

**FISHERY MANAGEMENT PLAN UPDATE
KINGFISHES
AUGUST 2018**

STATUS OF THE FISHERY MANAGEMENT PLAN

Fishery Management Plan History

| | |
|------------------------|---------------|
| Original FMP Adoption: | November 2007 |
| Amendments: | None |
| Revisions: | None |
| Supplements: | None |
| Information Updates: | November 2015 |
| Schedule Changes: | None |
| Next Benchmark Review: | July 2020 |

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

Management Unit

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

Goal and Objectives

The goal of the 2007 Kingfish Fishery Management Plan is to determine the health of the stock and ensure the long-term sustainability for the kingfishes stock in North Carolina (NCDMF 2007). To achieve this goal, it is recommended that the following objectives be met:

1. Develop an objective management program that provides conservation of the resource and sustainable harvest in the fishery.
2. Ensure that the spawning stock is of sufficient capacity to prevent recruitment overfishing.
3. Address socio-economic concerns of all user groups.
4. Restore, improve, and protect critical habitats that affect growth, survival, and reproduction of the North Carolina stock of kingfishes.
5. Evaluate, enhance, and initiate studies to increase our understanding of kingfishes' biology and population dynamics in North Carolina.
6. Promote public awareness regarding the status and management of the North Carolina kingfishes stock.

STATUS OF THE STOCK

Life History

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

Stock Status

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

need for management at this time. A coast-wide stock assessment is a high research priority that needs to be addressed before biological reference points relative to overfished and overfishing can be determined.

Stock Assessment

The 2007 Kingfish FMP selected the use of trend analysis with management triggers as the management strategy to monitor the viability of the kingfish stock in North Carolina (NCDMF 2007). During the review of the 2007 Kingfish FMP as part of the 2015 FMP Information Update, best available data and techniques used for the trend analysis and management triggers were refined and modified to better assess population trends. The trend analysis incorporates management triggers to alert NCDMF and NCMFC to the potential need for management action based on stock conditions. The activation of any two management triggers (regardless of trigger category) two years in a row warrants further evaluation of the data and potential management action. The analysis is updated each year and all trends relative to management triggers are provided as part of this annual update. Current management triggers are based on fishery independent indices of abundance for Young-of-Year (YOY), adult fish, the proportion of catch greater than size at 50% maturity (L_{50}) and a relative fishing mortality index. YOY fish includes new fish that enter the population that year. L_{50} is the length at which 50% of the adult population is sexually mature and ready to spawn.

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

STATUS OF THE FISHERY

Current Regulations

For shrimp or crab trawls, there is a three-hundred-pound trip limit for kingfishes south of Bogue Inlet from December 1 through March 31 (NCMFC Rule 15A NCAC 03J .0202 (5)). No other harvest limits are in place specific to kingfish in any other fisheries.

Commercial Landings

Commercial landings for kingfishes include southern, northern, and Gulf kingfishes combined. Landings have fluctuated historically, but have been on an increasing trend since 2011. The 2017 landings increased 12 percent from 2016 (Figure 1). The vast majority of kingfishes landed are

from the ocean gill net fishery. The average landings from 2008 to 2017 were 555,941 pounds. Harvest of kingfishes is seasonal with peak landings in April and November. Peaks in landings coincide with seasonal movements of kingfishes along the Atlantic coast.

Recreational Landings

Recreational landings for kingfish include southern, northern, and Gulf kingfishes. Total recreational landings had been on an increasing trend from 1983 – 2015. In 2016 and 2017, recreational landings declined, with 2017 having the lowest landings since 1999 (Figure 2). Most kingfishes are landed from the ocean and the majority of the fish are caught from man-made structures, such as piers, jetties, or bridges, or from beaches. A smaller portion of kingfishes are caught in estuarine waters of the state and the majority of those fish are harvested by anglers fishing from private vessels. Recreational harvest of kingfishes is also seasonal with the majority of fish harvested during the spring and the fall, and lowest during the summer.

MONITORING PROGRAM DATA

Fishery-Dependent Monitoring

Kingfishes are sampled from a variety of commercial fishery surveys, including the estuarine long haul, ocean trawl, pound net, ocean gill net, estuarine gill net and ocean beach seine fisheries in N.C. A total of 50,984 kingfishes were measured from 2008 to 2017 (45,250 southern, 2,896 northern and 2,838 Gulf; Table 1). Mean length for southern kingfish ranged from 286 to 306 mm, with a minimum of 160 mm and a maximum of 558 mm. Mean length for northern kingfish ranged from 311 to 340 mm, with a minimum of 110 mm and a maximum of 445 mm. Mean length for Gulf kingfish ranged from 305 to 337 mm with a minimum of 199 mm and a maximum of 464 mm.

Recreational lengths are collected as part of Marine Recreational Informational Program (MRIP) by recreational port agents. A total of 7,976 kingfishes were measured from 2008 to 2017 (5,558 southern, 249 northern and 2,169 Gulf; Table 2). Mean length for southern kingfish ranged from 267 to 293 mm, with a minimum of 134 mm and a maximum of 505 mm. Mean length for northern kingfish ranged from 255 to 333 mm, with a minimum of 157 mm and a maximum of 406 mm. Mean length for Gulf kingfish ranged from 255 to 301 mm, with a minimum of 150 mm and a maximum of 463 mm.

Fishery-Independent Monitoring

Fishery-independent data are collected through the NCDMF Pamlico Sound Survey (Program 195), the Southeast Area Monitoring and Assessment Program – South Atlantic (SEAMAP-SA) Coastal Survey and the NCDMF Independent Gill Net Survey (Program 915). The Pamlico Sound Survey catches the most kingfishes of any of the NCDMF fishery independent sampling programs, and the majority of those are southern kingfishes. This survey has been running uninterrupted since 1987. From 1991 to present, the Pamlico Sound Survey has been conducted during the middle two weeks in June and September. The stations sampled are randomly selected from strata based upon depth and geographic location. Tow duration is 20 minutes at 2.5 knots

using the R/V Carolina Coast pulling double rigged demersal mongoose trawls. The sample area covers all of Pamlico Sound and its bays, as well as Croatan Sound up to the Highway 64 Bridge, the Pamlico River up to Blounts Bay, the Pungo River up to Smith Creek, and the Neuse River up to Upper Broad Creek. However, most kingfish are caught in Pamlico Sound proper, and very few from the Neuse, Pamlico, and Pungo rivers. The September portion of the Pamlico Sound Survey is used to calculate a YOY index of relative abundance because there are more southern kingfish collected in the fall, and more YOY are present in the catch at this time. The relative index derived from Program 195 survey was calculated using a stratified generalized linear model (GLM) approach. The Program 195 YOY relative abundance index peaked in 2009, but has been on a decreasing trend since 2013, and remained low in 2017 (Figure 3 Table 3).

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). Stations are randomly selected from a pool of stations in each stratum, and sampled using paired mongoose-type Falcon trawls with tow times of 20 minutes. 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 2017 (Figure 4; Table 3). The YOY index of relative abundance increased to well above the average in 2015, and has since returned to approximately the average in 2016 and 2017 (Figure 5; Table 3).

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. Each array of nets consists of floating gill nets in 30-yard segments of 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, and 6.5-inch stretched mesh, for a total of 240 yards of nets. Catches from an array of gill nets comprise a single sample; two samples (one shallow, one deep) totaling 480 yards of gill net are completed each trip. Gill nets are typically deployed within an hour of sunset and fished the following morning. Efforts are made to keep all soak times within 12 hours. Gill net sets are determined using a random stratified survey design, based on area and water depth. The L_{50} management trigger is based on a conservative proportion of adults in the population. This is the length at which 50 percent of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in length. One of the data sources for this management trigger comes from the Pamlico Sound Survey and has been stable over the time series (Figure 6).

Table 2 summarizes the age data for kingfishes (southern, northern, and Gulf), collected from 2008 through 2017. 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 9 years old. Northern kingfish ages ranges from 0 to 5 years old. Gulf

kingfish ages ranged from 0 to 7 years old. The modal ages ranged from 1 to 3 years for southern and Gulf kingfishes, and 0 to 2 for northern kingfish.

MANAGEMENT STRATEGY

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

The L_{50} management trigger is based on a conservative proportion of adults in the population. This is the length at which 50 percent of the population is mature. For southern kingfish, this is 8.25 inches (210 mm) in length. Data sources for this management trigger come from two fisheries-independent surveys; the summer component of the SEAMAP-SA Coastal 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 catch (commercial landings plus recreational harvest) divided by a fisheries-independent index of relative abundance. Here, catch (commercial landings plus recreational harvest) was divided by the SEAMAP-SA Coastal Survey spring index (Onslow, Raleigh, and Long bays, inner—shallow—strata) of relative abundance, given that the majority of catch occurs in the spring.

The kingfish management triggers are summarized as follows:

Biological Monitoring

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

Proportion of adults $\geq L_{50}$ for NCDMF Program 915 (Figure 6)

Proportion of adults $\geq L_{50}$ for SEAMAP-SA Coastal Survey summer (Figure 8)

→ If the proportion of adults $\geq L_{50}$ falls below 2/3 of the average proportion of adults $\geq L_{50}$ for the time series, then the trigger will be considered tripped.

Fisheries-Independent Surveys—Juvenile and Adult

NCDMF Program 195 September index of YOY relative abundance (Figure 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 2017), 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 2017), the trigger will be considered tripped.

A summary of the various management triggers by year is provided in Table 3. Bold values indicate years when a particular management trigger was activated. In 2017, one management trigger was activated and only one trigger (the YOY index from the September portion of Pamlico Sound Survey) was slightly below the management trigger threshold. No action is required at this time.

RESEARCH NEEDS

The division reviewed and prioritized the research recommendations during the 2015 FMP Information Update (NCDMF 2015). The prioritization of each research recommendation is designated as a high, medium, or low priority. A low ranking does not infer a lack of importance but is either already being addressed by others or provides limited information for aiding in management decisions. A high ranking indicates there is a substantial need, which may be time sensitive in nature, to provide information to help with management decisions. Proper management of the kingfishes resource cannot occur until some of these research needs are met. The research recommendations include:

- Conduct a coast-wide stock assessment of southern kingfish along the Atlantic Coast including estimation of biological reference points for sustainable harvest – HIGH (No action)
- Validate YOY and adult indices used in trend analysis – HIGH (UNCW has conducted seine surveys in the ocean to determine trends for all three species)
- Develop a fisheries-independent survey in the ocean for juvenile and adult kingfishes – HIGH (No action)
- Collect observer data from commercial fishing operations to estimate at-sea species composition of the catch, discard rates, and lengths – HIGH (NCDMF has observers collecting data at sea for the shrimp fishery, flounder gill net fishery and other fisheries)
- Improve recreational data collection, particularly the species composition of discards, discard rates and associated biological data – HIGH (Steps have been taken to improve sampling in recreational fisheries, including a carcass collection program)
- Improve dependent commercial data collection of more sample sizes for life history information – MEDIUM (NCDMF ageing study collects kingfish for life history data)
- Evaluate and potentially expand the NCDMF fishery-independent gill net survey to provide data on species composition, abundance trends, and population age structure by including additional areas of North Carolina's estuarine and nearshore ocean waters – MEDIUM (No action)
- Continue bycatch reduction device studies in the shrimp trawl fishery to decrease bycatch – MEDIUM (Ongoing research through NCDMF and various federal agencies)
- Determine stock structure using genetics of kingfishes along North Carolina and the Atlantic Coast – LOW (Grant approved for UNCW and NCDMF to use genetic markers to delineate the population structure)

- Develop tagging study to estimate natural and fishing mortality, to investigate stock structure, and to understand movement patterns – HIGH (No action)
- Collect histological data to develop maturity schedule with priority to southern kingfish – HIGH (NCDMF currently collecting histology samples in order to validate and update maturity schedules)
- Conduct an age validation study with priority to southern kingfish – HIGH (No action)
- Conduct study to estimate fecundity with priority to southern kingfish – MEDIUM (No action)
- Conduct study to identify spawning areas with priority for southern kingfish – MEDIUM (No action)
- Sample inlets and river plumes to determine the importance of these areas for kingfishes and other estuarine-dependent species – LOW (Sampling in the nearshore ocean through N.C. Adult Fishery Independent Survey was initiated in 2008 but discontinued in 2015. Gill net sampling in Cape Fear, New, Neuse, Pamlico, and Pungo rivers continues)
- Determine the effects of beach re-nourishment on kingfishes and their prey – LOW (Grant approved for UNCW to investigate effects of beach renourishment)
- Conduct a study to investigate how tidal stages and time of day influence feeding in kingfishes – LOW (No action)
- Increase the sample size of surveyed participants in the commercial kingfish fishery to better determine specific business characteristics and the economics of working in the fishery – LOW (NCDMF conducted a study of CRFL holders in 2009/2010)
- Update information on the participants in the recreational kingfish fishery – LOW (Socioeconomic study was conducted by NCDMF on piers)

FISHERY MANAGEMENT PLAN RECOMMENDATION

The NCDMF recommends maintaining the current review schedule.

LITERATURE CITED

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- NCDMF (North Carolina Division of Marine Fisheries). 2007. North Carolina Fishery Management Plan, Kingfishes. North Carolina Department of Environment and Natural Resources. North Carolina Division of Marine Fisheries. Morehead City, North Carolina. 235 pp.
- NCDMF. 2015. North Carolina Fishery Management Plan Information Update, Kingfishes. 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. Summary of length data sampled from the kingfish commercial fishery, 2008 - 2017.

| Southern Kingfish | | | | |
|-------------------|-------------|----------------|----------------|-----------------------|
| Year | Mean Length | Minimum Length | Maximum Length | Total Number Measured |
| 2008 | 290 | 160 | 446 | 9,956 |
| 2009 | 289 | 176 | 418 | 6,131 |
| 2010 | 293 | 170 | 558 | 3,927 |
| 2011 | 295 | 206 | 461 | 3,250 |
| 2012 | 290 | 203 | 433 | 4,646 |
| 2013 | 306 | 164 | 409 | 1,593 |
| 2014 | 300 | 211 | 532 | 3,732 |
| 2015 | 297 | 195 | 402 | 4,560 |
| 2016 | 303 | 181 | 437 | 3,353 |
| 2017 | 290 | 200 | 410 | 4,102 |
| Northern Kingfish | | | | |
| Year | Mean Length | Minimum Length | Maximum Length | Total Number Measured |
| 2008 | 319 | 110 | 423 | 335 |
| 2009 | 317 | 174 | 401 | 301 |
| 2010 | 321 | 228 | 406 | 186 |
| 2011 | 317 | 219 | 431 | 208 |
| 2012 | 322 | 197 | 445 | 318 |
| 2013 | 335 | 218 | 406 | 930 |
| 2014 | 339 | 277 | 423 | 156 |
| 2015 | 324 | 253 | 422 | 84 |
| 2016 | 315 | 224 | 432 | 213 |
| 2017 | 340 | 255 | 442 | 165 |
| Gulf Kingfish | | | | |
| Year | Mean Length | Minimum Length | Maximum Length | Total Number Measured |
| 2008 | 306 | 199 | 447 | 487 |
| 2009 | 313 | 251 | 406 | 351 |
| 2010 | 318 | 260 | 412 | 135 |
| 2011 | 337 | 219 | 455 | 366 |
| 2012 | 321 | 233 | 406 | 163 |
| 2013 | 328 | 246 | 443 | 545 |
| 2014 | 309 | 234 | 394 | 182 |
| 2015 | 324 | 268 | 413 | 161 |
| 2016 | 315 | 206 | 464 | 192 |
| 2017 | 313 | 238 | 425 | 256 |

Table 2. Summary of length data sampled from the kingfish recreational fishery, 2008 - 2017.

| Southern Kingfish | | | | |
|-------------------|-------------|----------------|----------------|-----------------------|
| Year | Mean Length | Minimum Length | Maximum Length | Total Number Measured |
| 2008 | 278 | 134 | 410 | 517 |
| 2009 | 277 | 160 | 459 | 689 |
| 2010 | 283 | 161 | 413 | 968 |
| 2011 | 277 | 185 | 418 | 583 |
| 2012 | 281 | 154 | 410 | 828 |
| 2013 | 267 | 156 | 402 | 370 |
| 2014 | 293 | 197 | 505 | 383 |
| 2015 | 273 | 162 | 475 | 258 |
| 2016 | 283 | 197 | 419 | 490 |
| 2017 | 274 | 199 | 392 | 472 |

| Northern Kingfish | | | | |
|-------------------|-------------|----------------|----------------|-----------------------|
| Year | Mean Length | Minimum Length | Maximum Length | Total Number Measured |
| 2008 | 257 | 216 | 365 | 20 |
| 2009 | 278 | 223 | 383 | 19 |
| 2010 | 284 | 220 | 390 | 20 |
| 2011 | 321 | 181 | 406 | 70 |
| 2012 | 298 | 211 | 383 | 58 |
| 2013 | 283 | 157 | 375 | 26 |
| 2014 | 280 | 225 | 342 | 2 |
| 2015 | 308 | 259 | 359 | 7 |
| 2016 | 255 | 200 | 299 | 3 |
| 2017 | 333 | 248 | 367 | 24 |

| Gulf Kingfish | | | | |
|---------------|-------------|----------------|----------------|-----------------------|
| Year | Mean Length | Minimum Length | Maximum Length | Total Number Measured |
| 2008 | 262 | 167 | 402 | 321 |
| 2009 | 255 | 183 | 428 | 203 |
| 2010 | 274 | 150 | 463 | 363 |
| 2011 | 296 | 191 | 427 | 223 |
| 2012 | 266 | 162 | 415 | 406 |
| 2013 | 265 | 152 | 438 | 180 |
| 2014 | 289 | 165 | 411 | 203 |
| 2015 | 301 | 215 | 406 | 63 |
| 2016 | 266 | 192 | 358 | 81 |
| 2017 | 286 | 191 | 401 | 126 |

Table 3. Kingfish age data collected from all sources (commercial and recreational fisheries and fishery independent sampling programs) combined, 2008 - 2017.

| Southern Kingfish | | | | |
|-------------------|-----------|-------------|-------------|-------------------|
| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
| 2008 | 2 | 0 | 9 | 324 |
| 2009 | 2 | 2 | 5 | 15 |
| 2010 | 2 | 1 | 5 | 163 |
| 2011 | 2 | 0 | 6 | 243 |
| 2012 | 1 | 1 | 6 | 228 |
| 2013 | 2 | 1 | 5 | 298 |
| 2014 | 3 | 0 | 5 | 269 |
| 2015 | 2 | 0 | 5 | 353 |
| 2016 | 1 | 0 | 7 | 530 |
| 2017 | 2 | 0 | 6 | 413 |
| Northern Kingfish | | | | |
| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
| 2008 | 0 | 0 | 5 | 50 |
| 2009 | 1 | 1 | 3 | 14 |
| 2010 | 2 | 1 | 3 | 4 |
| 2011 | 2 | 0 | 4 | 115 |
| 2012 | 1 | 0 | 3 | 17 |
| 2013 | 2 | 1 | 3 | 26 |
| 2014 | 2 | 2 | 2 | 1 |
| 2015 | 2 | 0 | 2 | 40 |
| 2016 | 1 | 1 | 4 | 49 |
| 2017 | 2 | 1 | 3 | 13 |
| Gulf Kingfish | | | | |
| Year | Modal Age | Minimum Age | Maximum Age | Total Number Aged |
| 2008 | 1 | 0 | 7 | 47 |
| 2009 | - | - | - | 0 |
| 2010 | 3 | 3 | 3 | 1 |
| 2011 | 2 | 1 | 6 | 28 |
| 2012 | 1 | 0 | 4 | 98 |
| 2013 | 1 | 1 | 4 | 44 |
| 2014 | 2 | 1 | 4 | 38 |
| 2015 | 2 | 0 | 4 | 78 |
| 2016 | 1 | 0 | 5 | 116 |
| 2017 | 2 | 0 | 5 | 167 |

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

| Year | BIOLOGICAL MONITORING | | | FISHERIES-INDEPENDENT SURVEYS | | | OTHER |
|-------------------------|-----------------------------|-------------------------------|------------------|-------------------------------|----------------|------------------|----------------|
| | Proportion of Adults >= L50 | | | YOY Indices | | Adult Index | Relative F |
| | Program 195 June | Program 915 July-September | SEAMAP Summer | Program 195 September | SEAMAP Fall | SEAMAP Summer | Relative F |
| 1987 | 0.611 | | | 1.1 | | | |
| 1988 | 0.450 | | | 1.3 | | | |
| 1989 | 0.300 | | 0.585 | 1.7 | 6.4 | 4.1 | 47,084 |
| 1990 | 0.563 | | 0.463 | 3.2 | 6.4 | 15 | 135,272 |
| 1991 | 0.667 | | 0.894 | 5.4 | 4.7 | 20 | 40,705 |
| 1992 | 0.429 | | 0.622 | 3.8 | 1.8 | 8.0 | 44,678 |
| 1993 | 0.543 | | 0.456 | 0.1 | 2.0 | 7.7 | 158,612 |
| 1994 | 0.794 | | 0.917 | 5.5 | 5.7 | 1.3 | 189,532 |
| 1995 | 0.440 | | 0.486 | 10 | 1.5 | 5.0 | 93,382 |
| 1996 | 0.872 | | 0.780 | 0.4 | 5.6 | 2.7 | 89,697 |
| 1997 | 0.589 | | 0.373 | 0.5 | 1.1 | 5.6 | 46,676 |
| 1998 | 1.000 | | 0.769 | 0.3 | 6.1 | 2.7 | 27,432 |
| 1999 | 0.920 | | 0.608 | 5.9 | 7.1 | 14 | 60,475 |
| 2000 | 0.733 | | 0.929 | 8.9 | 3.5 | 5.5 | 123,301 |
| 2001 | 0.660 | 0.983 | 0.303 | 5.9 | 2.8 | 12 | 51,543 |
| 2002 | 0.704 | 0.978 | 0.882 | 8.2 | 6.0 | 5.6 | 50,484 |
| 2003 | 0.872 | 0.978 | 0.645 | 7.0 | 2.5 | 9.3 | 16,509 |
| 2004 | 0.513 | 0.963 | 0.284 | 5.4 | 6.2 | 22 | 16,902 |
| 2005 | 0.594 | 0.970 | 0.666 | 2.9 | 3.7 | 9.2 | 24,747 |
| 2006 | 0.541 | 0.979 | 0.423 | 39 | 3.1 | 12 | 31,103 |
| 2007 | 0.343 | 1.000 | 0.521 | 10 | 4.4 | 3.6 | 84,264 |
| 2008 | 0.488 | 0.987 | 0.520 | 17 | 4.6 | 1.9 | 77,346 |
| 2009 | 0.586 | 1.000 | 0.389 | 39 | 1.5 | 8.3 | 74,052 |
| 2010 | 0.529 | 0.981 | 0.786 | 2.3 | 4.2 | 5.5 | 37,126 |
| 2011 | 0.432 | 1.000 | 0.507 | 28 | 16 | 9.3 | 45,170 |
| 2012 | 0.511 | 1.000 | 0.368 | 6.8 | 4.0 | 30 | 12,822 |
| 2013 | 0.659 | 0.941 | 0.558 | 29 | 5.5 | 19 | 13,797 |
| 2014 | 0.422 | 0.981 | 0.548 | 8.2 | 4.9 | 19 | 44,156 |
| 2015 | 0.534 | 0.980 | 0.550 | 10 | 93 | 16 | 21,375 |
| 2016 | 0.358 | 0.963 | 0.345 | 3.0 | 9.4 | 14 | 7,067 |
| 2017 | 0.503 | 0.953 | 0.684 | 5.1 | 6.9 | 7.2 | 5,464 |
| Threshold | <0.392 | <0.652 | <0.385 | <5.9 | <5.3 | <6.8 | >76,817 |
| Total Years | 31 | 17 | 29 | 31 | 29 | 29 | 29 |
| Years Trigger Activated | 3 | 0 | 5 | 16 | 16 | 11 | 8 |

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

| Management Strategy | Implementation Status |
|--|---|
| Fisheries Management | |
| The proposed management strategy for kingfishes in North Carolina is to 1) maintain a sustainable harvest of kingfishes over the long-term and 2) promote public education. The first strategy will be accomplished by developing management triggers based on the biology of kingfishes, landings of kingfishes, independent surveys, and requesting a stock assessment of kingfishes be conducted by Atlantic States Marine Fisheries Commission (ASMFC). The second strategy will be accomplished by the NCDMF working to enhance public information and education. | Accomplished |
| Recommend ASMFC conduct a coastwide stock assessment on sea mullet. | ASMFC determined a stock assessment for the kingfishes was not necessary due to the positive trends in SEAMAP southern kingfish CPUE. |
| Endorse additional research to reduce bycatch in the shrimp trawl fishery, primarily shrimp trawl characterization studies involving at-sea observers and investigations into fish excluder devices with a higher success rate for reducing the harvest and retention of kingfish in shrimp trawls. | Ongoing |
| Implement rule giving NCDMF director proclamation authority to manage kingfish. | Accomplished. Rule 15A NCAC 3M .0518 in effect since October 1, 2008 |
| Habitat and Water Quality | |
| The NCDCM should continue promoting the use of shoreline stabilization alternatives that maintain or enhance fish habitat. That includes using oyster cultch or limestone marl in constructing the sills (granite sills do not attract oyster larvae). | Endorsed through the Coastal Habitat Protection Plan (CHPP) |
| To ensure protection of kingfish nursery areas, fish-friendly alternatives to vertical stabilization should be required around primary and secondary nursery areas. | Endorsed through the CHPP |
| The location and designation of nursery habitats should be continued and expanded by the NCDMF. | Endorsed through the CHPP |
| No trawl areas and mechanical harvest prohibited areas should be expanded to include recovery/restoration areas for subtidal oyster beds and SAV. | Endorsed through the CHPP |
| Expansion and coordination of habitat monitoring efforts is needed to acquire data for modeling the location of potential recovery/restoration sites for oysters and SAV. | Endorsed through the CHPP |
| Any proposed stabilization project threatening the passage of kingfish larvae through coastal inlets should be avoided. | Endorsed through the CHPP |
| All coastal-draining river basins should be considered for NSW classification because they all deliver excess nutrients to coastal waters, regardless of flushing rate. | Endorsed through the CHPP |
| Efforts to implement phase II stormwater rules must be continued. | Endorsed through the CHPP |
| The EEP process should be extended to other development projects. | Endorsed through the CHPP |
| Reduce sediment and nutrient loading by addressing multiple sources, including: <ul style="list-style-type: none"> • improvement and continuation of urban and agricultural BMPs, • more stringent sediment controls on construction projects, and • implementation of additional buffers along coastal waters. | Endorsed through the CHPP |

FIGURES

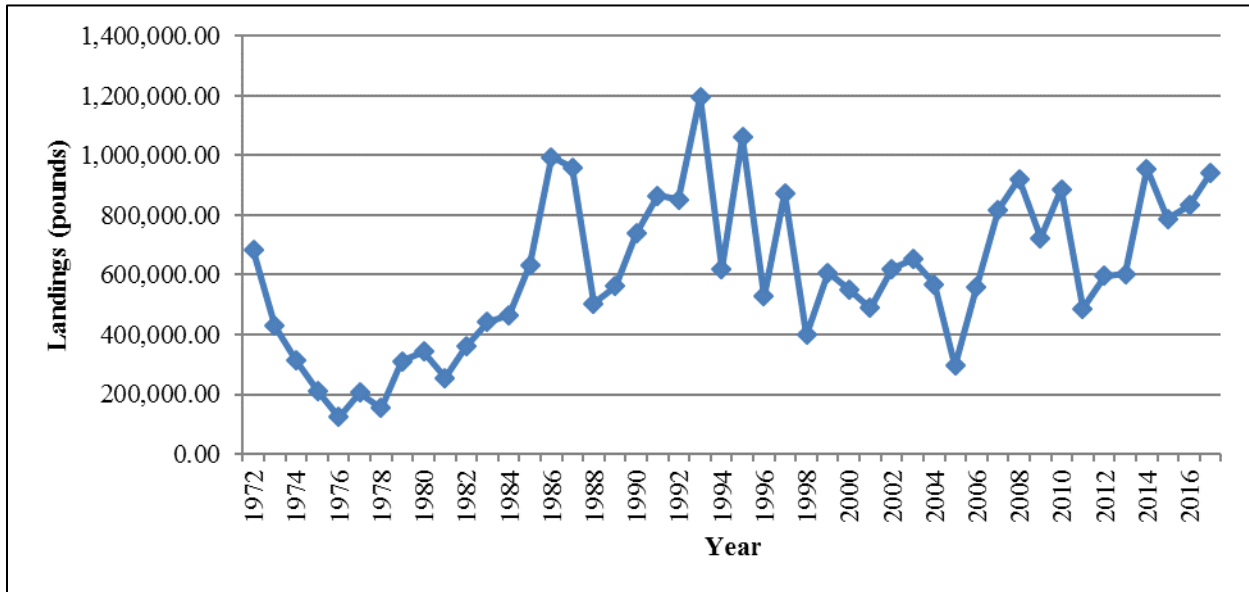


Figure 1. Commercial landings (pounds) of kingfishes (southern, northern, and Gulf combined) from 1972 to 2017.

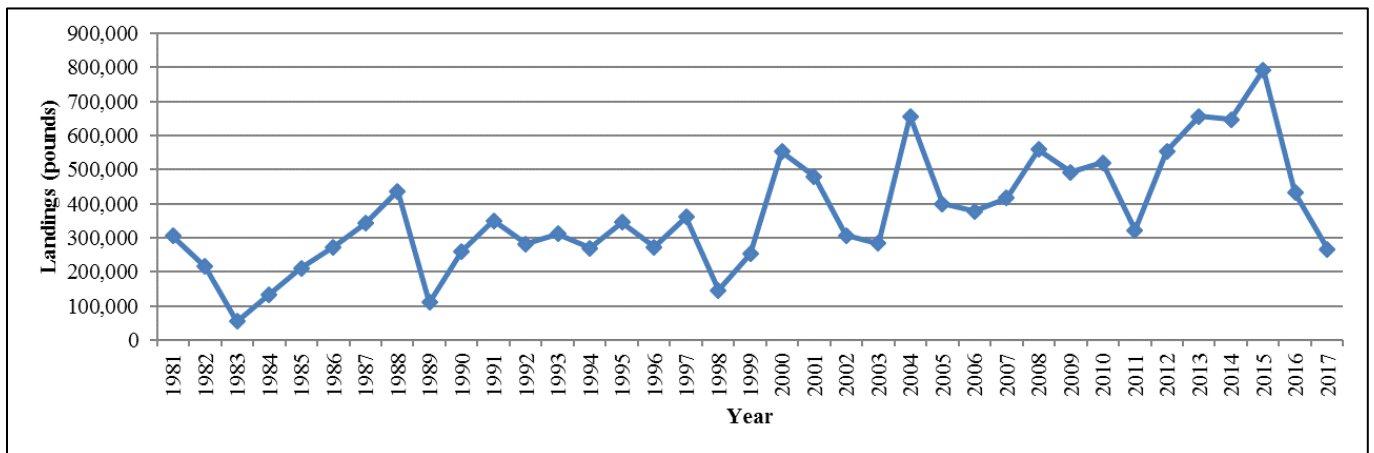


Figure 2. Recreational landings of kingfishes (southern, northern, and Gulf combined) from 1981 to 2017.

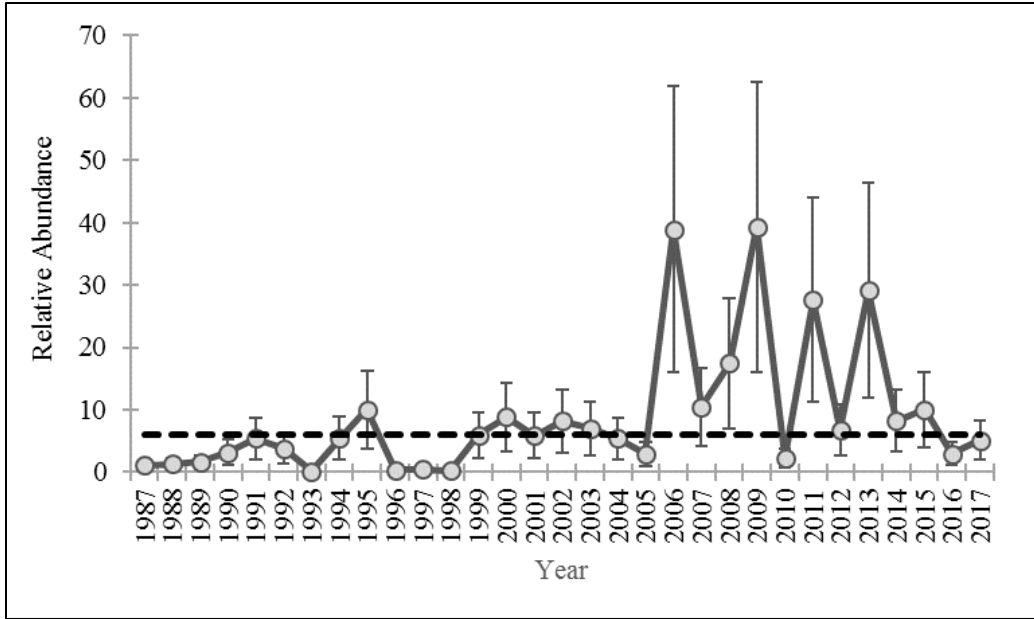


Figure 3. Annual index of relative YOY abundance for southern kingfish derived from the September component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 1987–2017. Dotted line represents 2/3 of the average of the time series.

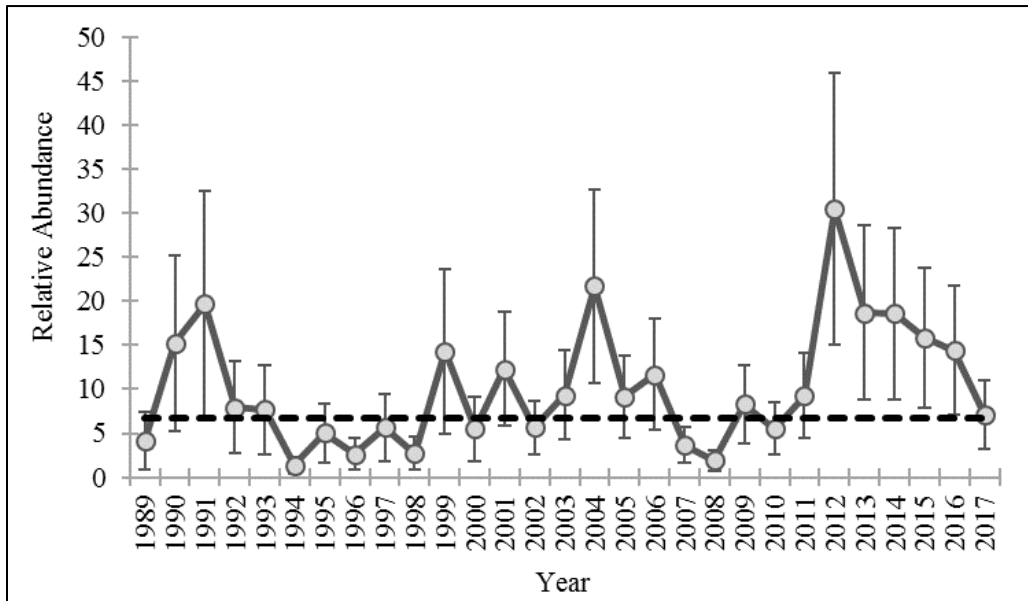


Figure 4. Annual index of relative adult abundance for southern kingfish derived from the summer component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2017. Dotted line represents 2/3 of the average of the time series.

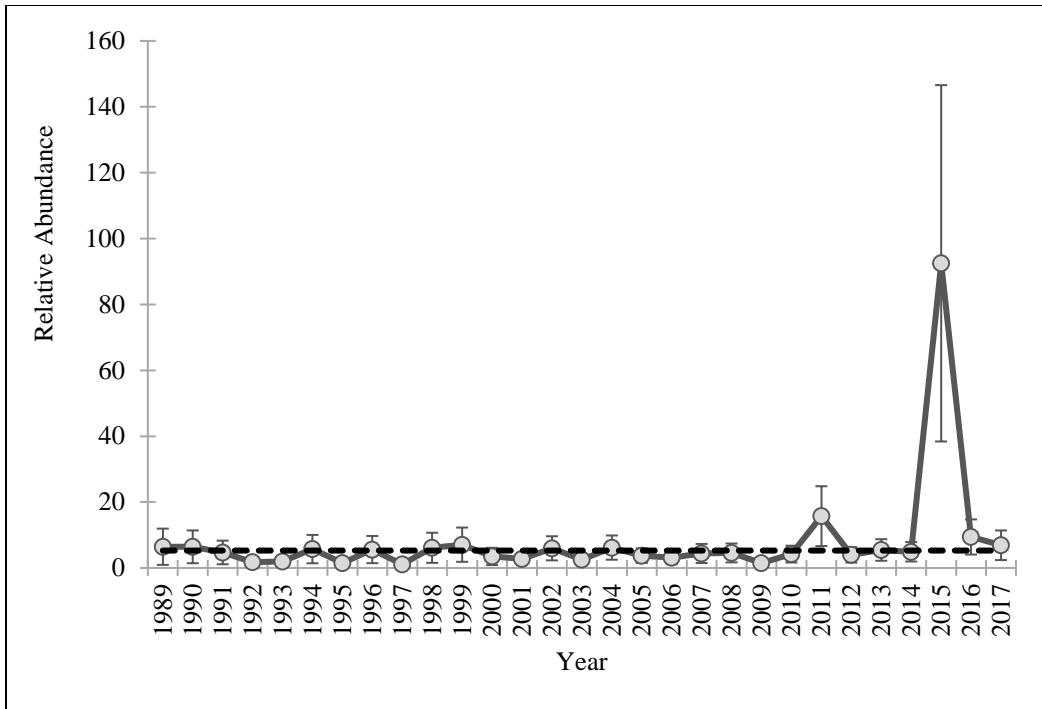


Figure 5. Annual index of relative YOY abundance for southern kingfish derived from the fall component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2017. Dotted line represents 2/3 of the average of the time series.

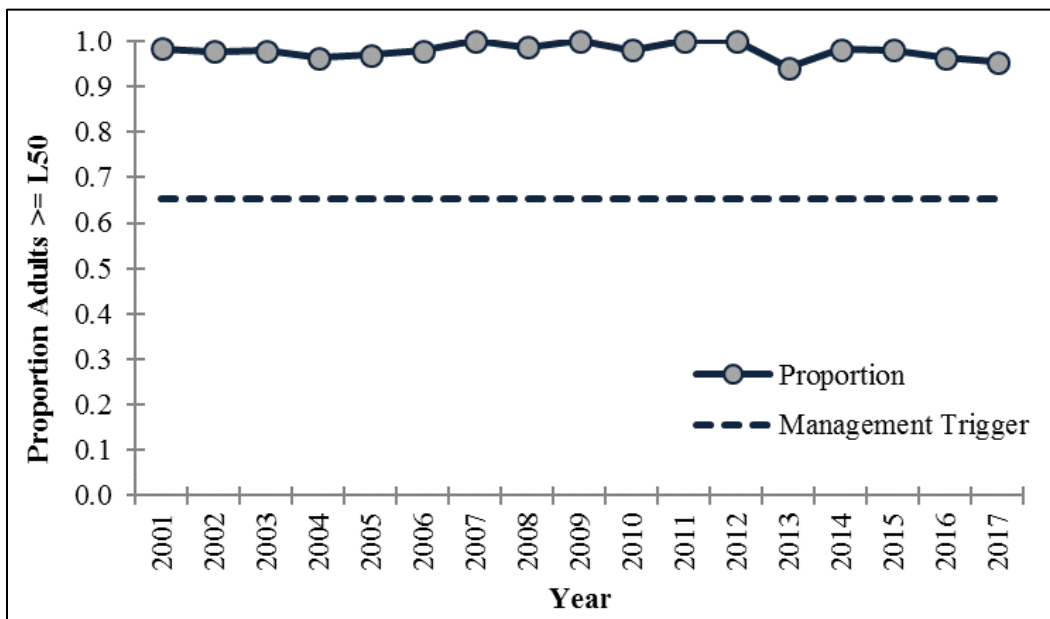


Figure 6. Annual proportions of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the July through September component of the NCDMF Program 915 survey (Pamlico Sound, deep strata only), 2001–2017. Dotted line represents 2/3 of the average of the time series.

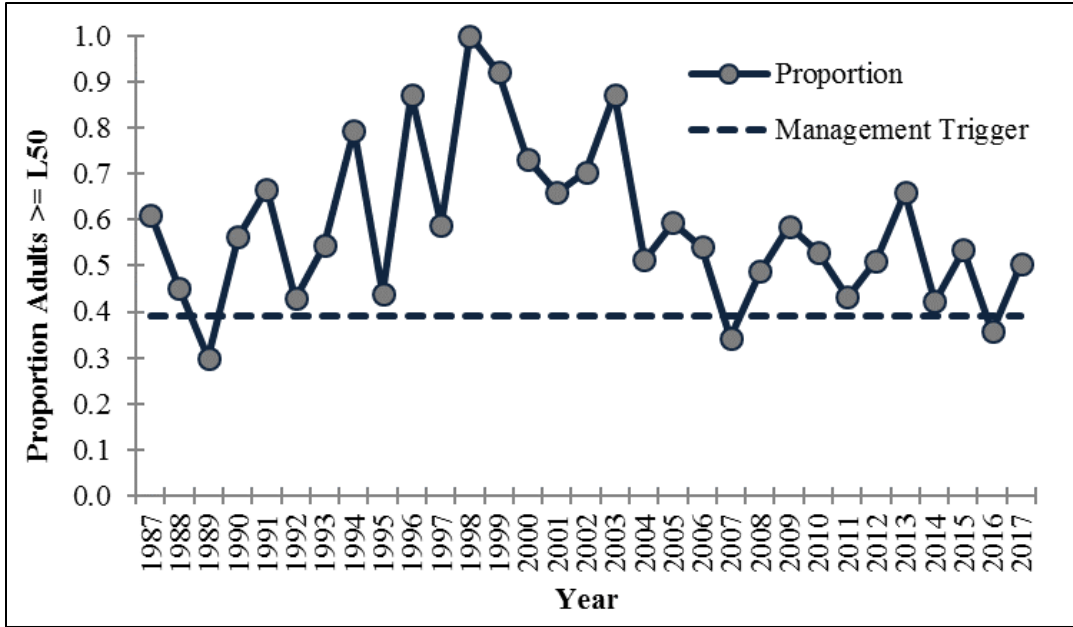


Figure 7. Annual proportions of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the June component of the NCDMF Program 195 survey (excluding strata from the Neuse, Pamlico, and Pungo rivers), 1987–2017. Dotted line represents 2/3 of the average of the time series.

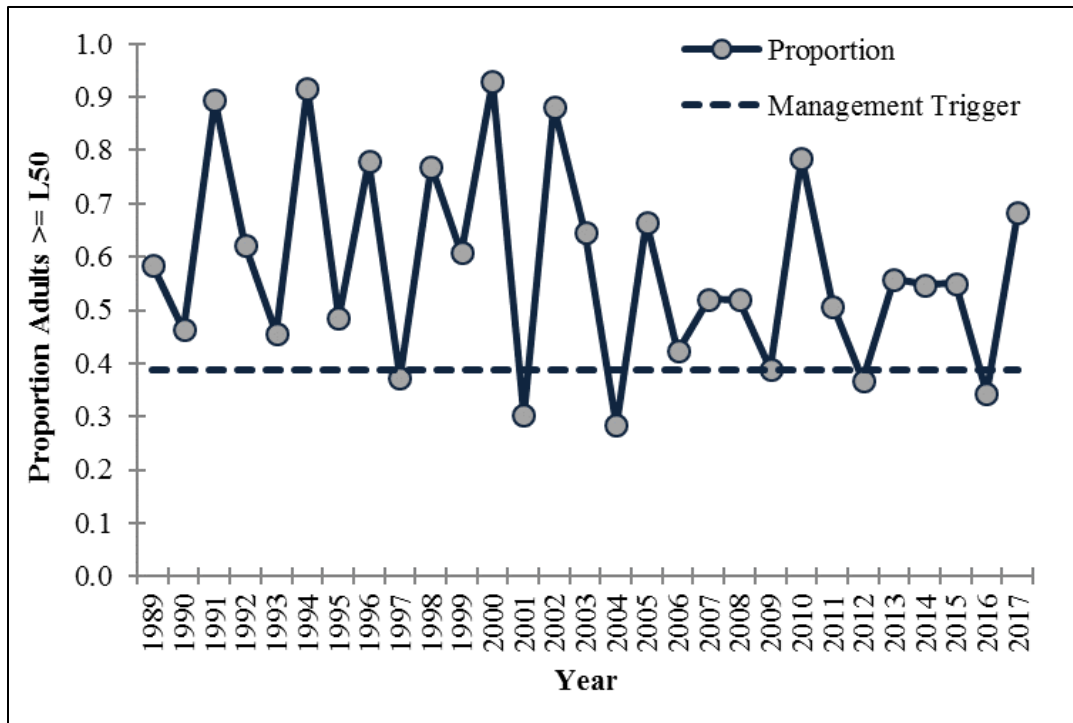


Figure 8. Annual proportions of adults (southern kingfish) greater than or equal to the length at 50% maturity occurring in the summer component of the SEAMAP-SA Coastal Survey (Onslow, Raleigh, and Long bays, inner—shallow—strata), 1989–2017. Dotted line represents 2/3 of the average of the time series.

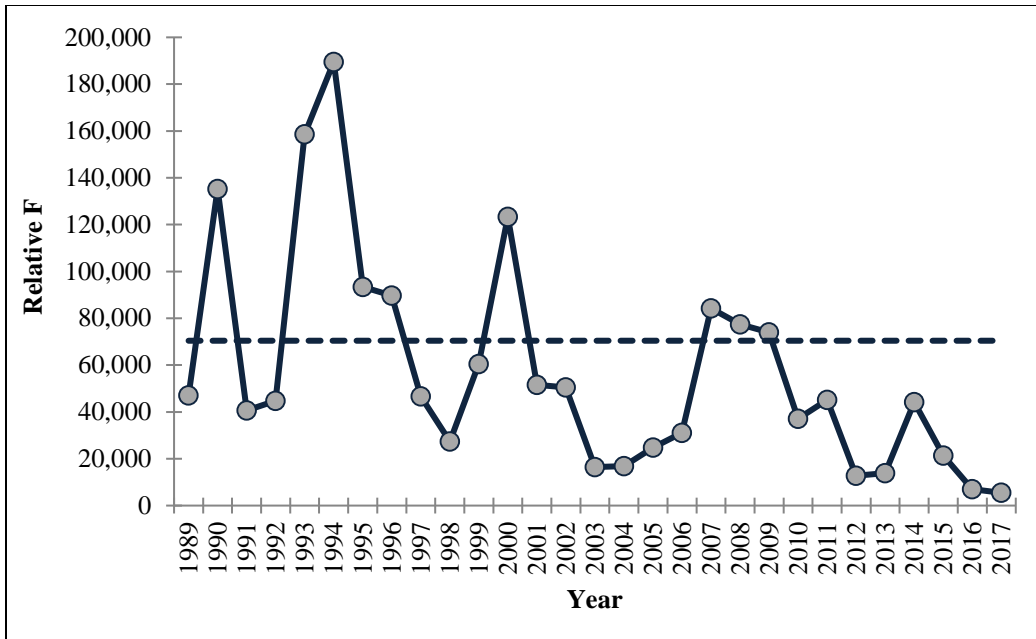


Figure 9. Relative F , as estimated as catch (commercial and recreational) divided by the SEAMAP-SA Coastal Survey spring index (Onslow, Raleigh, and Long bays, inner—shallow—strata) of relative abundance, 1989-2017. Dotted line represents $2/3$ of the average of the time series.