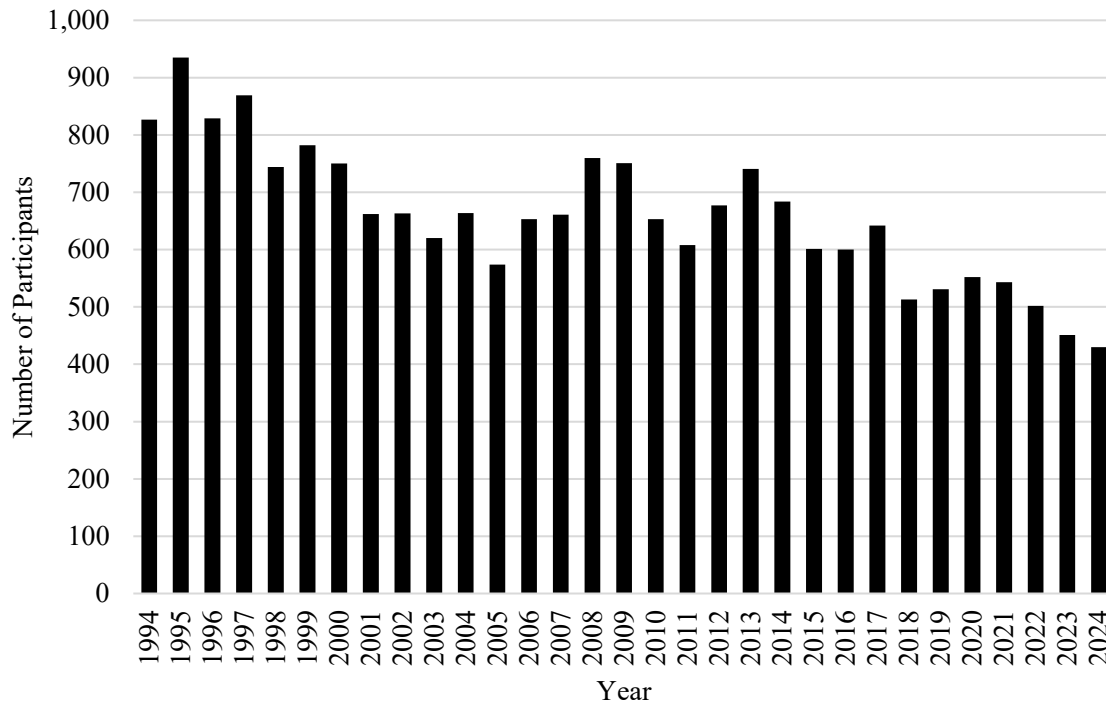


Figure 9. North Carolina commercial participants that caught Kingfishes by year, 1994-2024.

Most commercial landings occur south of Cape Hatteras in near-shore (less than three miles) ocean waters. Kingfish are predominantly landed in the spring and fall corresponding with seasonal inshore and offshore movement.

Commercial length composition is stable overall with recent quantiles comparable to the earlier part of the time series (Figure 10). Commercial catch from the early 2000s to 2015 was characterized by consistently larger Kingfish across all length quantiles. Age quantiles were stable from 2014 to 2020 and began increasing in 2020 (Figure 11) while length composition remained stable. This indicates Kingfish of similar sizes are older in recent years. Although age quantiles declined in 2015 and 2020, these short-term decreases are likely the result of limited sample sizes and do not appear to represent a meaningful change in the population.

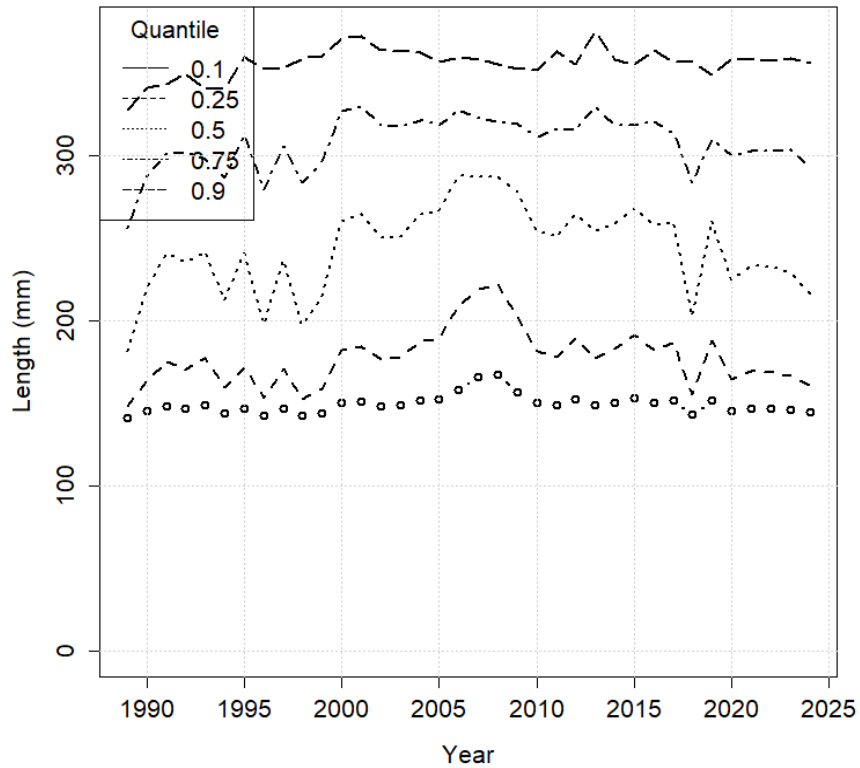


Figure 10. Commercial weighted length (mm) quantiles for the Kingfishes stock complex from commercial fish house sampling programs, 1989–2024.

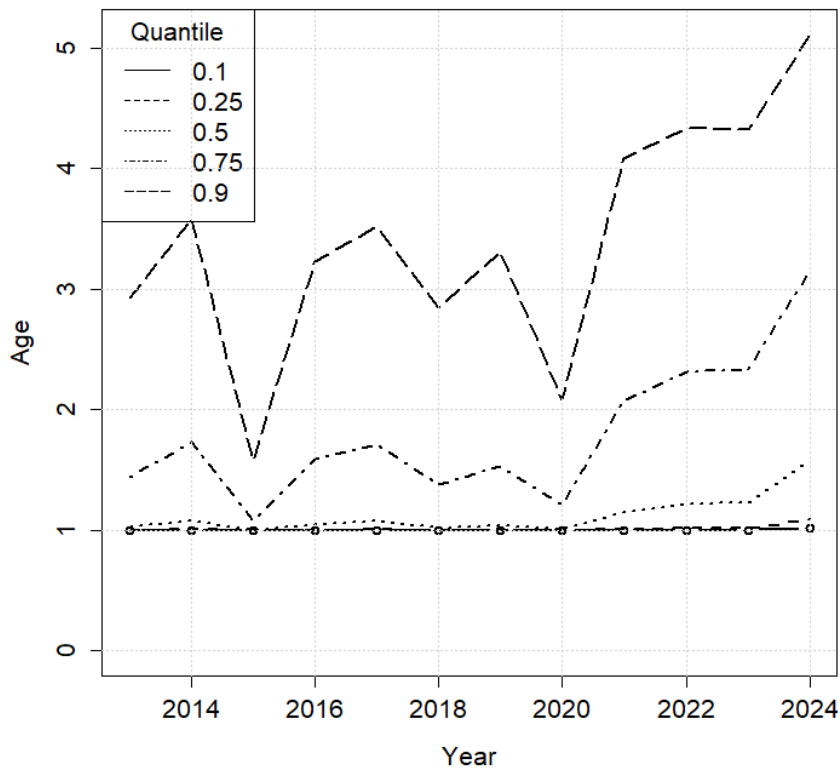


Figure 11. Quantile analysis for the Kingfishes stock complex ages from the commercial fishery, 2013–2024 (ages from 2005–2012 currently unavailable).

Pamlico Sound Survey (P195)

For the index fit, the best model used year as a fixed effect and used spatial random effects. The spatiotemporal random effects implicitly model environmental covariates, which themselves are correlated across space and time. Spatially, Pamlico Sound drove most of the Kingfish catch while the Neuse, Pamlico, and Pungo rivers had minimal catch (Figure 12). From 1987 to 2005, the index of relative abundance showed a slight increase, then a large jump in 2006 followed by a slight decline from 2006 to 2024 (Figure 13). The index in 2024 is comparable to peaks in the index in the 1987–2005 temporal window.

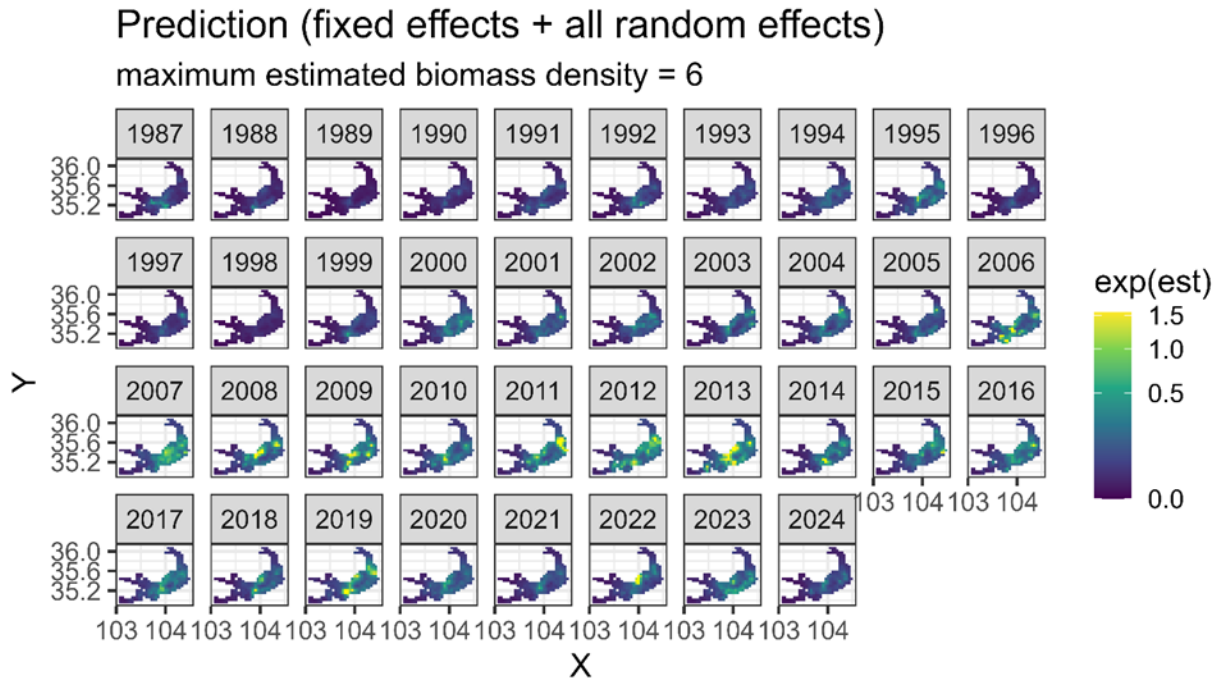


Figure 12. Map of the annual spatial variation of estimated relative density in numbers per minute for Pamlico Sound for the P195 index model, 1987–2024.

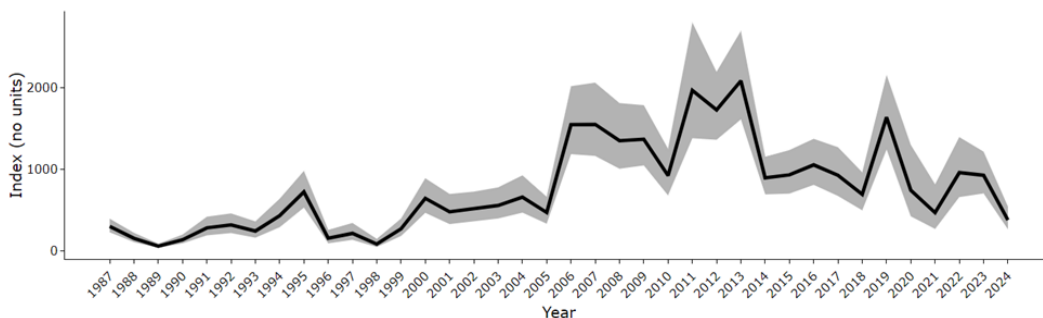


Figure 13. Index of Kingfishes stock complex relative abundance in Pamlico Sound from P195, 1987–2024. The shaded area represents the 95% confidence interval around the value.

From 1987 to 2002, the quantiles for Kingfish length composition declined steadily despite a slight increase in the index of abundance through that time (Figure 14). Therefore, while abundance was increasing, the catch consisted of smaller individuals. Length composition quantiles for Kingfish then increased and

expanded from the early 2000s through 2020. The expansion in length composition matches the heightened level of the index through that same temporal window. The slight dip in the index from 2020 to 2024 coincides with a level period in the terminal years of the length composition data. Thus, while overall abundance was decreasing the size structure was not impacted. The weighted age quantiles follow a similar pattern to the length quantiles, though ages are only available from 2013 to 2024 (Figure 15).

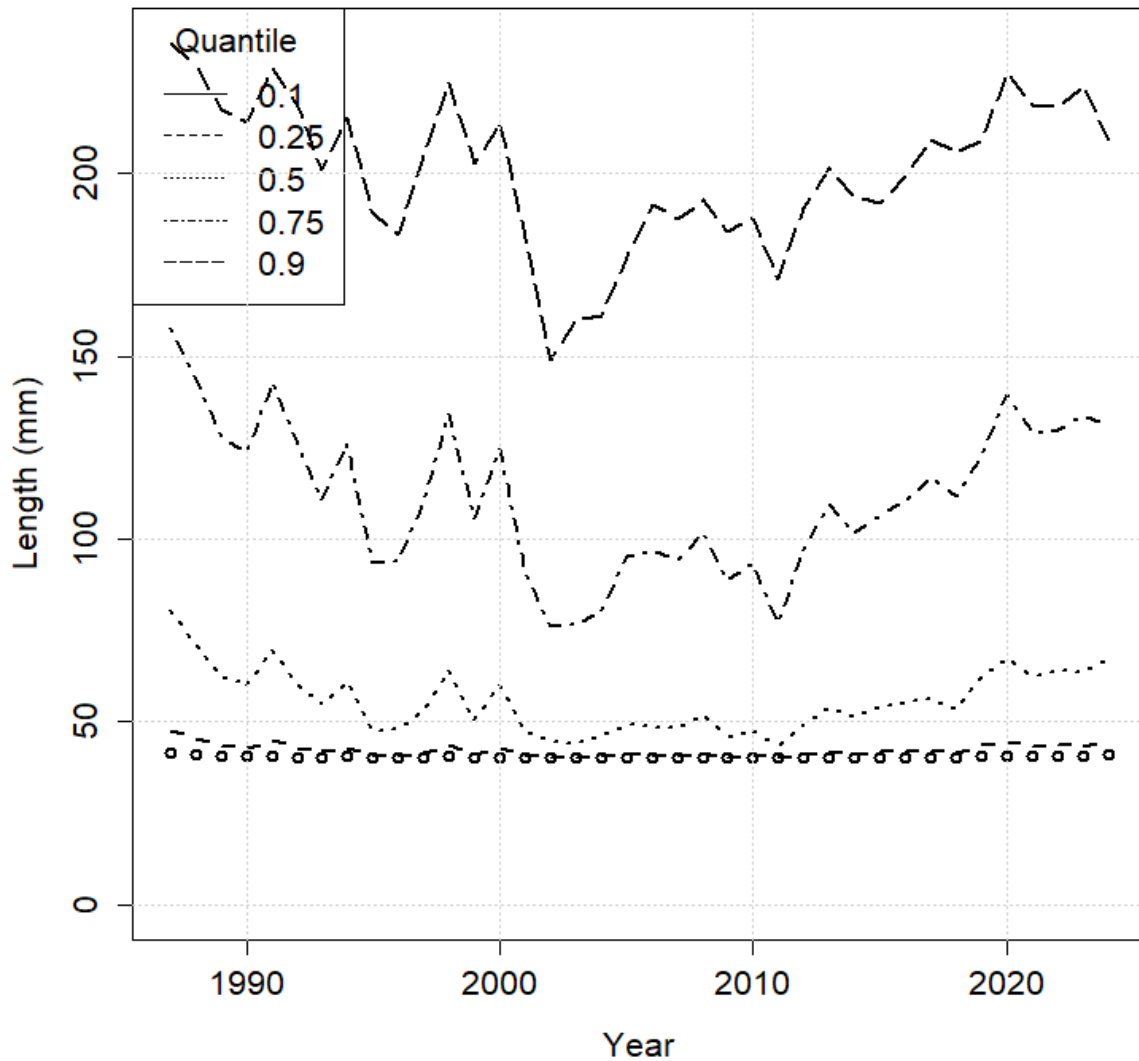


Figure 14. Weighted length (in mm) quantiles for the Kingfishes stock complex caught in P195 sampling, 1987–2024.

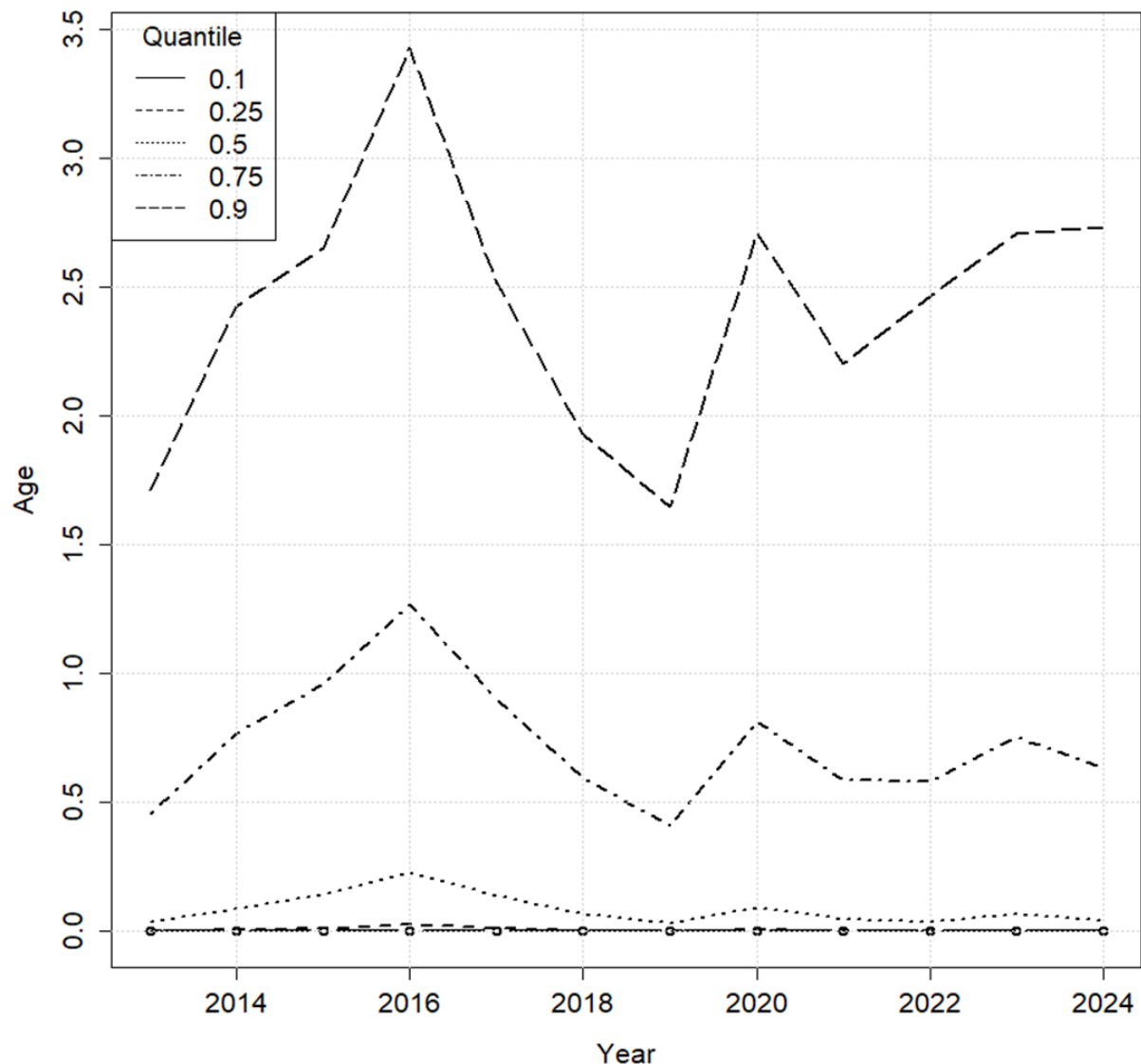


Figure 15. Quantile analysis for the Kingfishes stock complex ages caught in P195 sampling, 2013–2024 (ages from 2005–2012 currently unavailable).

NEAMAP/SEAMAP

The sampling conducted by NEAMAP and SEAMAP caught large numbers and large Kingfish that are similar in size to those caught in the commercial and recreational fisheries. NEAMAP/SEAMAP generally catches larger Kingfish than P195. The best fitting model used year and survey as fixed effects with the SEAMAP survey set as the reference level factor.

Geographically, areas of greater abundance for Kingfishes were concentrated between Hatteras Island and Bald Head Island (Figure 16). The combined index was relatively stable throughout the time series, with abundance peaks from 2003 to 2005, 2010, 2012, and 2015 to 2017 (Figure 17). The terminal year, 2024, was the lowest estimated value of the index (but not significantly so, upper bound overlaps with lower bound in several other years). Given the size selection and spatial coverage of NEAMAP/SEAMAP vs. P195, it is reasonable to connect the pulses of abundance from P195 from 2011 to 2013 to the 2015 to 2017 spike in the combined index.

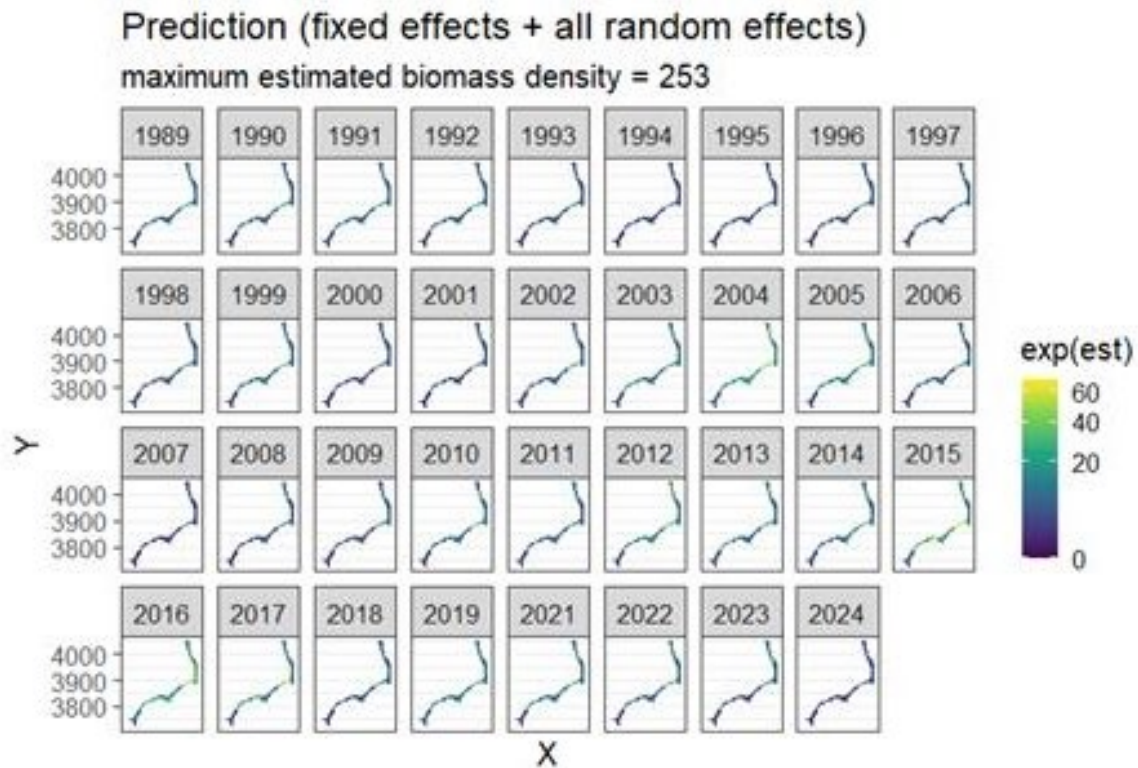


Figure 16. Map of the annual spatial variation of estimated relative density in numbers per hectare off the coast of North Carolina for the combined NEAMAP/SEAMAP index model, 1989–2024.

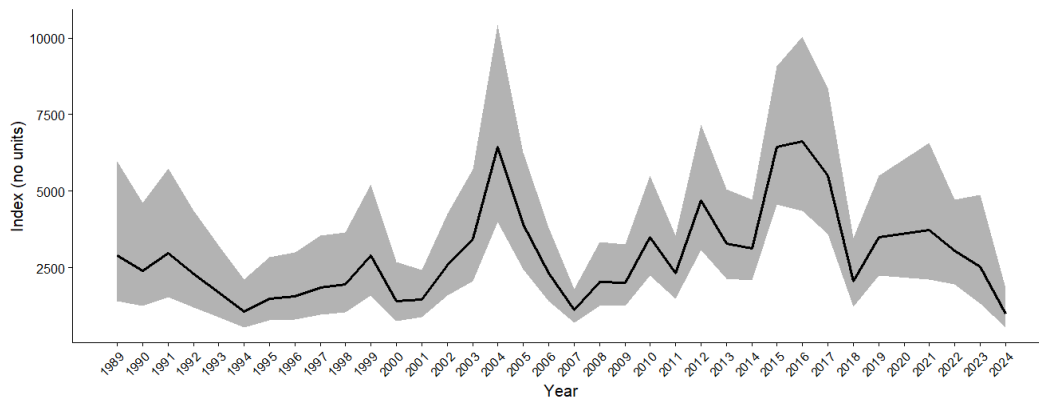


Figure 17. Index of relative abundance of the Kingfishes stock complex off the coast of North Carolina for the combined NEAMAP/SEAMAP index, 1989–2024. The dip in 2007 was likely caused by the addition of the NEAMAP survey which started that year. The shaded area represents the 95% confidence interval around the value.

Quantiles from the combined length composition data for NEAMAP and SEAMAP were stable through most of the time series (Figure 18). NEAMAP sampling started in 2007, driving the dip in observed quantiles. The 25th, 50th, and 75th quantiles generally increased from 2012 to 2020, and then dipped slightly from 2020 to 2024 but remain comparable to the early 1990s through early 2000s period. When these two data streams are combined, the weighting method emphasizes the most recent years of data, thus the effect of combining these two data streams creates the dip in 2007 and attempts to adjust earlier years in the time series using the most recent data.

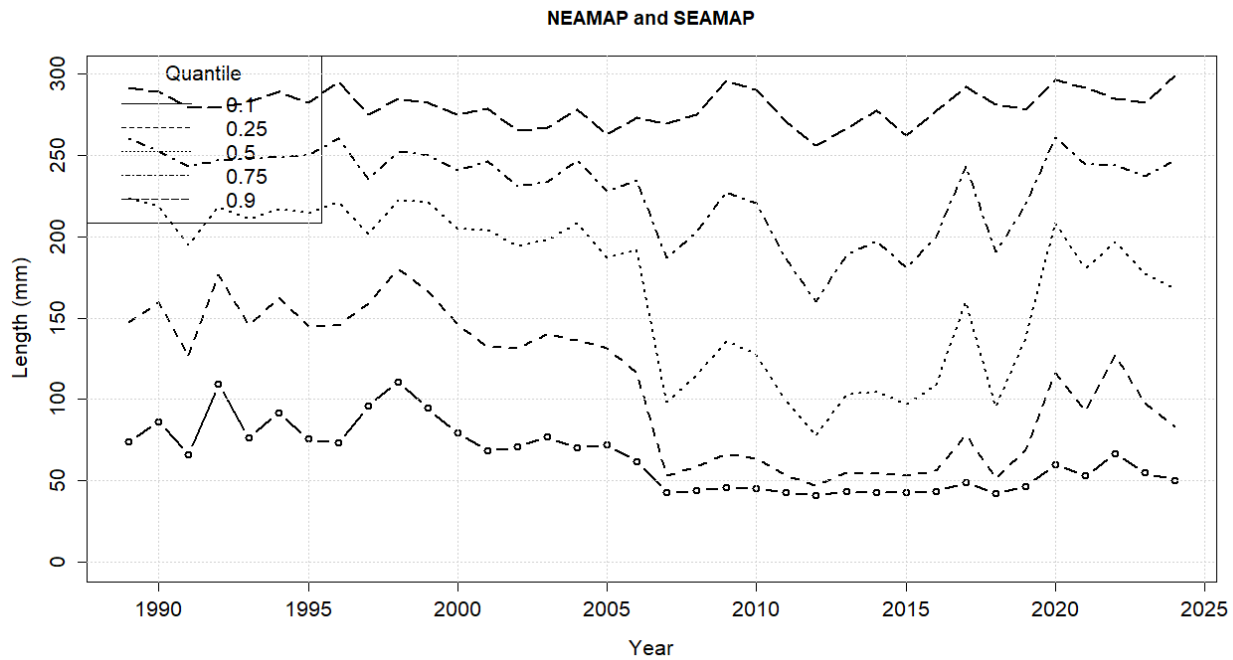


Figure 18. Weighted length (in mm) quantiles of the Kingfish stock complex caught in the NEAMAP/SEAMAP surveys, 1989–2024. NEAMAP sampling began in 2007, driving the dip in quantiles observed in that year.

Division Conclusions

The Kingfishes stock complex is unassessed; thus, overfishing and overfished status cannot be determined. 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.

Though stock status relative to overfished or overfishing reference points cannot be determined, available data can be used to inform relative status of the Kingfishes stock complex. While the data are limited, the information provided is informative. Based on the reviewed data, the Division concludes there is no immediate concern for the Kingfishes stock complex but recognizes the data limitations and acknowledges there could be concern in the future if fishing effort shifts occur, which may result in the need for management changes. Results of this data review will inform the ongoing review of the Kingfishes FMP. At a minimum the FMP review will update the trend analysis and management triggers with the best available data and techniques to better assess population trends.

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