

## STATE MANAGED SPECIES – KINGFISHES

### FISHERY MANAGEMENT PLAN UPDATE KINGFISHES AUGUST 2022

#### 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 stock.

## **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/overfished status cannot be determined. Only three of the seven triggers were able to be updated with 2021 data due to the impacts from the COVID-19 pandemic and staffing issues with the division's survey vessel. One of the three updated triggers tripped in 2021. Only two of the triggers were able to be updated with 2020 data due to impacts from the COVID-19 pandemic. One of the two updated triggers tripped in 2020. However, results from the 2019 trend analysis suggested there were no concerns with the stock

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

## **Stock Assessment**

The 2007 Kingfish FMP selected the use of trend analysis with management triggers as the management strategy to monitor the viability of the kingfish stocks in North Carolina (NCDMF 2007). During the review of the 2007 N.C. Kingfishes FMP as part of the 2015 FMP Information Update, best available data and techniques used for the trend analysis and management triggers were refined and modified to better assess population trends. The trend analysis incorporates management triggers to alert 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), adult fish, the proportion of catch 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.

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.

## **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 been increasing since 2019. In 2021, landings (808,049 lb) increased 26 percent from 2020 (640,759 lb; Table 1; Figure 1). The average landings from 2012 to 2021 was 727,530 pounds. Harvest of kingfishes is seasonal with peak landings in

April and November. Peaks in landings coincide with seasonal movements of kingfishes along the Atlantic coast.

## **Recreational 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 <https://www.fisheries.noaa.gov/topic/recreational-fishing-data>.

Recreational landings for kingfishes include southern, northern, and gulf kingfishes. Total recreational landings fluctuate but have been generally increasing since 2007. The low landings year in 2018 was likely due to impacts from Hurricane Florence. In 2021, recreational landings (5,676,092 lb) increasing 127% from 2020 (2,505,507 lb; Table 1; Figure 1). Recreational landings in 2021 were the highest on record (previous high was 3,425,201 lb in 2014). 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.

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 awarded through the North Carolina Saltwater Fishing Tournament for kingfishes have varied by year throughout the time series, averaging 238 citations (Figure 2). The number of awarded citations in 2021 (120 citations) decreased from the previous year (611 citations), which was the highest number of citations on record. The decrease in 2021 may be partially due to the increase in weight required to qualify for a citation from one and one-half pounds to two pounds on beginning May 1, 2021.

## **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 29,533 kingfishes were measured from 2012 to 2021 (25,278 southern, 2,489 northern and 1,766 gulf; Table 2; Figure 10). 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 12.2 to 13.9 inches, with a minimum of 7.8 inches and a maximum of 18.6 inches. Mean length for gulf kingfish ranged from 12.0 to 13.1 inches with a minimum of 8.1 inches and a maximum of 18.3 inches. The length composition and modal length of kingfish caught in the commercial fishery has been stable since 2003 (Figure 12).

Recreational lengths are collected as part of MRIP by recreational port agents. A total of 5,674 kingfishes were measured from 2012 to 2021 (4,279 southern, 145 northern and 1,350 gulf; Table 3). 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 15.1 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. Most of the recreational catch consists of kingfishes from 8 to 12 inches (Figure 13).

### **Fishery-Independent Monitoring**

Fishery-independent data are collected through the NCDMF Pamlico Sound Survey (Program 195), the Southeast Area Monitoring and Assessment Program – South Atlantic (SEAMAP-SA) Coastal Survey and the NCDMF Independent Gill Net Survey (Program 915). The Pamlico Sound Survey catches the most kingfishes of the NCDMF fishery independent sampling programs, and the majority of those are southern kingfishes. This survey has been running uninterrupted since 1987. From 1991 to present, the Pamlico Sound Survey has been conducted during the middle two weeks in June and September. The stations sampled are randomly selected from strata based upon depth and geographic location. Tow duration is 20 minutes at 2.5 knots using the R/V Carolina Coast pulling double rigged demersal mongoose trawls. The sample area covers all of Pamlico Sound and its bays, as well as Croatan Sound up to the Highway 64 Bridge, the Pamlico River up to Blounts Bay, the Pungo River up to Smith Creek, and the Neuse River up to Upper Broad Creek. However, most kingfishes are caught in Pamlico Sound proper, and very few from the Neuse, Pamlico, and Pungo rivers. The September portion of the Pamlico Sound Survey is used to calculate a YOY index of relative abundance because there are more southern kingfish collected in the fall, and more YOY are present in the catch at this time. The relative index derived from was calculated using a stratified generalized linear model (GLM) approach. The Program 195 YOY relative abundance index peaked in 2009, but has been on a decreasing trend since 2013, and remained low in 2021 (Figure 3; Table 5).

During 2020, sampling was impacted during June and September due to the COVID pandemic. Not all stations were able to be sampled as only day trips were permitted. In June, only 32 of the 51 stations were sampled, and in September, only 25 of the 51 stations were sampled. Thus, the relative abundance indices from this year should be viewed with caution.

The Southeast Area Monitoring and Assessment Program-South Atlantic (SEAMAP-SA) Coastal Survey is conducted by the South Carolina Department of Natural Resources-Marine Resources Division and provides long-term fishery independent data on the distribution and relative abundance of coastal species (Cowen and Zimney 2016). SEAMAP-SA Coastal Survey cruises are conducted each year in spring (mid-April to the end of May), summer (mid-July to mid-August), and fall (the first of October to mid-November). The summer portion of SEAMAP-SA Coastal Survey is used to calculate an adult index of abundance and the fall portion of SEAMAP-SA Coastal Survey is used as a young of year index of abundance. The indices derived from the SEAMAP-SA Coastal Survey were computed using standard (non-stratified) GLMs. After a peak in 2012, the SEAMAP-SA Coastal Survey adult index of relative abundance has been on a declining trend, which continued in 2018 (Figure 4; Table 5). The YOY index of relative abundance increased to well above the average in 2015 and has since returned to approximately the average in 2018 (Figure 5; Table 5). The survey did not occur in 2020 or 2021, due to COVID.

The Independent Gill Net Survey is designed to characterize the size and age distribution for key estuarine species in Pamlico Sound and its major river tributaries. Sampling began in Pamlico Sound in 2001 and was expanded to the current sampling area (including tributaries) in 2003. Gill

net sets are determined using a random stratified survey design, based on area and water depth. The L50 management trigger is based on a conservative proportion of adults in the population. This is the length at which 50 percent of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in total length. One of the data sources for this management trigger comes from the Independent Gill Net Survey (Program 915) and has been stable over the time series, ranging from 0.947% to 1.00% (Figure 6).

During 2020 no index of abundance is available for southern kingfish from the fishery-independent assessment (Program 915). Sampling in this program was suspended in February 2020 due to COVID-19 restrictions and protected species interactions but resumed July 2021.

Table 4 summarizes the age data for kingfishes (southern, northern, and gulf), collected from 2012 through 2021. The majority of kingfish age samples came from Independent Gill Net Survey (Program 915), followed by the commercial ocean gill net fishery. Southern kingfish ages ranged from 0 to 7 years old. Northern kingfish ages ranged from 0 to 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.

## **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 tagging study to estimate natural and fishing mortality, to investigate stock structure, and to understand movement patterns. — No Action
- Collect histological data to develop maturity schedule with priority to southern kingfish. — NCDMF 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 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 study to estimate fecundity with priority to southern kingfish. — No Action
- Conduct 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 STRATEGY

The 2007 Kingfish FMP selected the use of trend analysis and management triggers as the management strategy to monitor the viability of the southern kingfish stock in North Carolina (NCDMF 2007; 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 Survey data are currently used for management triggers for kingfishes in North Carolina.

The L50 management trigger is based on a conservative proportion of adults in the population. This is the length at which 50 percent of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in total length. Data sources for this management trigger come from three fisheries-independent surveys: the summer component of the SEAMAP-SA Coastal Survey, the July-September component of independent gill net survey, and the June component of the Pamlico Sound Survey.

Relative F is a simple method for estimating trends in F (Sinclair 1998). It is estimated as harvest (commercial landings plus recreational harvest) divided by a fisheries-independent index of relative abundance. Here, harvest (commercial landings plus recreational harvest) was divided by the SEAMAP-SA Coastal Survey spring index (Onslow, Raleigh, and Long bays, inner-shallow-strata) of relative abundance, given 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  $>$  L50 for NCDMF Program 915 (Figure 6)

Proportion of adults  $\geq$  L50 for SEAMAP-SA Coastal Survey summer (Figure 8)

- If the proportion of adults  $\geq$  L50 falls below 2/3 of the average proportion of adults  $\geq$  L50 for the time series (through 2013), then the trigger will be considered tripped.

### Fisheries-Independent Surveys-Juvenile and Adult

NCDMF Program 195 September index of YOY relative abundance (Figure 3)

SEAMAP-SA Coastal Survey summer index of adult relative abundance (Figure 4)

SEAMAP-SA Coastal Survey fall index of YOY relative abundance (Figure 5)



- If a fisheries-independent survey falls below 2/3 of the average abundance for the time series (through 2013), then the trigger will be considered tripped.

### Other

#### Relative fishing mortality rate (F) (Figure 9)

- If relative F rises above the average +1/3 of relative F for the time series (through 2013), 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. Only three of the triggers were able to be updated with 2021 data due to the impacts from the COVID-19 pandemic and staffing issues with the division's survey vessel. One of the three updated triggers tripped in 2021. Only two of the triggers were able to be updated with 2020 data due to impacts from COVID-19 pandemic. One of the two updated triggers tripped in 2020. In 2019, one management trigger was activated (the YOY index from the fall portion of SEAMAP Survey) and below the management trigger threshold.

## **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.

## **LITERATURE CITED**

- Cowen, J. and A.B. Zimney. 2016. Results of Trawling Efforts in the Coastal Habitat of the South Atlantic Bight, 2015. South Carolina Department of Natural Resources. Marine Resources Division. Charleston, South Carolina. 104 pp.
- NCDMF (North Carolina Division of Marine Fisheries). 2007. North Carolina Kingfishes Fishery Management Plan. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, North Carolina. 235 pp.
- NCDMF. 2015. North Carolina Kingfishes Fishery Management Plan Information Update. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, North Carolina. 196 pp.
- Sinclair, A.F. 1998. Estimating trends in fishing mortality at age and length directly from research survey and commercial catch data. *Canadian Journal of Fisheries and Aquatic Sciences*. 55(5):1248–1263.

## TABLES

Table 1. 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 1987–2021.

Year	Recreational			Commercial	Total Weight (lb)
	Number Landed	Number Released	Weight Landed (lb)	Weight Landed (lb)	
1987	1,857,068	260,871	992,633	959,928	1,952,561
1988	2,890,243	437,608	901,222	503,949	1,405,171
1989	694,996	232,077	354,489	562,424	916,913
1990	2,185,356	794,834	1,045,318	738,612	1,783,930
1991	2,556,003	797,605	1,342,855	864,651	2,207,506
1992	2,101,326	622,123	1,205,802	851,708	2,057,510
1993	1,713,370	363,653	970,140	1,194,224	2,164,364
1994	1,905,437	704,638	932,088	620,841	1,552,929
1995	1,566,976	887,357	877,355	1,058,785	1,936,140
1996	1,594,185	604,856	824,301	528,260	1,352,561
1997	1,377,757	315,294	764,540	872,888	1,637,428
1998	887,493	542,905	543,575	399,313	942,888
1999	1,434,966	879,223	789,732	607,465	1,397,197
2000	2,650,504	1,943,897	1,747,843	551,940	2,299,783
2001	2,425,319	1,059,193	1,374,961	489,743	1,864,704
2002	1,640,675	968,687	987,857	619,737	1,607,594
2003	1,480,769	1,920,446	962,157	652,636	1,614,792
2004	2,638,463	2,528,681	1,656,167	567,659	2,223,826
2005	1,796,386	1,814,579	961,919	296,263	1,258,182
2006	2,649,617	2,509,056	1,476,769	559,440	2,036,209
2007	2,277,856	2,408,418	1,397,901	817,588	2,215,489
2008	2,783,237	2,344,633	1,480,223	921,120	2,401,343
2009	3,785,900	4,711,527	2,070,355	721,924	2,792,279
2010	3,745,586	4,465,523	2,213,702	886,841	3,100,543
2011	2,345,068	2,631,056	1,444,020	486,853	1,930,873
2012	3,444,198	3,665,650	1,876,114	596,249	2,472,363
2013	5,878,620	6,069,055	2,892,756	603,186	3,495,942
2014	5,545,372	6,959,626	3,425,201	955,087	4,380,288
2015	5,503,438	4,850,505	3,110,112	784,753	3,894,865
2016	4,149,467	4,076,760	2,224,575	834,771	3,059,346
2017	3,387,471	4,075,827	2,316,609	942,946	3,259,556
2018	1,731,339	2,180,732	1,008,600	407,173	1,415,772
2019	3,370,636	4,152,005	1,888,848	702,328	2,591,176
2020	3,865,040	3,461,090	2,505,507	640,759	3,146,265
2021	8,425,767	5,593,293	5,676,092	808,049	6,484,141
Mean	2,642,945	2,242,353	1,487,242	700,060	2,187,303

Table 2. Summary of length data (total length, inches) sampled from kingfishes in the commercial fishery, 2012–2021.

Southern Kingfish					
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	
2012	11.5	7.0	17.0	2,947	
2013	12.1	6.5	16.1	1,390	
2014	11.9	8.3	20.9	2,880	
2015	11.9	7.7	15.8	3,286	
2016	12.0	7.1	17.2	3,107	
2017	11.6	7.9	16.1	2,504	
2018	11.4	6.8	16.1	1,264	
2019	11.4	8.0	24.8	4,360	
2020	11.3	7.8	20.0	1,770	
2021	11.3	7.8	20.0	1,770	
Northern Kingfish					
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	
2012	12.8	7.8	17.5	370	
2013	13.1	8.6	16.0	815	
2014	13.4	9.5	16.7	216	
2015	12.7	10.0	16.6	100	
2016	12.4	8.8	17.0	227	
2017	13.3	9.8	17.4	177	
2018	13.9	9.7	17.7	64	
2019	12.2	8.1	16.1	174	
2020	13.5	10.0	18.6	173	
2021	13.5	10.0	18.6	173	
Gulf Kingfish					
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	
2012	12.6	9.2	16.0	151	
2013	12.9	8.3	17.4	470	
2014	12.2	8.6	15.5	182	
2015	12.7	9.2	16.3	168	
2016	12.4	8.1	18.3	193	
2017	12.3	9.4	16.7	257	
2018	12.5	9.0	18.0	161	
2019	12.0	8.9	16.9	154	
2020	13.1	11.3	15.6	15	
2021	13.1	11.3	15.6	15	

Table 3. Summary of length data (fork length, inches) sampled from kingfishes in the recreational fishery, 2012–2021.

Southern Kingfish					
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	
2012	10.9	6.1	16.1	828	
2013	10.4	6.1	15.8	370	
2014	11.7	7.8	19.9	383	
2015	10.7	6.4	18.7	258	
2016	11.2	7.8	16.5	490	
2017	11.0	7.8	15.4	472	
2018	11.5	7.8	15.2	290	
2019	10.9	6.3	15.7	374	
2020	11.2	7.6	16.9	467	
2021	11.5	7.5	16.1	347	
Northern Kingfish					
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	
2012	11.3	8.3	15.1	58	
2013	10.9	6.2	14.8	26	
2014	11.2	9.3	13.5	2	
2015	10.9	8.5	14.1	7	
2016	10.8	7.9	11.8	3	
2017	13.2	9.8	14.4	24	
2018	9.2	6.4	13.1	2	
2019	10.9	10.9	10.9	1	
2020	11.7	10.7	12.4	7	
2021	10.6	8.3	13.1	15	
Gulf Kingfish					
Year	Mean Length	Minimum Length	Maximum Length	Total Number Measured	
2012	10.4	6.4	17.2	406	
2013	10.4	6.0	17.2	180	
2014	11.5	6.5	17.2	203	
2015	11.3	8.5	16.0	63	
2016	10.7	6.9	14.1	81	
2017	12.1	7.5	15.8	126	
2018	11.6	6.5	17.0	83	
2019	11.1	6.2	15.0	72	
2020	12.1	7.4	16.0	92	
2021	12.2	7.9	15.5	44	

Table 4. Kingfishes age data collected from all sources (commercial and recreational fisheries and fishery independent sampling programs) combined, 2012–2021.

Southern Kingfish					
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged	
2012	1	1	6	228	
2013	2	1	5	298	
2014	3	0	5	269	
2015	2	0	5	353	
2016	1	0	7	530	
2017	2	0	6	413	
2018	1	0	7	308	
2019	2	1	7	386	
2020	2	0	7	249	
2021	2	1	6	423	
Northern Kingfish					
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged	
2012	1	0	3	17	
2013	2	1	3	26	
2014	2	2	2	1	
2015	2	0	2	40	
2016	1	1	4	49	
2017	2	1	3	13	
2018	3	3	3	1	
2019	-	-	-	0	
2020	4	3	4	6	
2021	3	1	5	9	
Gulf Kingfish					
Year	Modal Age	Minimum Age	Maximum Age	Total Number Aged	
2012	1	0	4	98	
2013	1	1	4	44	
2014	2	1	4	38	
2015	2	0	4	78	
2016	1	0	5	116	
2017	2	0	5	167	
2018	2	0	6	95	
2019	1	0	6	183	
2020	1	0	5	170	
2021	2	0	7	205	

Table 5. 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 $\geq$ 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	
1987	0.611			<b>0.80</b>			
1988	0.450			<b>1.34</b>			
1989	<b>0.300</b>		0.585	<b>1.21</b>	65.4	<b>19.7</b>	8,832
1990	0.563		0.463	<b>2.77</b>	48.9	45.3	<b>40,806</b>
1991	0.667		0.894	<b>4.40</b>	36.9	64.6	11,804
1992	0.429		0.622	<b>2.23</b>	26.7	53.7	12,088
1993	0.543		0.456	<b>0.10</b>	<b>14.4</b>	40.6	<b>32,840</b>
1994	0.794		0.917	6.73	42.4	<b>9.00</b>	<b>48,429</b>
1995	0.440		0.486	7.86	<b>18.0</b>	<b>15.2</b>	20,115
1996	0.872		0.780	<b>0.30</b>	34.5	<b>10.9</b>	20,742
1997	0.589		<b>0.373</b>	<b>0.43</b>	<b>20.7</b>	27.4	8,708
1998	1.000		0.769	<b>0.20</b>	35.8	<b>12.1</b>	5,814
1999	0.920		0.608	<b>4.37</b>	40.1	75.4	14,118
2000	0.733		0.929	8.32	32.2	<b>19.8</b>	<b>45,526</b>
2001	0.660	0.983	<b>0.303</b>	5.75	27.3	40.3	15,967
2002	0.704	0.978	0.882	6.91	47.1	<b>25.4</b>	15,042
2003	0.872	0.978	0.645	5.53	<b>18.7</b>	31.3	4,103
2004	0.513	0.971	<b>0.284</b>	<b>2.81</b>	58.8	80.9	4,267
2005	0.594	0.971	0.666	<b>2.02</b>	34.5	42.2	7,033
2006	0.547	0.980	0.423	28.85	33.1	51.7	11,413
2007	<b>0.343</b>	0.976	0.521	8.44	52.9	<b>18.4</b>	20,943
2008	0.488	0.978	0.577	15.31	33.9	<b>9.61</b>	19,640
2009	0.586	1.000	<b>0.389</b>	32.94	<b>15.3</b>	37.5	<b>27,647</b>
2010	0.523	0.982	0.786	<b>1.66</b>	38.9	27.9	14,045
2011	0.432	1.000	0.507	16.61	95.5	34.2	17,134
2012	0.511	1.000	<b>0.368</b>	6.03	31.0	100	4,734
2013	0.659	0.947	0.558	23.93	48.5	61.8	6,401
2014	0.420	0.981	0.548	7.41	71.4	68.5	20,074
2015	0.534	0.981	0.550	8.50	557	56.5	9,929
2016	<b>0.358</b>	0.950	<b>0.345</b>	<b>2.01</b>	79.8	61.0	2,979
2017	0.503	0.958	0.684	<b>3.77</b>	49.2	<b>23.9</b>	2,288
2018	0.639	1.000	0.404	6.76	34.3	32.1	5,056
2019	0.525	0.971	0.447	6.61	36.9	70.3	5,109
2020	0.528	*	*	<b>2.46</b>	*	*	*
2021	0.471	1.000	*	<b>0.66</b>	*	*	*
Threshold	<0.403	<0.653	<0.394	<4.89	<25.4	<25.5	>23,370
Total Years	35	20	31	35	31	31	31
Years Trigger Activated	3	0	6	18	5	10	5

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
<b>Fisheries Management</b>	
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
<b>Habitat and Water Quality</b>	
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"> <li>• improvement and continuation of urban and agricultural BMPs,</li> <li>• more stringent sediment controls on construction projects, and</li> <li>• implementation of additional buffers along coastal waters.</li> </ul>	Endorsed through the CHPP

**FIGURES**

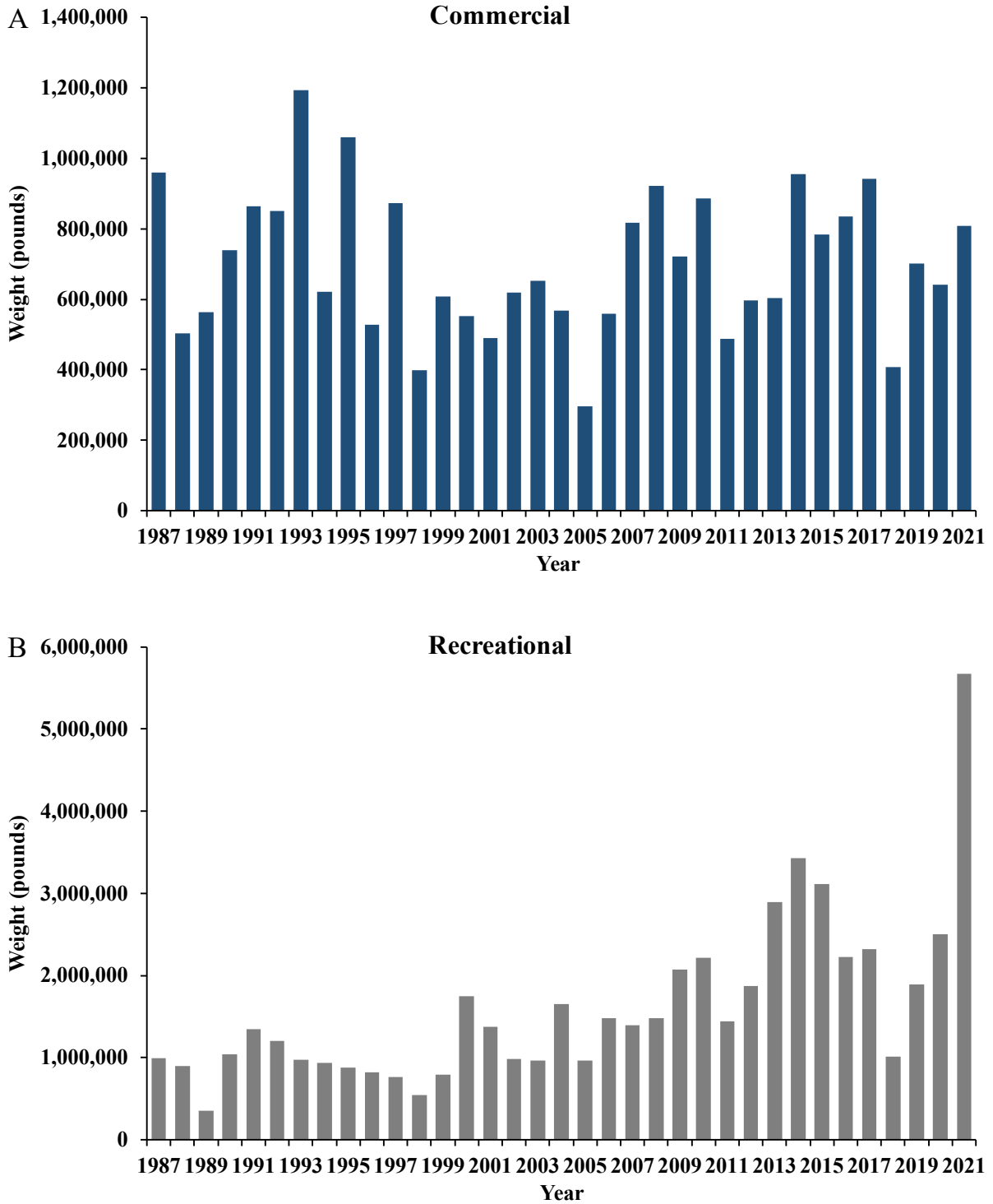


Figure 1. Commercial landings (pounds) reported through the North Carolina Trip Ticket Program (A) and recreational landings (Type A + B1; pounds) estimated from the Marine Recreational Information Program survey (B) for North Carolina from 1987–2021.



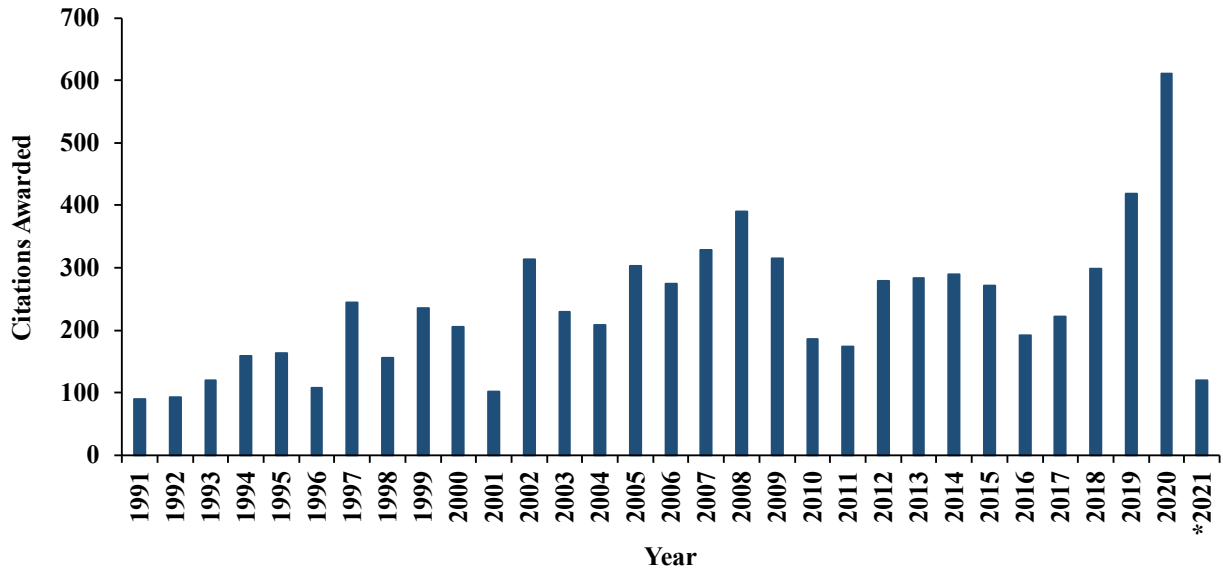


Figure 2. North Carolina Saltwater Fishing Tournament citations awarded for spotted seatrout, 1991–2021. Citations are awarded for kingfishes > two pounds landed. \*Prior to May 1, 2021, citations were awarded for kingfishes > one and one-half pounds landed.

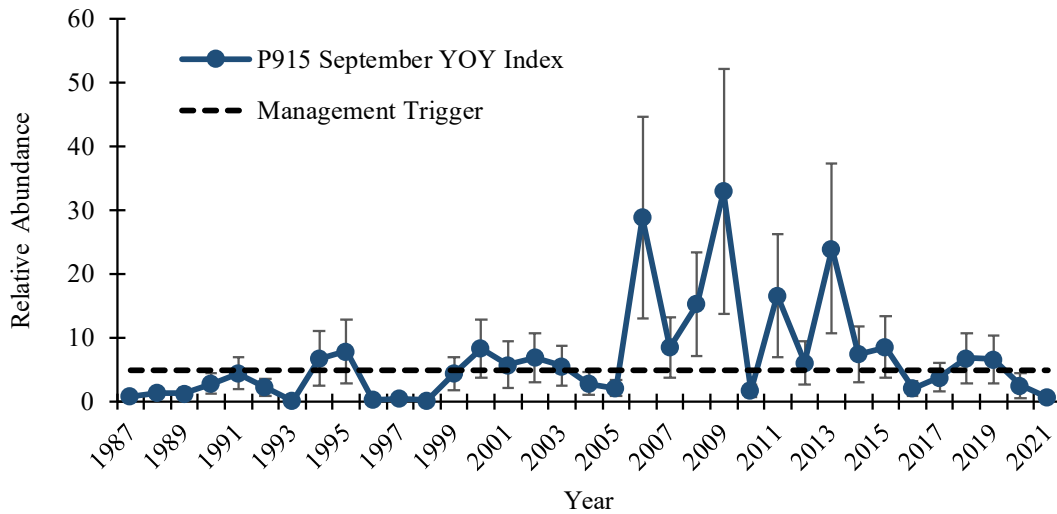


Figure 3. Annual index of relative YOY abundance for southern kingfish derived from the September component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 1987–2021. Dotted line represents 2/3 of the average of the base years, 1987–2013.

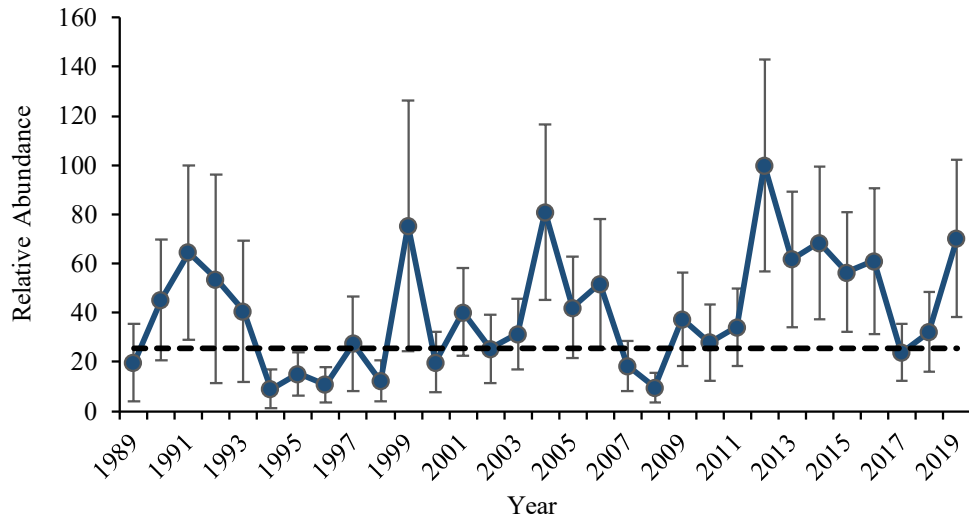


Figure 4. Annual index of relative adult abundance for southern kingfish derived from the summer component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2019. Survey not conducted in 2020 or 2021. Dotted line represents 2/3 of the average of the base years, 1989–2013.

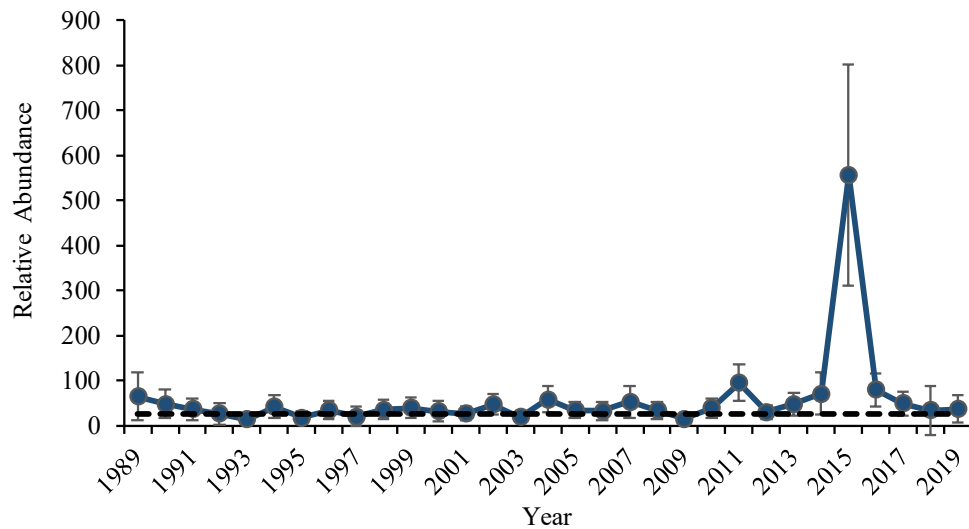


Figure 5. Annual index of relative YOY abundance for southern kingfish derived from the fall component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2019. Survey not conducted in 2020 or 2021. Dotted line represents 2/3 of the average of the base years, 1989–2013.

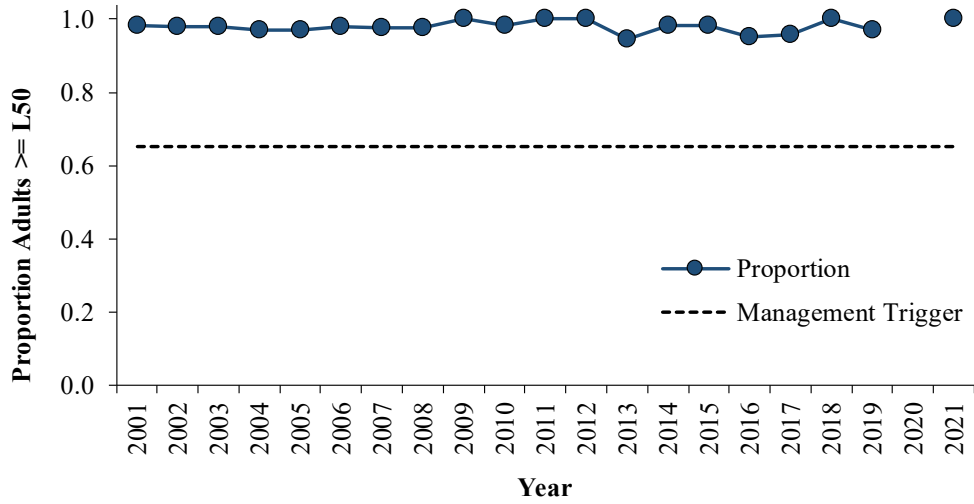


Figure 6. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the July through September component of the NCDMF Program 915 survey (Pamlico Sound, deep strata only), 2001–2021. Dotted line represents 2/3 of the average of the base years, 2001–2013.

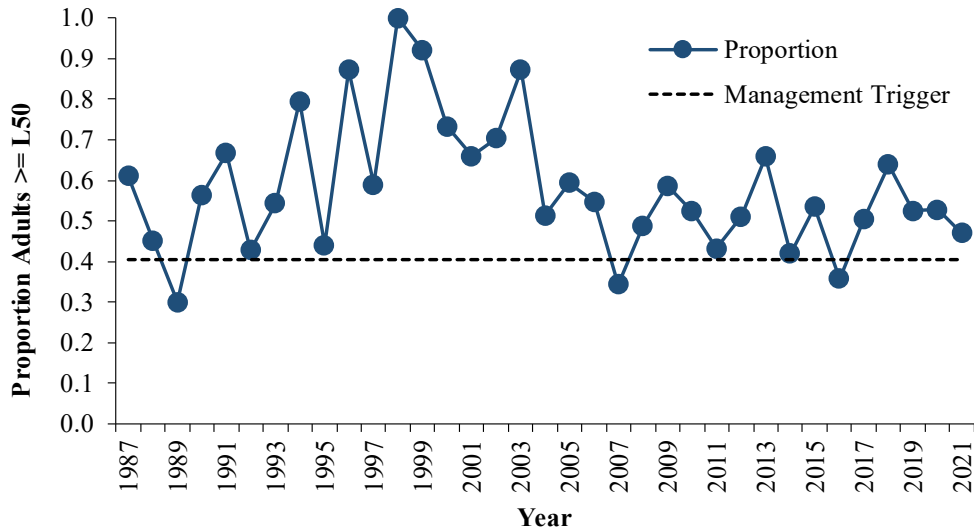


Figure 7. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the June component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 1987–2021. Dotted line represents 2/3 of the average of the base years, 1987–2013.

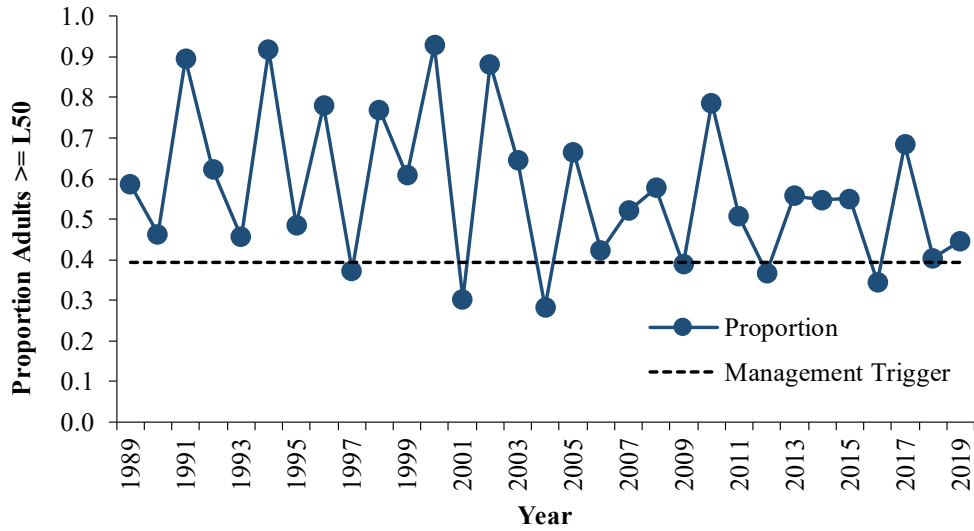


Figure 8. Annual proportion of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the summer component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2019. Survey not conducted in 2020 or 2021. Dotted line represents 2/3 of the average of the base years, 1989–2013.

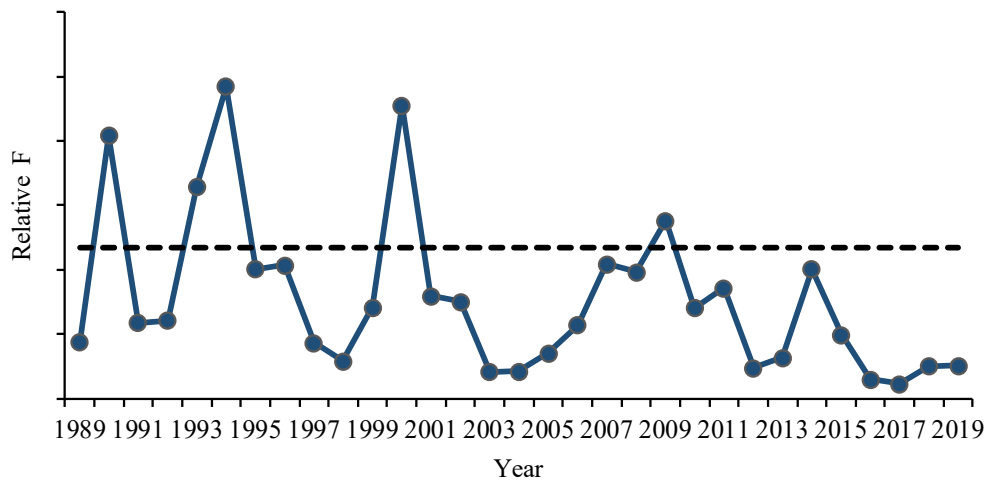


Figure 9. Relative F, as estimated as harvest (commercial and recreational) divided by the SEAMAP-SA Coastal Survey spring index (Onslow, Raleigh, and Long bays, inner—shallow—strata) of relative abundance for southern kingfish, 1989–2019. Survey not conducted in 2020 or 2021. Dotted line represents the average plus 1/3 of the average of the base years, 1989–2013.

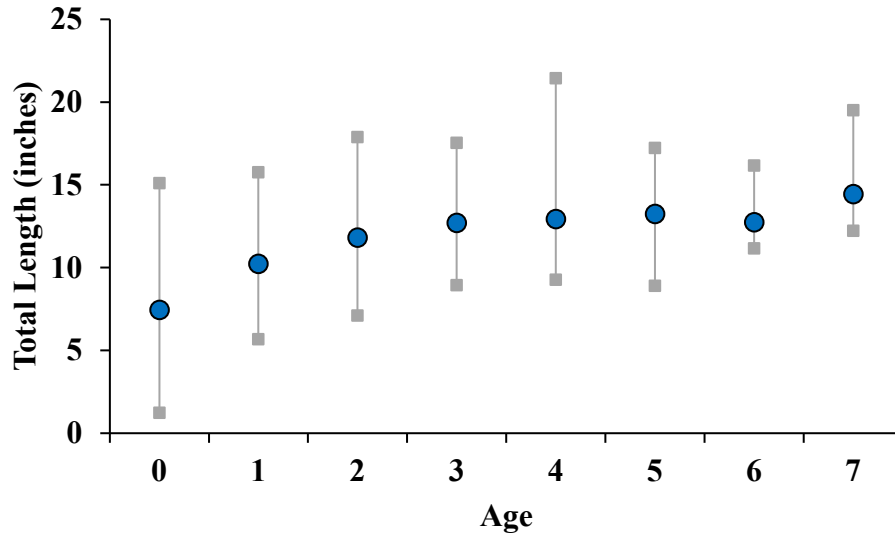


Figure 10: Kingfishes total length at age based on all samples collected, 1997–2021. Blue circles represent the mean size at a given age while the grey squares represent the minimum and maximum observed for each age.

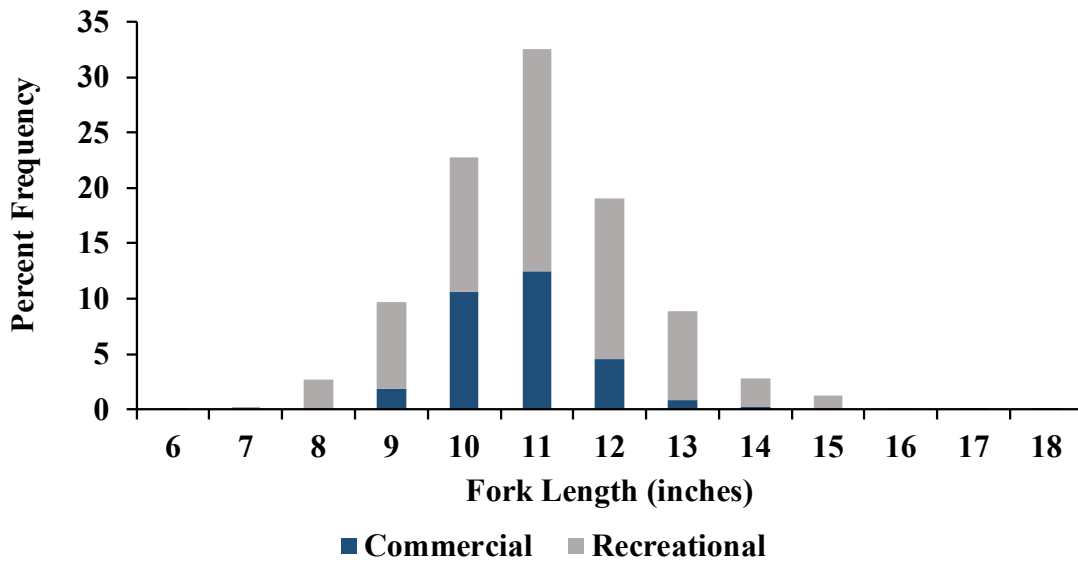


Figure 11: Commercial total length and recreational fork length frequency distribution of kingfishes harvested in 2021.

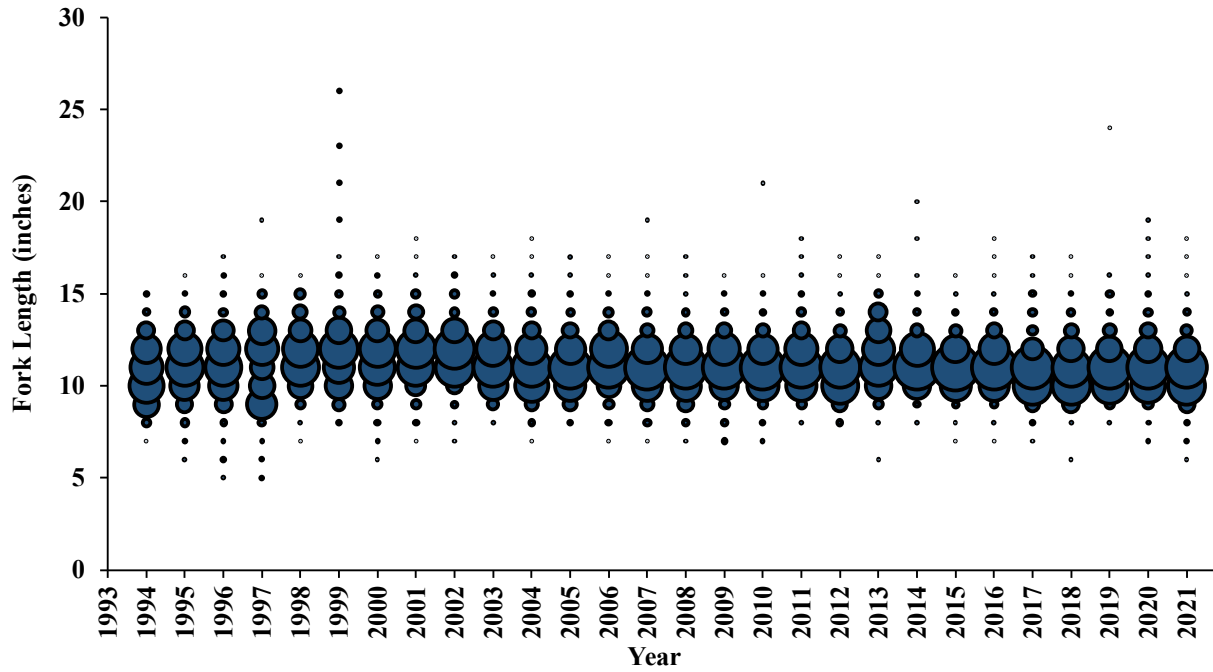


Figure 12: Commercial total length frequency of kingfishes harvested, 1994–2021. Bubble represents the proportion of fish at length.

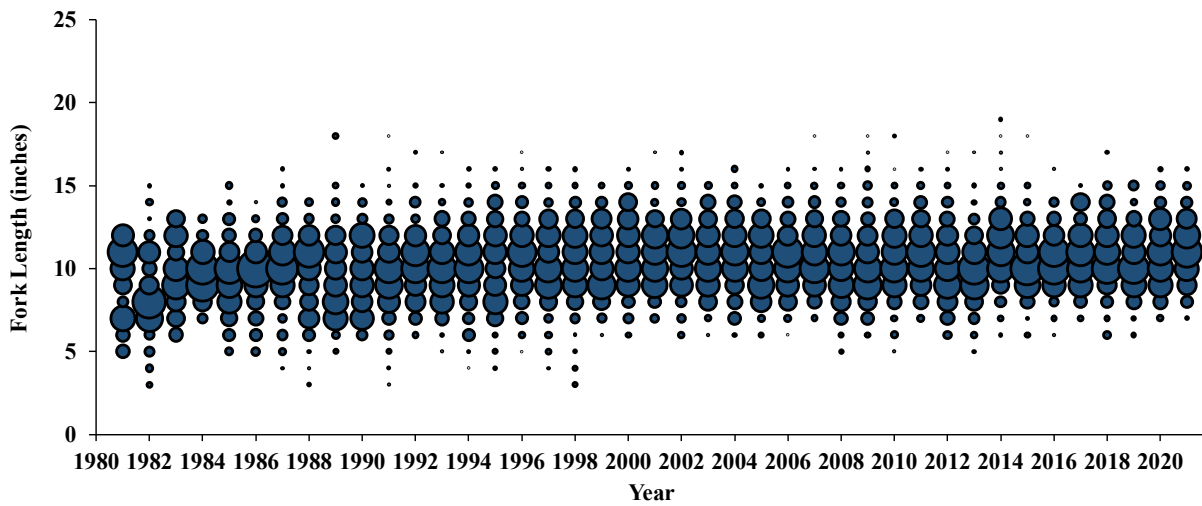


Figure 13: Recreational fork length frequency of kingfishes harvested, 1981–2021. Bubble represents the proportion of fish at length.