

**FISHERY MANAGEMENT PLAN UPDATE
KINGFISHES
AUGUST 2024**

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

Original FMP Adoption:	November 2007
Amendments:	None
Revisions:	None
Supplements:	None
Information Updates:	December 2015 August 2020
Schedule Changes:	None
Comprehensive Review:	2025

The original 2007 North Carolina Kingfish Fishery Management Plan (FMP) developed management strategies that ensure a long-term sustainable harvest for recreational and commercial fisheries in 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 N.C. Kingfish FMP in November 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 the 2015 Information Update. The annual FMP Update in 2020 served as the formal review of the N.C. Kingfish FMP. The next review will begin in July 2025.

Management Unit

The N.C. Kingfish FMP includes the kingfishes in all coastal fishing waters of North Carolina. The fishery includes three species: southern kingfish (*Menticirrhus americanus*), gulf kingfish (*M. littoralis*), and northern kingfish (*M. saxatilis*). 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. For this reason, a state-specific stock assessment cannot be conducted, and a regional stock assessment approach is recommended as the most appropriate mechanism for determining stock status and the long-term viability of these stocks (NCDMF 2007).

Goal and Objectives

The goal of the 2007 N.C. Kingfish FMP was 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:

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

- Ensure that the spawning stock is of sufficient capacity to prevent recruitment overfishing.
- Address socio-economic concerns of all user groups.
- Restore, improve, and protect critical habitats that affect growth, survival, and reproduction of the North Carolina stock of kingfishes.
- Evaluate, enhance, and initiate studies to increase our understanding of kingfishes' biology and population dynamics in North Carolina.
- Promote public awareness regarding the status and management of the North Carolina kingfishes stocks.

DESCRIPTION OF THE STOCK

Biological Profile

Three species of kingfishes occur in North Carolina: southern, gulf, and northern. 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 are 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.

Stock Assessment

A 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.

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 N.C. Kingfish FMP as part of the 2015 FMP Information

Update and 2020 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 the 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 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 (L50), and a relative fishing mortality index. Young-of-year fish includes new fish that enter the population that year. The L50 is the length at which 50% of the adult population is sexually mature and ready to spawn.

DESCRIPTION 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 Fishery

Commercial landings for kingfishes include southern, northern, and gulf kingfishes combined. Landings have fluctuated historically but have generally been increasing since 2018. In 2023, landings (834,669 pounds) decreased 0.5% from 2022 (838,784 pounds; Table 1; Figure 1). The average landings from 2012 to 2023 was 745,993 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.

Table 1. Recreational harvest (number of fish landed and weight in pounds) and releases (number of fish) and commercial harvest (weight in pounds) of kingfishes from North Carolina for the period 2012-2023.

Year	Recreational			Commercial	Total Weight Landed (lb)
	Number Landed	Number Released	Weight Landed (lb)	Weight Landed (lb)	
2012	3,444,198	3,665,650	1,870,307	596,249	2,466,556
2013	5,878,620	6,069,055	2,908,365	605,953	3,514,318
2014	5,545,372	6,959,626	3,489,132	955,087	4,444,219
2015	5,503,438	4,850,505	3,093,643	784,753	3,878,396
2016	4,149,467	4,076,760	2,226,493	834,771	3,061,264
2017	3,387,471	4,075,827	2,061,922	942,946	3,004,868
2018	1,731,339	2,180,732	1,094,514	407,201	1,501,715
2019	3,370,636	4,152,005	1,980,068	702,696	2,682,764
2020	3,865,040	3,461,090	2,476,380	640,759	3,117,139
2021	8,425,767	5,593,293	5,941,448	808,049	6,749,497
2022	5,594,759	4,197,190	3,264,122	838,784	4,102,906
2023	3,003,876	2,817,382	1,833,510	834,669	2,668,179
Mean	4,491,665	4,341,593	2,686,659	745,993	3,432,652

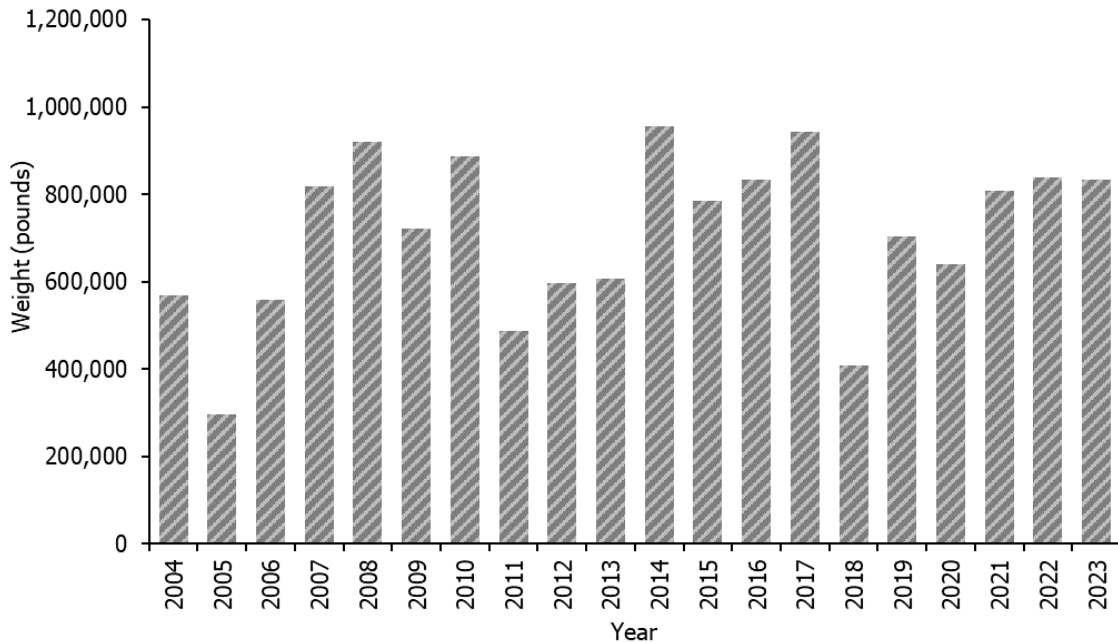


Figure 1. Commercial landings (pounds) of kingfishes reported through the North Carolina Trip Ticket Program from 2004–2023.

Recreational Fishery

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 new Fishing Effort Survey-based calibrated estimates. For more information on MRIP see [here](#).

Recreational landings for kingfishes include southern, northern, and gulf kingfishes. Total recreational landings have fluctuated but have been generally increasing since 2018 (Table 1; Figure 2). The low landings year in 2018 was likely due to impacts from Hurricane Florence. In 2023, recreational landings (1,833,510 pounds) decreased 44% from 2022 (3,264,122 pounds; Table 1; Figure 2). The average recreational landings from 2012-2023 was 2,686,659 pounds. Most kingfishes are landed from the ocean and 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 by anglers fishing from private vessels. Recreational harvest of kingfishes is seasonal with most fish harvested during the spring and the fall, and lowest during the summer.

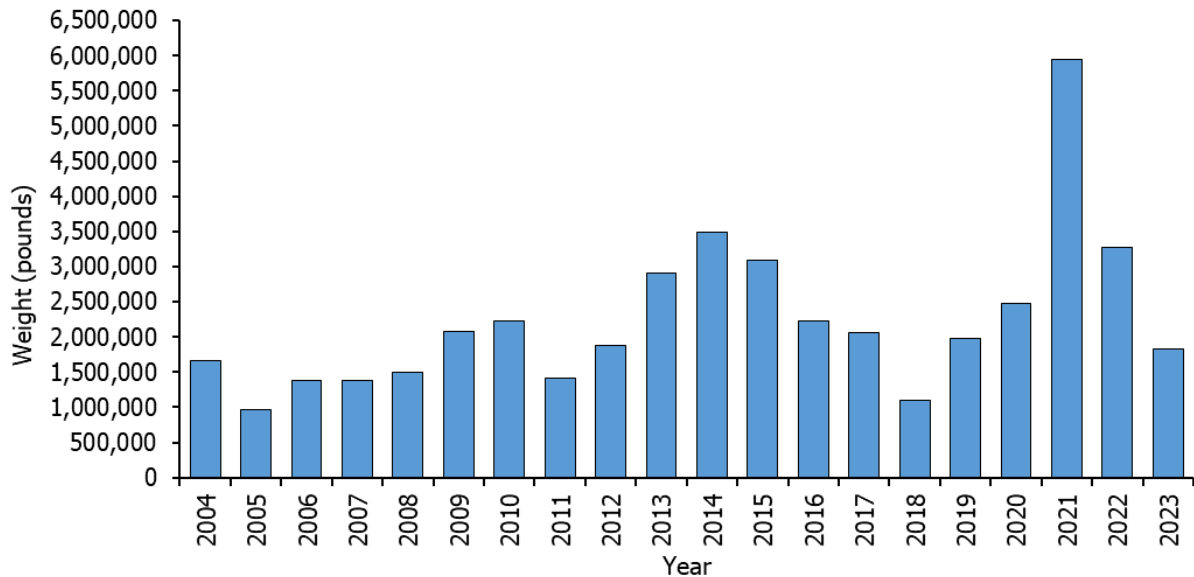


Figure 2. Recreational landings (Type A + B1; pounds) of kingfishes estimated from the Marine Recreational Information Program survey for North Carolina from 2004-2023.

The North Carolina Saltwater Fishing Tournament recognizes anglers for landing and/or releasing fish of exceptional size or rarity by issuing citations that document the capture for the angler. Citations were awarded for kingfishes landed larger than one and one-half pounds prior to May 1, 2021, and since then have been awarded to kingfishes landed larger than two pounds. Citations awarded through the North Carolina Saltwater Fishing Tournament for kingfishes have varied by year throughout the time series (1991-2023), averaging 227 citations (Figure 3). The number of awarded citations in 2023 (39 citations) decreased 47% from the previous year (74 citations in 2022). The decrease in awarded citations beginning in 2021 may be partially due to the increase in weight required to qualify for a citation effective May 1, 2021.

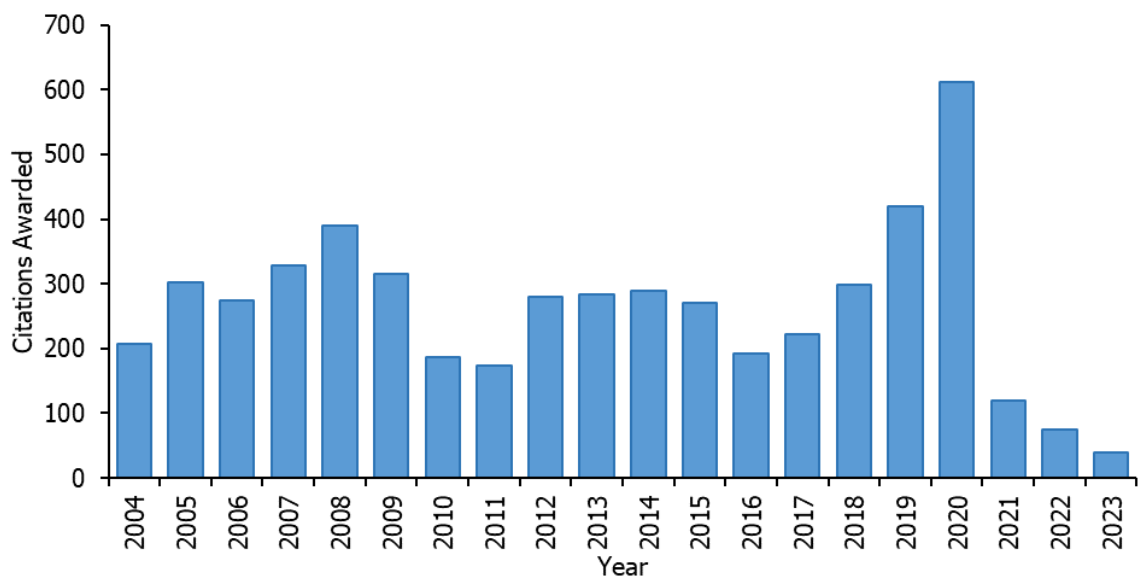


Figure 3. North Carolina Saltwater Fishing Tournament citations awarded for kingfishes, 2004–2023. Citations are awarded for kingfishes > two pounds landed. Prior to May 1, 2021, citations were awarded for kingfishes > one and one-half pounds landed.

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 North Carolina. A total of 21,193 kingfishes were measured from 2013 to 2023 (17,119 southern, 2,001 northern and 2,073 gulf; Table 2; Figure 4). Mean total length for southern kingfish ranged from 11.4 to 12.0 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 14.1 inches, with a minimum of 8.1 inches and a maximum of 18.6 inches. Mean length for gulf kingfish ranged from 12.0 to 12.9 inches with a minimum of 6.4 inches and a maximum of 18.3 inches. The length composition and modal length of kingfishes caught in the commercial fishery has been stable since 2004 (Figure 4). Most of the commercial catch consists of kingfishes from 10 to 12 inches total length (Figure 4). The length frequency distribution of kingfishes in the commercial and recreational fisheries is presented in Figure 5.

Recreational lengths are collected as part of MRIP by recreational port agents. A total of 5,026 kingfishes were measured from 2013 to 2023 (3,886 southern, 105 northern and 1,035 gulf; Table 3; Figure 6). Mean fork 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 14.8 inches. Mean length for gulf kingfish ranged from 10.4 to 12.2 inches, with a minimum of 6.0 inches and a maximum of 17.2 inches. The length composition and modal length of kingfishes caught in the recreational fishery has been stable since 2004 (Figure 6). Most of the recreational catch consists of kingfishes from 8 to 12 inches (Figure 6).

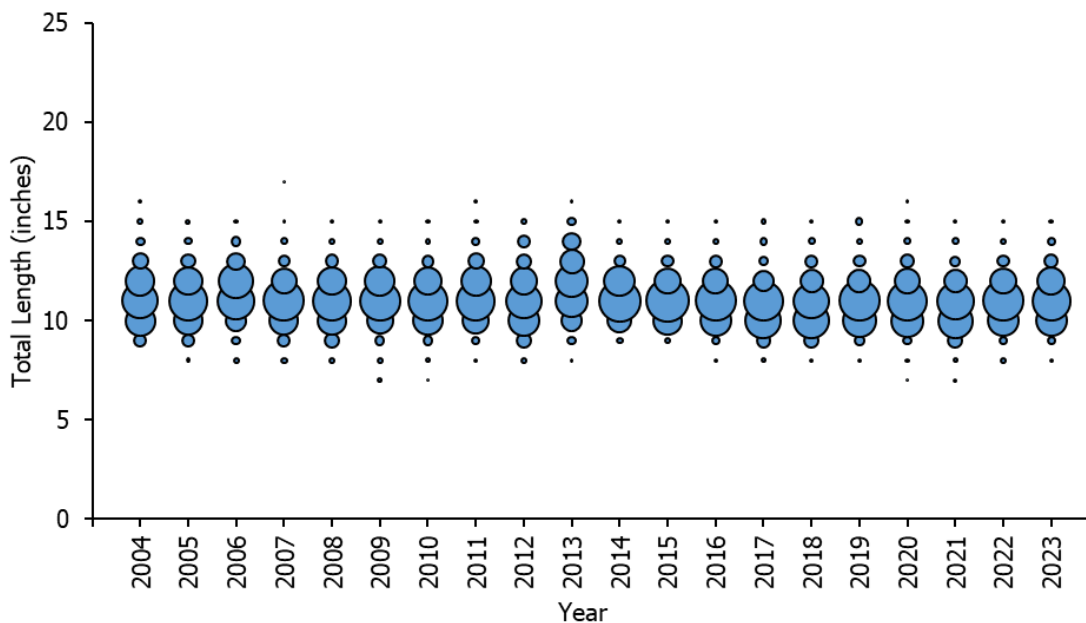


Figure 4. Commercial total length frequency of kingfishes harvested, 2004–2023. Bubbles represent fish at length and the bubble size is proportional to the number of fish at that length.

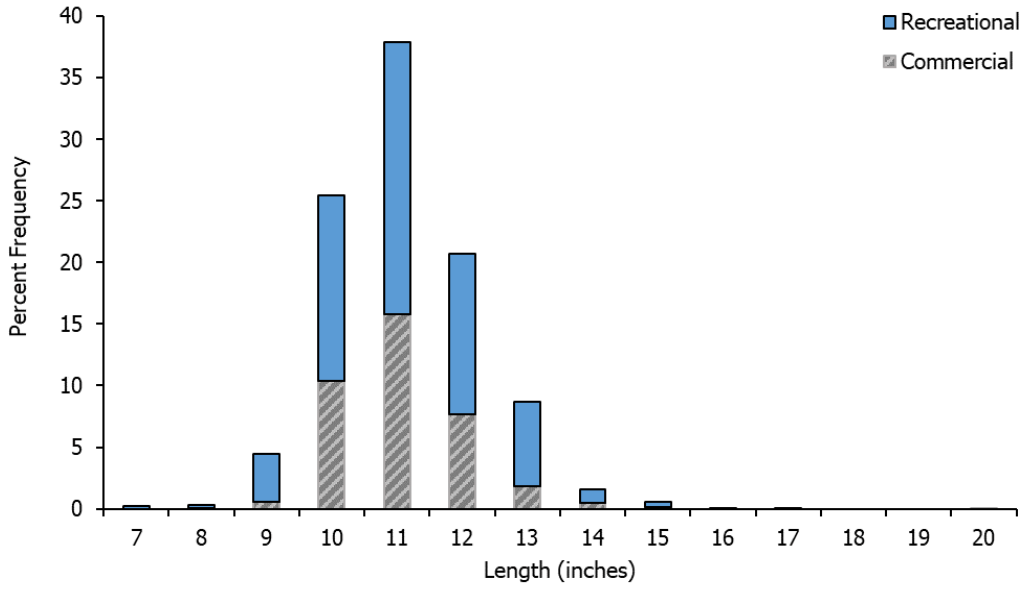


Figure 5. Commercial total length and recreational fork length frequency distribution of kingfishes harvested in 2023.

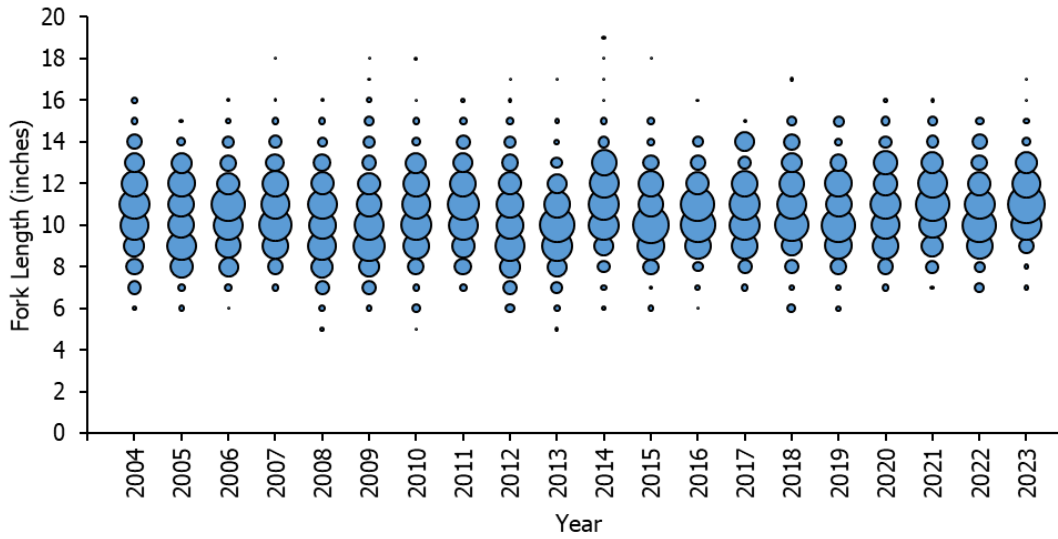


Figure 6. Recreational fork length frequency of kingfishes harvested, 2004–2023. Bubbles represent fish at length and the bubble size is proportional to the number of fish at that length.

Table 2. Summary of length data (total length, inches) sampled from kingfishes in the commercial fishery, 2013– 2023.

Southern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2013	12.0	6.5	16.1	1,357
2014	11.8	8.3	20.9	2,831
2015	11.7	7.7	15.8	3,276
2016	11.9	7.1	17.2	3,095
2017	11.4	7.9	16.1	2,486
2018	11.3	6.8	16.1	1,254
2019	11.4	8.0	24.8	4,342
2020	11.4	7.8	20.0	2,086
2021	11.4	7.5	16.0	2,485
2022	11.6	7.9	17.9	2,516
2023	11.7	7.9	20.7	1,950
Northern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2013	13.2	8.6	16.0	754
2014	13.3	10.9	16.7	155
2015	12.7	10.0	16.6	84
2016	12.4	8.8	17.0	213
2017	13.4	10.0	17.4	165
2018	14.1	12.4	17.7	56
2019	12.1	8.1	16.1	148
2020	13.5	10.0	18.6	175
2021	13.5	9.9	18.4	153
2022	13.2	10.6	18.0	29
2023	12.9	10.8	15.6	69
Gulf Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
2013	12.9	9.7	17.4	469
2014	12.2	9.2	15.5	181
2015	12.8	10.6	16.3	161
2016	12.4	8.1	18.3	192
2017	12.3	9.4	16.7	256
2018	12.5	9.0	18.0	160
2019	12.0	8.9	16.9	154
2020	12.8	9.3	17.0	130
2021	12.7	6.4	16.8	138
2022	12.5	10.5	16.1	80
2023	12.8	8.6	17.1	152

Table 3. Summary of length data (fork length, inches) sampled from kingfishes in the recreational fishery, 2013–2023.

Southern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
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
2020	11.2	7.6	16.9	467
2021	11.5	7.5	16.1	347
2022	11.0	7.5	15.6	256
2023	11.6	8.8	16.4	179
Northern Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
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
2020	11.7	10.7	12.4	7
2021	10.6	8.3	13.1	15
2022	11.1	8.3	13.7	12
2023	11.7	10.5	13.9	6
Gulf Kingfish				
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured
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	17.1	83
2019	11.1	6.2	15.0	72
2020	12.1	7.4	16.0	92
2021	12.2	7.9	15.5	44
2022	11.5	7.8	15.2	65
2023	11.1	7.6	17.1	26

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 Trawl Survey and the NCDMF Independent Gill Net Survey (Program 915).

Pamlico Sound Survey

The Pamlico Sound Survey catches the most kingfishes of the NCDMF fishery independent sampling programs, and the majority of those are southern kingfish. 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. The sample area covers all of Pamlico Sound, 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, since most kingfishes are caught in Pamlico Sound, only those stations are used for the associated triggers.

The June portion of the Pamlico Sound Survey is used to calculate an annual maturity index tracking the proportion of adults larger than the length at which 50% (L50) of the adult population is sexually mature. For southern kingfish, this is 8.25 inches (210 mm) in total length. This index has been variable through the time series, however it generally increased through 2003, then entered a more stable lower period from 2004 through 2019 (Table 4; Figure 7). During 2020 and 2021, sampling was impacted during June due to the COVID-19 pandemic. All stations were not sampled as only day trips were permitted. In June 2020, 15 of the 41 stations used in the L50 index were sampled, and in June 2021, 22 of the 41 stations used in the L50 index were sampled. Thus, the L50 indices may not be representative of the population and were not included for those years. In 2022, the L50 index was the highest on record (0.79) since 2003; however, the index subsequently decreased 39% in 2023 to approximately 0.48 (Table 4; Figure 7).

The September portion of the Pamlico Sound Survey is used to calculate an annual YOY index of relative abundance because YOY southern kingfish are more abundant in the fall. The Program 195 YOY relative abundance index peaked in 2009, was on a decreasing trend through 2016 and has remained low since then, though it increased slightly in 2023 (Table 4; Figure 8).

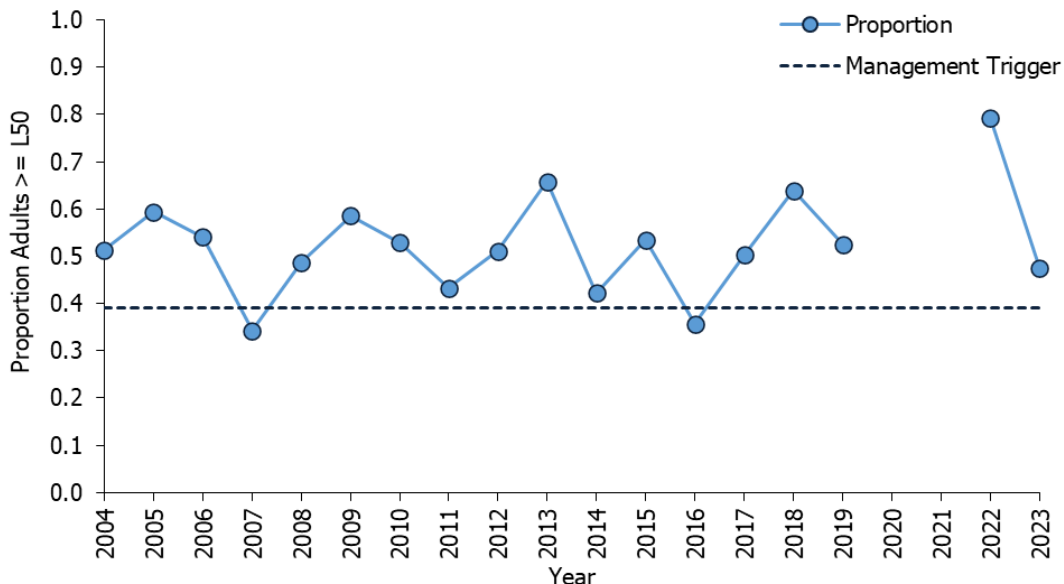


Figure 7. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the June component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 2004–2023. The dotted line represents 2/3 of the average of the base years, 1987–2017. *Data for 2020 and 2021 are not included due to incomplete sampling in those years.

During 2020 and 2021, sampling was impacted during September due to the COVID-19 pandemic. All stations were not sampled as only day trips were permitted. In September 2020, 23 of the 41 stations used in the YOY index were sampled and in September 2021, 20 of the 41 stations used in the YOY index were sampled. Thus, the YOY indices may not be representative of the population and were not included for those years.

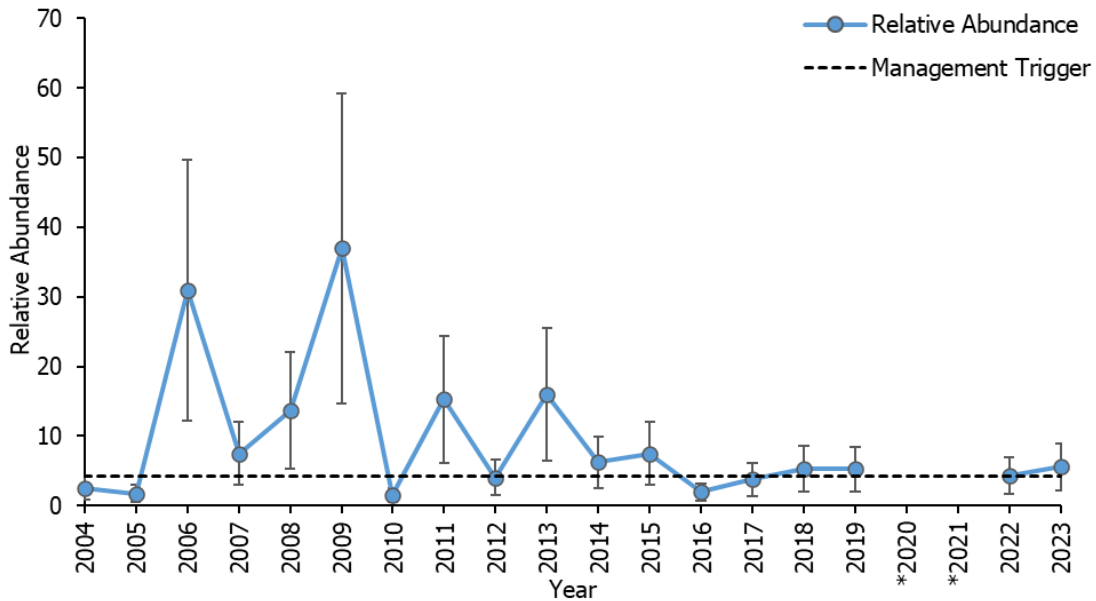


Figure 8. Annual index of relative YOY abundance for southern kingfish derived from the September component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 2004–2023. The dotted line represents 2/3 of the average of the base years, 1987–2017. *Data for 2020 and 2021 are not included due to incomplete sampling in those years.

Table 4. Summary of management trigger organized by category. Bold values indicate years a trigger was activated.

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	
2012	0.51	1.00	0.37	4.06	13.42	46.80	6,870
2013	0.66	0.95	0.56	15.99	16.02	28.74	9,275.5
2014	0.42	0.98	0.54	6.26	13.36	28.25	31,893
2015	0.53	0.98	0.56	7.49	325.06	24.56	12,124
2016	0.36	0.95	0.35	1.97	28.45	22.01	3,790
2017	0.50	0.96	0.68	3.78	26.23	10.84	2,468
2018	0.64	1.00	0.40	5.32	6.60	11.99	5,765
2019	0.53	0.97	0.45	5.25	32.91	34.22	6,417
2020	*	*	*	*	*	*	*
2021	*	1.00	*	*	32.60	*	*
2022	0.79	1.00	0.77	4.32	35.58	8.95	15,256
2023	0.48	1.00	0.73	5.58	2.97	7.98	156,027
Threshold	<0.39	<0.65	<0.39	<4.32	<17.73	<10.36	>40,723
Total Years	35	22	33	35	34	33	32
Years Trigger Activated	3	0	5	18	21	13	8

SEAMAP-SA Coastal Trawl Survey

The Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) Coastal Trawl 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). Historically, SEAMAP-SA Coastal Trawl Survey cruises were conducted each year in spring (April to the end of May), summer (mid-July to mid-August), and fall (September to mid-November). Beginning in 2023, sampling for the survey is conducted during spring/summer (April-June) and summer/fall (August-October). The spring (April-May) portion of the SEAMAP-SA Coastal Trawl Survey is used as part of a relative fishing mortality (F) index. The summer (July-August) portion of SEAMAP-SA Coastal Trawl Survey is used to calculate an annual adult index of abundance as well as an annual maturity index. The fall (September-November) portion of SEAMAP-SA Coastal Trawl Survey is used to calculate an annual YOY index of abundance. After a peak in 2012, the SEAMAP-SA Coastal Trawl Survey adult index of relative abundance has been on a declining trend, which continued until 2017, peaking again in 2019 and then declining in 2022 and 2023 (Table 4; Figure 9). The YOY index of relative abundance increased to well above the average in 2015 and has since returned to approximately the average in 2022 and declined in 2023 (Table 4; Figure 10). The L50 index has fluctuated throughout the time series, ranging from 0.28 to 0.93, but was well above the average in 2022 and 2023 (Table 4; Figure 11). Relative F was generally on a declining trend since a peak in 2000, but increased again and reached the maximum level in the time-series in 2023 (Table 4; Figure 12). The survey did not occur in 2020 or in spring and summer of 2021, due to the COVID-19 pandemic.

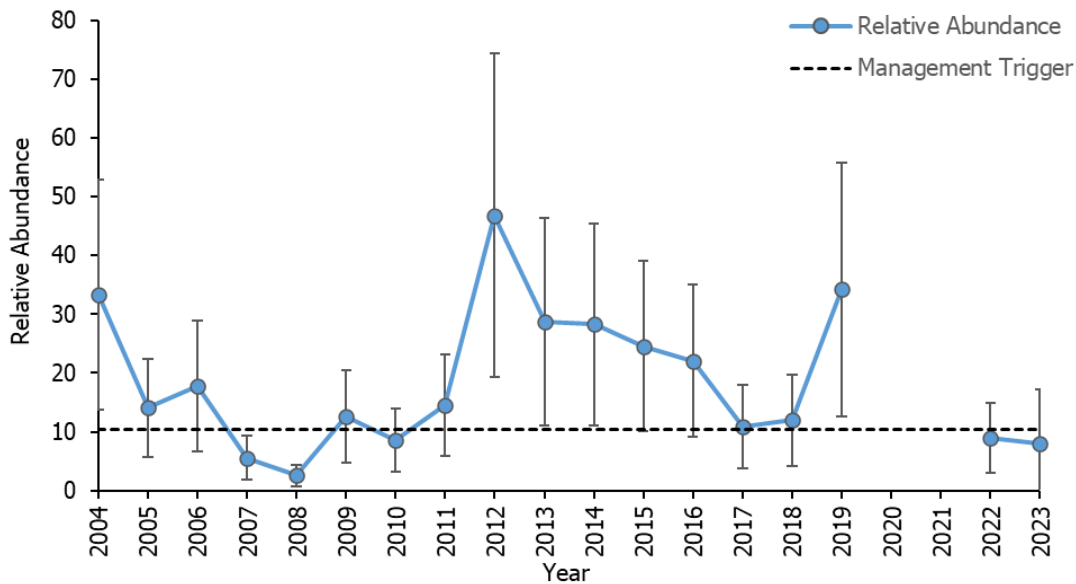


Figure 9. Annual index of relative adult abundance for southern kingfish derived from the summer component of the SEAMAP-SA Coastal Trawl Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 2004–2023. The summer component of the survey was not conducted in 2020 or 2021. The dotted line represents 2/3 of the average of the base years, 1989–2017.

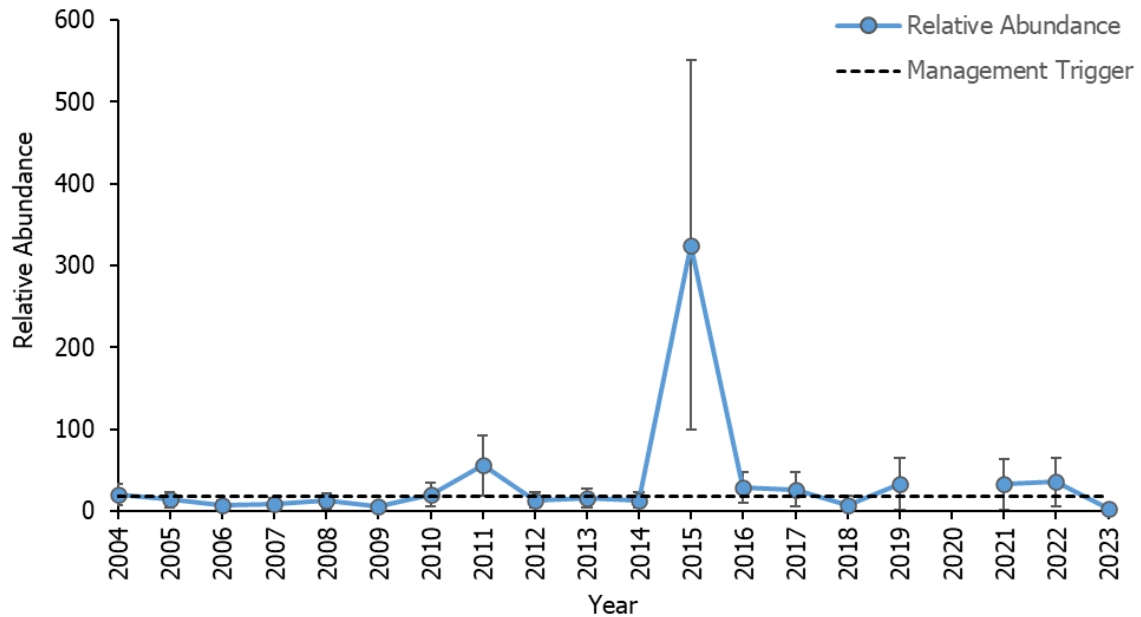


Figure 10. Annual index of relative YOY abundance for southern kingfish derived from the fall component of the SEAMAP-SA Coastal Trawl Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 2004–2023. The fall component of the survey was not conducted in 2020. The dotted line represents 2/3 of the average of the base years, 1989–2017.

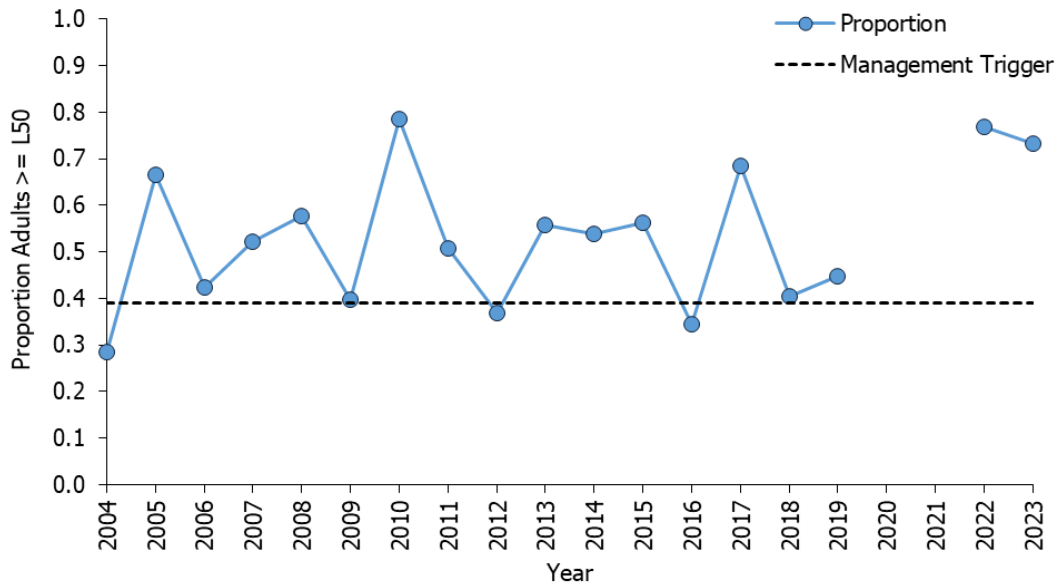


Figure 11. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the summer component of the SEAMAP-SA Coastal Trawl Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 2004–2023. The summer component of the survey was not conducted in 2020 or 2021. The dotted line represents 2/3 of the average of the base years, 1989–2017.

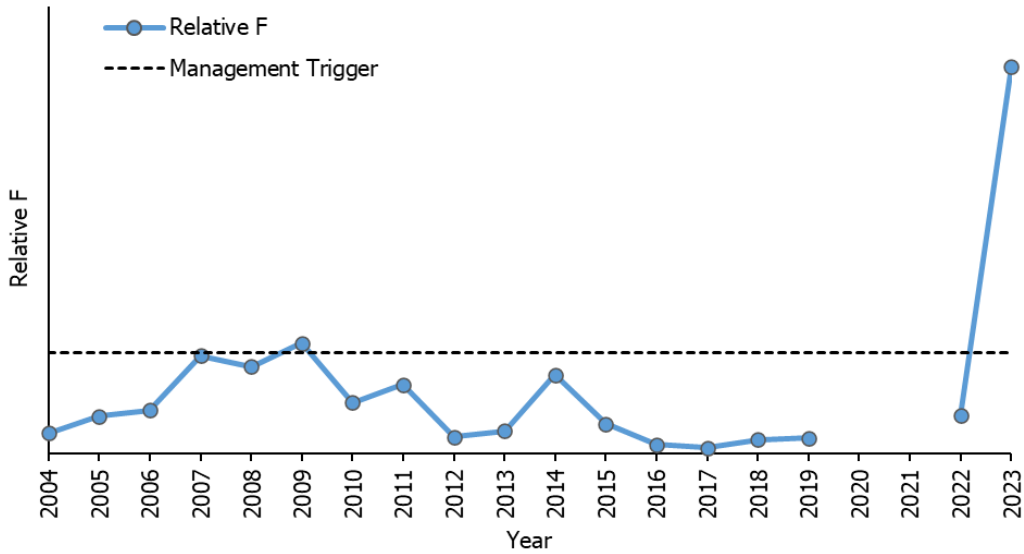


Figure 12. Relative F, as estimated as harvest (commercial and recreational) divided by the SEAMAP-SA Coastal Trawl Survey spring index (Onslow, Raleigh, and Long bays, inner—shallow—strata) of relative abundance for southern kingfish, 1990–2023. The spring component of the survey was not conducted in 2020 or 2021. The dotted line represents the average plus 1/3 of the average of the base years, 1990–2017.

Independent Gill Net Survey

The Independent Gill Net Survey (Program 915) 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 Program 915 maturity index management trigger is based on a conservative proportion of adults in the population from July through September. The L50 index has been stable over the time series, ranging from 0.947 to 1.00, and has never fallen below the management trigger threshold (Figure 13).

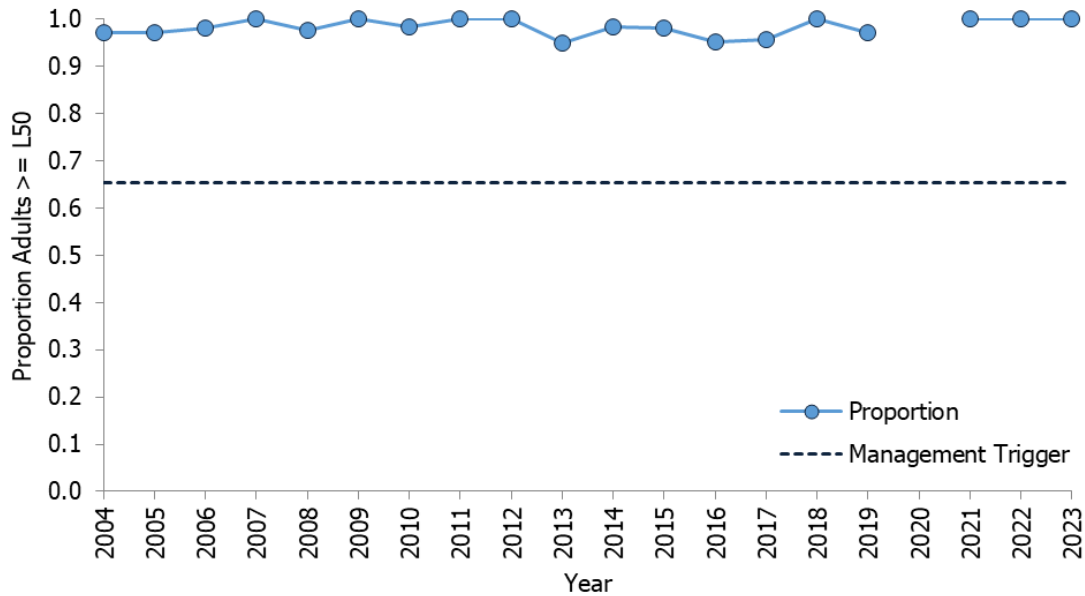


Figure 13. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the July through September component of the NCDMF Program 915 survey (Pamlico Sound, deep strata only), 2004–2023. The dotted line represents 2/3 of the average of the base years, 2001–2017.

During 2020 no maturity index was available for southern kingfish from the Independent Gill Net Survey (Program 915). Sampling in this program was suspended in February 2020 due to COVID-19 restrictions and protected species interactions but resumed in July 2021.

Table 5 summarizes the age data for kingfishes (southern, northern, and gulf), collected from 2013 through 2023. 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 (Figure 14). The length at age for all southern kingfish samples are presented in Figure 14. Northern kingfish ages ranged from 0 to 5 years old. Gulf kingfish ages ranged from 0 to 7 years old. The modal age has ranged from 1 to 4 years for southern, gulf, and northern kingfishes (Table 5).

Table 5. Kingfishes age data collected from all sources (commercial and recreational fisheries and fishery independent sampling programs) combined, 2013–2023.

Southern Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
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
2020	2	0	7	249
2021	2	1	6	423
2022	3	1	7	516
2023	3	0	7	635

Northern Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
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
2020	4	3	4	6
2021	3	1	5	9
2022	2	1	4	29
2023	3	1	5	18

Gulf Kingfish				
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged
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
2020	1	0	5	170
2021	2	0	7	205
2022	3	1	7	298
2023	2	0	6	156

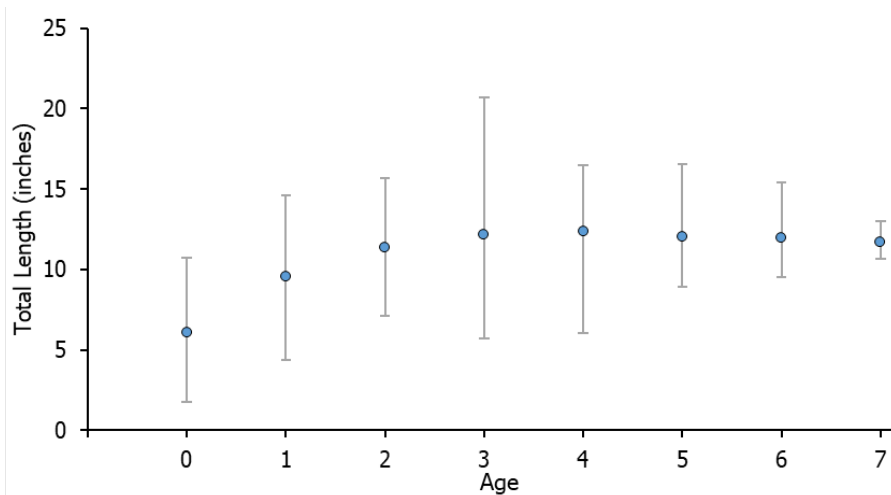


Figure 14. Southern kingfish total length at age based on all samples collected, 1997–2023. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum length observed for each age.

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:

High

- Conduct a coast-wide stock assessment of southern kingfish along the Atlantic Coast including estimation of biological reference points for sustainable harvest. — No Action
- Validate YOY and adult indices used in trend analysis. — 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. — No Action
- Collect observer data from commercial fishing operations to estimate at-sea species composition of the catch, discard rates, and lengths. — 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. — Steps have been taken to improve sampling in recreational fisheries, including a carcass collection program.
- Develop a tagging study to estimate natural and fishing mortality, to investigate stock structure, and to understand movement patterns. — No Action
- Collect histological data to develop a maturity schedule with priority to southern kingfish. — NCDMF is currently collecting histology samples in order to validate and update maturity schedules.

- Conduct an age validation study with priority to southern kingfish. — No Action

Medium

- Improve fishery-dependent commercial data collection of more sample sizes for life history information. — 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. — No Action
- Continue bycatch reduction device studies in the shrimp trawl fishery to decrease bycatch. — Ongoing research through NCDMF and various federal agencies.
- Conduct a study to estimate fecundity with priority to southern kingfish. — No Action
- Conduct a study to identify spawning areas with priority for southern kingfish. — No Action

Low

- Determine stock structure using genetics of kingfishes along North Carolina and the Atlantic Coast. — Grant approved for UNCW and NCDMF to use genetic markers to delineate the population structure.
- Sample inlets and river plumes to determine the importance of these areas for kingfishes and other estuarine-dependent species. — 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. — 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. — 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. — NCDMF conducted a study of CRFL holders in 2009/2010.
- Update information on the participants in the recreational kingfish fishery. — Socioeconomic study was conducted by NCDMF on piers.

MANAGEMENT

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; Table 6). 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. Southern kingfish is designated as the indicator species for this assemblage. The Pamlico Sound Survey, the Independent Gill Net Survey and the SEAMAP-SA Coastal Trawl Survey data are currently used for management triggers for kingfishes in North Carolina.

Table 6. 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
<i>Fisheries Management</i>	
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
<i>Habitat and Water Quality</i>	
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

The L50 management triggers are based on the 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 these management triggers come from three fisheries-independent surveys: the summer component of the SEAMAP-SA Coastal Trawl 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 fishing mortality (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 Trawl Survey spring index (Onslow, Raleigh, and Long bays, inner-shallow-strata) of relative abundance, given the majority of harvest occurs in the spring.

The southern kingfish management triggers are summarized as follows:

Biological Monitoring

Proportion of adults \geq length at 50 percent maturity (L50) for NCDMF Program 195 June (Figure 7)

Proportion of adults \geq L50 for NCDMF Program 915 July-September (Figure 13)

Proportion of adults \geq L50 for SEAMAP-SA Coastal Trawl Survey summer (Figure 11)

- If the proportion of adults \geq L50 falls below 2/3 of the average proportion of adults \geq L50 for the base years (through 2017), then the trigger will be considered tripped.

Fisheries-Independent Surveys-Juvenile and Adult

NCDMF Program 195 September index of YOY relative abundance (Figure 8)

SEAMAP-SA Coastal Trawl Survey summer index of adult relative abundance (Figure 9)

SEAMAP-SA Coastal Trawl Survey fall index of YOY relative abundance (Figure 10)

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

Other

Relative fishing mortality rate (F) (Figure 12)

- If relative F rises above the average +1/3 of relative F for the base years (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. For 2020, none of the seven triggers were able to be updated with 2020 data due to impacts from the COVID-19 pandemic. For 2021, only two of the seven triggers were able to be updated with 2021 data due to impacts from the COVID-19 pandemic and staffing issues with the division's survey vessel. Neither of the two updated triggers were activated in 2021. For 2022, all seven triggers were able to be updated, with two management triggers activated (the YOY index from the September portion of the Pamlico Sound Survey and the adult index from the summer SEAMAP-SA Coastal Trawl Survey). For 2023, all seven triggers were able to be updated, and three management triggers were activated (the YOY index from the fall SEAMAP-SA Coastal Trawl Survey, the adult index from the

summer SEAMAP-SA Coastal Trawl Survey, and relative F). While two or more triggers have now been activated for two consecutive years, it is important to consider that the data used to inform all three triggers that were activated in 2023 were from the SEAMAP-SA Coastal Trawl Survey. Recent spatial and temporal adjustments in the sampling design for the SEAMAP-SA Coastal Trawl Survey likely impacted the 2023 southern kingfish indices of relative abundance. Specifically, in 2023 sampling did not occur in the months (April, November) or region (Raleigh Bay) that have historically had the highest catch per unit effort of southern kingfish. Given these considerations, further evaluation of the best indices used to assess the North Carolina stock of kingfishes will occur during the 2025 formal review of this plan and prior to the assessment of possible management needs.

FISHERY MANAGEMENT PLAN SCHEDULE RECOMMENDATIONS

The management program currently in place for kingfishes has resulted in a stock that has met ongoing management targets. All management strategies 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 NCMFC 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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