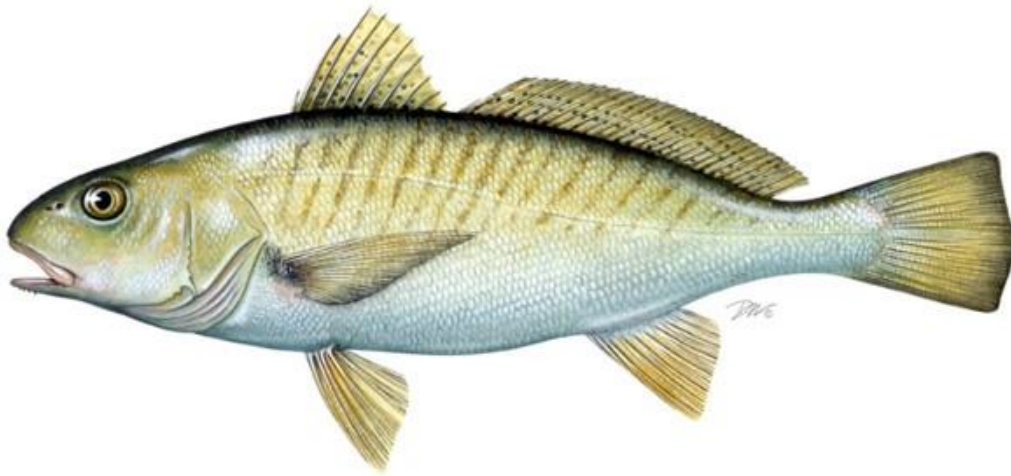


ATLANTIC STATES MARINE FISHERIES COMMISSION

REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR ATLANTIC CROAKER
(*Micropogonias undulatus*)

2017 FISHING YEAR



Prepared by the Plan Review Team

Approved by the South Atlantic State/Federal Fisheries Management
Board August 2018

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I. Status of the Fishery Management Plan

<u>Date of FMP Approval:</u>	Original FMP – October 1987
<u>Amendments:</u>	Amendment 1 – November 2005 (implemented January 2006) Addendum I – March 2011 Addendum II – August 2014
<u>Management Areas:</u>	The Atlantic coast distribution of the resource from New Jersey through Florida
<u>Active Boards/Committees:</u>	South Atlantic State/Federal Fisheries Management Board; Atlantic Croaker Technical Committee, Stock Assessment Subcommittee, and Plan Review Team; South Atlantic Species Advisory Panel

The Fishery Management Plan (FMP) for Atlantic Croaker was adopted in 1987 and included the states from Maryland through Florida (ASMFC 1987). In 2004, the South Atlantic State/Federal Fisheries Management Board (Board) found the recommendations in the FMP to be vague, and recommended that an amendment be prepared to define management measures necessary to achieve the goals of the FMP. The Interstate Fisheries Management Program Policy Board also adopted the finding that the original FMP did not contain any management measures that states were required to implement.

In 2002, the Board directed the Atlantic Croaker Technical Committee to conduct the first coastwide stock assessment of the species to prepare for developing an amendment. The Atlantic Croaker Stock Assessment Subcommittee developed a stock assessment in 2003, which was approved by a Southeast Data Assessment Review (SEDAR) panel for use in management in June 2004 (ASMFC 2005a). The Board quickly initiated development of an amendment and, in November 2005, approved Amendment 1 to the Atlantic Croaker FMP (ASMFC 2005b). The amendment was fully implemented by January 1, 2006.

The goal of Amendment 1 is to utilize interstate management to perpetuate the self-sustainable Atlantic croaker resource throughout its range and generate the greatest economic and social benefits from its commercial and recreational harvest and utilization over time. Amendment 1 contains four objectives:

- 1) Manage the fishing mortality rate for Atlantic croaker to provide adequate spawning potential to sustain long-term abundance of the Atlantic croaker population.
- 2) Manage the Atlantic croaker stock to maintain the spawning stock biomass above the target biomass levels and restrict fishing mortality to rates below the threshold.
- 3) Develop a management program for restoring and maintaining essential Atlantic croaker habitat.
- 4) Develop research priorities that will further refine the Atlantic croaker management program to maximize the biological, social, and economic benefits derived from the Atlantic croaker population.

Amendment 1 expanded the management area to include the states from New Jersey through Florida. Consistent with the stock assessment completed in 2004, the amendment defined two Atlantic coast management regions: the south-Atlantic region, from Florida through South Carolina; and the mid-Atlantic region, from North Carolina through New Jersey.

Amendment 1 established biological reference points (BRPs) to define an overfished and overfishing stock status for the mid-Atlantic region only. Reliable stock estimates and BRPs for the South Atlantic region could not be developed during the 2004 stock assessment due to a lack of data. The BRPs were based on maximum sustainable yield (MSY), and included threshold and target levels of fishing mortality (F) and spawning stock biomass (SSB): F threshold = F_{MSY} (estimated to be 0.39); F target = $0.75 \times F_{MSY}$ (estimated to be 0.29); SSB threshold = $0.7 \times SSB_{MSY}$ (estimated to be 44.65 million pounds); and SSB target = SSB_{MSY} (estimated to be 63.78 million pounds). An SSB estimate below the SSB threshold resulted in an overfished status determination, and an F estimate above the F threshold resulted in an overfishing status determination. The Amendment established that the Board would take action, including a stock rebuilding schedule if necessary, should the BRPs indicate the stock is overfished or overfishing is occurring.

Amendment 1 did not require any specific measures restricting recreational or commercial harvest of Atlantic croaker. States with more conservative measures were encouraged to maintain those regulations (Table 1). The Board was able to revise Amendment 1 through adaptive management, including any regulatory and/or monitoring requirements in subsequent addenda, along with procedures for implementing alternative management programs via conservation equivalency.

The Board initiated Addendum I to Amendment I at its August 2010 meeting, following the updated stock assessment, in order to address the proposed reference points and management unit. The stock assessment evaluated the stock as a coastwide unit, rather than the two management units established within Amendment I. In approving Addendum I, the Board endorsed consolidating the stock into one management unit, as proposed by the stock assessment. In addition, Addendum I established a procedure, similar to other species, by which the Board may approve peer-reviewed BRPs without a full administrative process, such as an amendment or addendum.

In August 2014, the Board approved Addendum II to the Atlantic Croaker FMP. The Addendum established the Traffic Light Approach (TLA) as the new precautionary management framework to evaluate fishery trends and develop management actions. The TLA was originally developed as a management tool for data poor fisheries. The name comes from assigning a color (red, yellow, or green) to categorize relative levels of population indicators. When a population characteristic improves, the proportion of green in the given year increases. Harvest and abundance thresholds of 30% and 60% were established in Addendum II, representing moderate and significant concern for the fishery. If thresholds for both population characteristics achieve or exceed a threshold for a three year period, then management action is enacted.

The TLA framework replaces the management triggers stipulated in Addendum I, which dictated that action should be taken if recreational and commercial landings dropped below 70% of the previous two year average. Those triggers were limited in their ability to illustrate long-term declines or increases in stock abundance. In contrast, the TLA approach is capable of better illustrating trends in the fishery through changes in the proportion of green, yellow, and red coloring. A recent TC report recommends several updates to the current TLA approach, that the Board is currently considering for incorporation (ASMFC 2018).

Addenda I and II did not add or change any management measures or requirements. The only existing requirement is for states to submit an annual compliance report by July 1st of each year that contains commercial and recreational landings as well as results from any monitoring programs that intercept Atlantic croaker.

II. Status of the Stock

The most recent stock assessment, conducted in 2017, upon peer review was not recommended for management use. Therefore, current stock status is unknown, although the Peer Review Panel did not indicate problems in the Atlantic croaker fishery that would require immediate management action. The Peer Review Panel did recommend continued evaluation of the fishery using the annual TLA.

The conclusions of the 2010 stock assessment (ASMFC 2010), which is the most recent assessment that was recommended by peer review for management use, were that Atlantic croaker was not experiencing overfishing and biomass had increased and fishing mortality decreased since the late 1980s. The 2010 assessment was unable to confidently determine stock status, particularly with regards to biomass, due to an inability to adequately estimate removals from discards of the South Atlantic shrimp trawl fishery. Improvements on estimation of these discards were made in the 2017 assessment, allowing the potential for shrimp trawl discards to be included as supplemental information with the annual TLA. Annual monitoring of shrimp trawl fishery discards is important because these discards represent a considerable proportion of Atlantic croaker removals, ranging from 7% to 78% annually during 1988-2008, according to the 2010 assessment (ASMFC 2010).

One of the primary reasons that the 2017 stock assessment did not pass peer review was due to conflicting signals in harvest and abundance metrics. Theoretically, increases in adult abundance should result in more fish available to be caught by the fishery; thus, fishing would be more efficient (greater catch per unit effort) and harvest would increase in a pattern similar to adult abundance. However, several of the most recent abundance indices have shown increases while harvest has declined to some of the lowest levels on record. One factor that has been identified to contribute to overestimates of adult abundance is an increase in the number of juveniles misclassified as adults in surveys that historically have typically caught adults. In response to this conflict, the Atlantic Croaker Technical Committee has recommended several changes to the annual TLA such as additional abundance indices and survey length-composition

information so that the TLA abundance metric would more accurately reflect trends in the stock.

III. Status of the Fishery

This report includes updated recreational estimates from the Marine Recreational Information Program's transition to the mail-based Fishing Effort Survey (FES) on July 1, 2018. Therefore, recreational estimates will likely be different from those shown in past FMP Reviews and state compliance reports (due annually on July 1) through 2018. Figure 1 shows coastwide recreational landings including estimates using both the previous Coastal Household Telephone Survey (CHTS) and FES calibration for comparison, but other figures, tables, and text will only show data based on the FES calibration. Data based on either survey can be referenced at: <https://www.st.nmfs.noaa.gov/st1/recreational/queries/>.

Total Atlantic croaker harvest from New Jersey through the east coast of Florida in 2017 is estimated at 9.0 million pounds (Tables 2 and 3, Figure 2). This represents an 81% decline in total harvest since the peak of 47.4 million pounds in 2003 (85% commercial decline, 74% recreational decline). The commercial and recreational fisheries harvested 46% and 54% of the total, respectively.

Atlantic coast commercial landings of Atlantic croaker exhibit a cyclical pattern, with low harvests in the 1960s to early 1970s and the 1980s to early 1990s, and high harvests in the mid-to-late 1970s and the mid-1990s to early 2000s (Figure 2). Commercial landings increased from a low of 3.7 million pounds in 1991 to 28.6 million pounds in 2001 (Table 2); however, landings have declined every year since 2010 to 4.1 million pounds in 2017, which registers below the 1950-2017 average of 12.1 million pounds. Within the management unit, the majority of 2017 commercial landings came from Virginia (71%) and North Carolina (24%). The Potomac River Fisheries Commission (PRFC) had the next highest level, with 2.8% of coastwide landings.

In 2018, recreational landings estimates from the Marine Recreational Information Program were updated based on effort estimates calibrated from the mail-based Fishing Effort Survey (Figure 1). From 1981-2017, recreational landings of Atlantic croaker from New Jersey through Florida have varied between 9.2 million fish (3.7 million pounds) and 36.2 million fish (17.4 million pounds; Tables 3 and 4, Figure 3). Landings generally increased until 2003, after which they showed a declining trend through 2017. The 2017 landings are estimated at 10.9 million fish and 4.8 million pounds. Virginia was responsible for 70% of the 2017 recreational landings, in numbers of fish, followed by Florida, South Carolina, and North Carolina (9%, 7%, and 6%, respectively).

The number of recreational releases generally increased over the time series until 2013, after which numbers of releases have decreased in every year through 2017 (Figure 3). However, percentage of released recreational catch has shown a slight increasing trend from the 1990s through 2017. In 2017, anglers released approximately 24 million fish, a decline from the 26 million fish released in 2016. Anglers released an estimated 69% of the croaker catch in 2017 (Figure 3).

IV. Status of Assessment Advice

A statistical catch-at-age (SCA) model was used in the 2010 Atlantic croaker stock assessment (ASMFC 2010). This model combines catch-at-age data from the commercial and recreational fisheries with information from fishery-independent surveys and biological information such as growth rates and natural mortality rates to estimate the size of each age class and the exploitation rate of the population. The assessment was peer reviewed by a panel of experts in conjunction with the Southeast Data, Assessment, and Review (SEDAR) process.

The Review Panel was unable to support some of the 2010 assessment results due to uncertainty regarding the estimation of Atlantic croaker discards in the shrimp trawl fishery, and the application of estimates in modeling. Specifically, model-estimated values of stock size, fishing mortality, and biological reference points are too uncertain for use; however, the trends in model-estimated parameters and ratio-based fishing F reference points are considered reliable. Despite the uncertainty in assessment results caused by shrimp trawl bycatch, the Review Panel concluded that it is unlikely that the stock is in trouble. The stock is not experiencing overfishing, biomass has been trending up, commercial catches are stable, and discards from the shrimp trawl fishery have been reduced.

A benchmark stock assessment was conducted in 2017, but was not recommended for management use due to uncertainty in biomass estimates resulting from conflicting signals among abundance indices and catch time series as well as sensitivity of model results to assumptions and model inputs. Because the most recent assessment was not recommended for management use, current stock status is unknown. One noted improvement in this assessment was in the estimation of Atlantic croaker discards by the shrimp trawl fishery. The Review Panel recommended incorporation of shrimp trawl discard estimates into the annual monitoring of Atlantic croaker through the TLA. The TC has recommended several changes to the TLA that would help resolve some of the conflict between harvest and abundance signals. In order to incorporate these changes, the Board would need to initiate an addendum to the Atlantic Croaker FMP.

V. Status of Research and Monitoring

There are no research or monitoring programs required of the states except for the submission of an annual compliance report. The following fishery-dependent (other than catch and effort data) and fishery-independent monitoring programs were reported in the 2017 compliance reports.

Fishery-Dependent Monitoring

- New Jersey: initiated biological monitoring of commercially harvested Atlantic croaker in 2006 in conjunction with ACCSP (2017 n=50 lengths, weights, and ages)
- Delaware: collects trip-based information on pounds landed, area fished, effort, and gear type data through mandatory monthly state logbook reports submitted by fishermen.
- Maryland: commercial pound net fishery biological sampling (2,037 lengths); seafood dealer sampling (767 lengths and 737 weights)
- PRFC: has a mandatory commercial harvest daily reporting system, with reports due weekly.

- Virginia: commercial fishery biological sampling (6,855 length measurements, 6,849 weight measurements, 313 otolith ages, and 690 sex determinations in 2017)
- North Carolina: commercial fishery biological sampling since 1982 for length (2017 n=6,021), weight, otolith, sex determination, and reproductive condition.
- South Carolina: recreational fishery biological sampling via SCDNR State Finfish Survey, MRIP, and a SCDNR-managed mandatory trip reporting system for licensed charter boat operators. In 2013, SCDNR took over its portion of MRIP data collection.
- Georgia: collects biological information, including length, sex, and maturity stage, through the Marine Sportfish Carcass Recovery Project (0 fish in 2017)
- Florida: commercial fishery biological sampling

Fishery-Independent Monitoring

- New Jersey: 3 nearshore ocean (within 12 nm) juvenile trawl surveys (New Jersey Ocean Trawl Survey, 1988-present: 2017 CPUE was well below time-series average but above 2016 value; nearshore Delaware Bay juvenile trawl survey, 1991-present: 2017 survey index was well below time series average; Delaware River juvenile seine survey, 1980-present: 2016 survey index was below time series average)
- Delaware: offshore Delaware Bay adult finfish trawl survey (1990-present; 2017 #/tow = 5.89; 165% increase in relative abundance from 2016 index, below mean for time series); nearshore Delaware Bay juvenile finfish trawl survey (1980-present; 2017 index decreased from 1.17 in 2016 to 0.81; Inland Bays index decreased from 0.43 in 2016 to 0.30 in 2017).
- Maryland: summer gill net survey was initiated in 2013 on lower Choptank (53 fish were captured in 2017); Atlantic coast bays juvenile otter trawl survey (standardized from 1989-present; 2017 GM of 0.38 fish/hectare is the second lowest value of the 29-year time series); Chesapeake Bay juvenile trawl index (standardized from 1989-present; CPUE increased from 0.81 in 2016 to 2.35 in 2017).
- PRFC: Maryland DNR conducts an annual juvenile beach haul seine survey in the Potomac River (1954-present; YOY GM increased from 0.27 in 2016 to 0.35 in 2017).
- Virginia: Virginia Institute of Marine Science (VIMS) Juvenile Finfish and Blue Crab Trawl Survey (1988-present; 2017 index was 15.19, which is down from the 2016 value of 27.41).
- North Carolina: Pamlico Sound juvenile trawl survey (1987-present; 2017 juvenile abundance index (mean number of individuals/tow) was 1,172.3, the second-highest value in the time series)
- South Carolina: estuarine electroshock survey for juveniles (2001-present; 2017 CPUE increased by 80% since 2016, above the long-term mean); SEAMAP shallow water (15-30 ft) trawl survey from Cape Hatteras to Cape Canaveral (1989-present; 2017 CPUE decreased by 36% from 2016; inshore estuarine trammel net survey for adults (May-September, 1991-present; 2017 CPUE increased 178% from 2016); SCECAP estuarine trawl survey (1999-present, primarily targets juveniles, 2017 CPUE decreased from 2016 by 47%).
- Georgia: Marine Sportfish Population Health Survey (trammel and gill net surveys in the Altamaha River Delta and Wassaw estuary, 2002-present; 2017 trammel net index (GM #/standard net set): 0.1, gill net index: 0.4); Ecological Monitoring Survey (trawl, 2003-present; 2017 CPUE (#/tow) decreased from 95.35 in 2016 to 78.8 in 2016).

- Florida: juvenile seine survey (2002-present; 2017 index decreased by 23% from 2016); juvenile trawl survey (2002-present; 2017 index decreased by 9% from 2016); adult haul seine survey (2001-present; 2017 index value increased by 2% from 2016)

The Northeast Fishery Science Center (NEFSC) performs a randomly stratified groundfish survey along the U.S. east coast. Atlantic croaker are one of the main species caught throughout much of the survey area and, since the surveys started in 1972, it provides a long term data set. Regionally, mean CPUE (catch-per-unit-effort) of Atlantic croaker has increased from north to south. Since 1994, there has been an increase in annual catch variability. Catch levels in 2016 decreased 34.6% from 2015 and were above the long term mean. The NEFSC survey was not carried out in 2017 due to mechanical issues with the RV Bigelow. While there will be a survey in 2018, that particular data metric was not available in 2017. In order to maintain the usefulness of the NEFSC index, an initial placeholder value was utilized for 2017 that was calculated as the mean annual catch from the three previous years (2014-2016). The TC has not had a chance to address this specific issue to date and may modify it in the future if a better method or consensus is reached on how to maintain an index value for 2017.

VI. Status of Management Measures and Issues

Fishery Management Plan

Amendment 1 was fully implemented by January 1, 2006, and provided the management plan for the 2009 fishing year. There are no interstate regulatory requirements for Atlantic croaker. Should regulatory requirements be implemented in the future, all state programs must include law enforcement capabilities adequate for successfully implementing the regulations. Addendum I to Amendment 1 was initiated in August 2010 and approved in March 2011, in order to 1) revise the biological reference points to be ratio-based, and 2) remove the distinction of two regions within the management unit, based on the results of the 2010 stock assessment. Addendum II was approved August 2014 and established the TLA management framework for Atlantic croaker in order to better illustrate long-term trends in the fishery.

Traffic Light Approach

Addendum II established the TLA as the new management framework for Atlantic croaker. Under this management program, if thresholds for both population characteristics (harvest and adult abundance) achieve or exceed the proportion of threshold for the specified three year period, management action will be taken.

Analysis of the harvest composite index for 2017 shows that this population characteristic tripped for a fifth consecutive year (Figure 4). Recreational harvest was estimated based on MRIP's mail-based Fishing Effort Survey calibration. The mean proportion of red color from 2014-2016 was 69%, exceeding the 60% threshold. The harvest composite index was comprised of commercial and recreational landings. Both commercial and recreational indices would have individually tripped in 2017 at the 30% level. The TLA for commercial landings was above the 60% threshold in 2017, and has exceeded 60% in three consecutive years.

The abundance composite TLA index was broken into two components based on age composition. The adult composite index was generated from the NEFSC and SEAMAP surveys, since the majority of Atlantic croaker captured in those surveys were ages 1+. The juvenile composite index was generated from the North Carolina (NC) Program 195 and VIMS surveys because these two captured primarily young-of-the-year Atlantic croaker.

Two of four TLA abundance indices showed increases in 2017 with no red proportion. The NEFSC survey was not conducted in 2017 due to mechanical issues with the RV Bigelow. The 2017 value for this index is estimated in this report as the 3-year average of the 2014-2016 index values. The adult composite TLA characteristic (Figure 5) did not trigger in 2017 with no red proportion and no red in the five previous years. The juvenile composite characteristic index (Figure 6) was fifty percent red and fifty percent green, due to a large decrease in the VIMS index and a large increase in the NC Program 195 survey. The higher annual variability for the different color proportions in the juvenile composite characteristic, in comparison to the adult composite characteristic, is likely a reflection annual recruitment variability rather than population trends.

Overall, management triggers were not tripped in 2017 since both population characteristics (harvest and adult abundance) were not above the 30% threshold for the 2015-2017 time period. This continues a trend of disconnect between the harvest and abundance indices since the mid-2000s, with the harvest metric generally decreasing and abundance metric generally increasing.

De Minimis Requests

States are permitted to request *de minimis* status if, for the preceding three years for which data are available, their average commercial landings or recreational landings (by weight) constitute less than 1% of the coastwide commercial or recreational landings for the same three year period. A state may qualify for *de minimis* in either its recreational or commercial sector, or both, but will only qualify for exemptions in the sector(s) that it qualifies for as *de minimis*. Amendment 1 does not include any compliance requirements other than annual state reporting, which is still required of *de minimis* states, thus *de minimis* status does not exempt states from any measures.

In the annual compliance reports, the following states requested *de minimis* status: Delaware (commercial fishery), South Carolina (commercial fishery), Georgia (commercial fishery), and Florida (commercial fishery). The commercial and recreational *de minimis* criteria for 2017 are based on 1% of the average coastwide 2015-2017 landings in each fishery: 58,000 pounds for the commercial fishery and 58,400 pounds for the recreational fishery. The Delaware commercial fishery qualifies for *de minimis* status, but landings are confidential. The South Carolina commercial fishery qualifies for *de minimis* status with a three-year average of 279 pounds. The Georgia commercial fishery qualifies for *de minimis* status with a three-year average of zero pounds. The Florida commercial fishery qualifies for *de minimis* status with a three-year average of 46,441 pounds.

Changes to State Regulations

In 2017, North Carolina enacted several gill net restrictions for coastal waters pertaining to area closures/openings, gear modifications, and attendance rules to avoid interactions with endangered species or bycatch species. These restrictions may indirectly affect the harvest and bycatch of Atlantic croaker and are defined by North Carolina Proclamations: M-24-2017, M-20-2017, M-23-2017, FF-47-2017, M-19-2017, M-18-2017, M-17-2017, M-14-2017, M-13-2017, M-12-2017, M-11-2017, M-10-2017, M-9-2017, M-8-2017, M-7-2017, M-6-2017, M-5-2017, M-4-2017, M-3-2017, M-2-2017, and M-1-2017.

In 2017, the Georgia General Assembly approved the addition of species endorsements to commercial fishing licenses (O.C.G.A 27-2-23 (6) and (11)). Species endorsements regulations were adopted by the Board of Natural Resources in December 2017 and became effective January 2018 (Board of Natural Resources Rule 391-2-4-.17). The endorsements effectively replaced Letters of Authorization.

In Georgia, a new seafood dealer license was also implemented in 2018 through the same 2017 legislation for endorsements (O.C.G.A 27-2-23 (8A)). Seafood dealers are defined as “any person or entity, other than the end-consumer, who purchases seafood products from a harvester unless the harvester is a licensed seafood dealer”. Georgia requires seafood dealers and commercial fishermen to be properly licensed as described by O.C.G.A Sections 27-4-118, 27-4-136, and Board of Natural Resources Rule 391-2-4-.09. Commercial harvesters fishing in Georgia waters and/or unloading seafood products must possess a commercial fishing license and the appropriate species endorsements. A harvester is required to have a dealer’s license if he is selling his catch to end consumers.

Atlantic Croaker Habitat

In winter of 2017, the ASMFC Habitat Committee released *Atlantic Sciaenid Habitats: A Review of Utilization, Threats, and Recommendations for Conservation, Management, and Research*, which outlines the habitat needs of Atlantic croaker at different life stages (egg, larval, juvenile, adult). This report also highlights threats and uncertainties facing these ecological areas and identifies Habitat Areas of Particular Concern. It can be found online at:

http://www.asmfc.org/files/Habitat/HMS14_AtlanticSciaenidHabitats_Winter2017.pdf.

Bycatch Reduction

Atlantic croaker is subject to both direct and indirect fishing mortality. Historically, croaker ranked as one of the most abundant bycatch species of the south Atlantic shrimp trawl fishery, resulting in the original FMP’s recommendation that bycatch reduction devices (BRDs) be developed and required in the shrimp trawl fishery. Since then, the states of North Carolina through Florida have all enacted requirements for the use of BRDs in shrimp trawl nets in state waters, reducing croaker bycatch from this fishery (ASMFC 2010). However, bycatch and discard monitoring from the shrimp trawl fishery have historically been inadequate, resulting in a major source of uncertainty for assessing this stock, as well as other important Mid- and South Atlantic species. Most of the discarded croaker are age-0 and thus likely have not yet reached maturity (ASMFC 2010). The North Carolina Division of Marine Fisheries conducted a

two-year study, published in 2015, to collect bycatch data from state shrimp trawlers. It found that Atlantic croaker represent between 34-49% of the total observed finfish bycatch by weight in estuarine waters and between 20-42% in ocean waters. The at-net mortality for Atlantic croaker was found to be 23% (Brown 2015). These data will be valuable for incorporating estimates of removals in future stock assessments.

Atlantic croaker are also discarded from other commercial fishing gears, primarily due to market pressures and few restrictions on croaker harvest at the state level. The National Oceanic and Atmospheric Administration (NOAA) Fisheries Pelagic Observer Program provides data to estimate these discards for use in assessments; however, the time series is limited and only discards from gill nets and otter trawls could be estimated for the 2010 assessment based on the available data. Since 1988, estimated discards have fluctuated between 94 and 15,176 mt without trend, averaging 2,503 mt (ASMFC 2010).

Atlantic croaker is also a major component of the scrap/bait fishery. Landings from this fishery are not reported at the species level, except in North Carolina, which has a continuous program in place to sample these landings and enable estimation of croaker scrap landings for use in the stock assessment. As part of the 2010 stock assessment, North Carolina estimated the scrap/bait landings, which have declined in recent years, from a high of 1,569 mt in 1989 to a low of 84 mt in 2008, primarily due to restrictions placed on fisheries producing the highest scrap/bait landings (ASMFC 2010). Regulations instituted by North Carolina include a ban on flynet fishing south of Cape Hatteras, incidental finfish limits for shrimp and crab trawls in inside waters, minimum mesh size restrictions in trawls, and culling panels in long haul seines.

South Carolina has also begun a state monitoring program to account for scrap landings. The state initiated a bait harvester trip ticket program for all commercial bait harvesters licensed in South Carolina. The impetus for this program is to track bait usage of small sciaenid species (croaker, spot, and whiting) as well as other important bait species.

Several states have implemented other commercial gear requirements that further reduce bycatch and bycatch mortality, while others continue to encourage the use of the BRD devices. NOAA Fisheries published a notice on June 24, 2011 for public scoping in the Federal Register to expand the methods for reducing bycatch interactions with sea turtles, which may have additional effects on the bycatch of finfish like Atlantic croaker in trawls (76 FR 37050). Continuing to reduce the quantity of sub-adult croaker harvested should increase spawning stock biomass and yield per recruit.

Atlantic croaker are also subject to recreational discarding. The percentage of Atlantic croaker released alive by recreational anglers has generally increased over time. Discard mortality was estimated to be 10% for the 2010 stock assessment (ASMFC 2010). The use of circle hooks and appropriate handling techniques can help reduce mortality of released fish.

VII. Implementation of FMP Compliance Requirements for 2015

The PRT finds that all states have fulfilled the requirements of Amendment 1.

VIII. Recommendations

Management and Regulatory Recommendations

- Consider initiation of an addendum to incorporate TC-recommended changes to the annual TLA.
- Encourage the use of circle hooks to minimize recreational discard mortality.
- Consider approval of the *de minimis* requests from Delaware, South Carolina, Georgia, and Florida for their commercial fisheries.
- Consider the basic research and monitoring information needed for informed management in light of the budgetary constraints limiting all state governments.

Research and Monitoring Recommendations

High Priority

- Increase observer coverage for commercial discards, particularly the shrimp trawl fishery. Develop a standardized, representative sampling protocol for observers to use to increase the collection of individual lengths and ages of discarded finfish.
- Describe the coast-wide distribution, behavior, and movement of croaker by age, length, and season, with emphasis on collecting larger, older fish.
- Continue state and multi-state fisheries-independent surveys throughout the species range and subsample for individual lengths and ages. Ensure NEFSC trawl survey continues to take lengths and ages. Examine potential factors affecting catchability in long-term fishery independent surveys.
- Investigate environmental covariates in stock assessment models including climate cycles (e.g., Atlantic Multi-decadal Oscillation, AMO, and El Niño Southern Oscillation, El Niño) and recruitment and/or year class strength, spawning stock biomass, stock distribution, maturity schedules, and habitat degradation.
- Continue to develop estimates of length-at-maturity and year-round reproductive dynamics throughout the species range. Assess whether temporal or density-dependent shifts in reproductive dynamics have occurred.
- Re-examine historical ichthyoplankton studies for an indication of the magnitude of estuarine and coastal spawning, as well as for potential inclusion as indices of spawning stock biomass in future assessments. Pursue specific estuarine data sets from the states (NJ, VA, NC, SC, DE, MD) and coastal data sets (MARMAP, EcoMon).
- Investigate the relationship between estuarine nursery areas and their proportional contribution to adult biomass, i.e., are select nursery areas along Atlantic coast ultimately contributing more to SSB than others, reflecting better quality juvenile habitat?

Medium Priority

- Conduct studies of discard mortality for recreational and commercial fisheries by each gear type in regions where removals are highest.

- In the recreational fishery, develop sampling protocol for collecting lengths of discarded finfish and collect otolith age samples from retained fish.
- Encourage fishery-dependent biological sampling, with proportional landings representative of the distribution of the fisheries. Develop and communicate clear protocols on truly representative sampling.
- Quantify effects of BRDs and TEDs implementation in the shrimp trawl fishery by examining their relative catch reduction rates on Atlantic croaker.
- Utilize NOAA Fisheries Ecosystem Indicators bi-annual reports to consider folding indicators into the assessment; identify mechanisms for how environmental indicators affect the stock.
- Encourage efforts to recover historical landings data, determine whether they are available at a finer scale for the earliest years than are currently reported.
- Collect data to develop gear-specific fishing effort estimates and investigate methods to develop historical estimates of effort.
- Develop gear selectivity studies for commercial fisheries with emphasis on age 1+ fish.
- Conduct studies to measure female reproductive output at size and age (fecundity, egg and larval quality) and impact on assessment models and biomass reference points.
- Develop and implement sampling programs for state-specific commercial scrap and bait fisheries in order to monitor the relative importance of Atlantic croaker. Incorporate biological data collection into the program.

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X. Figures

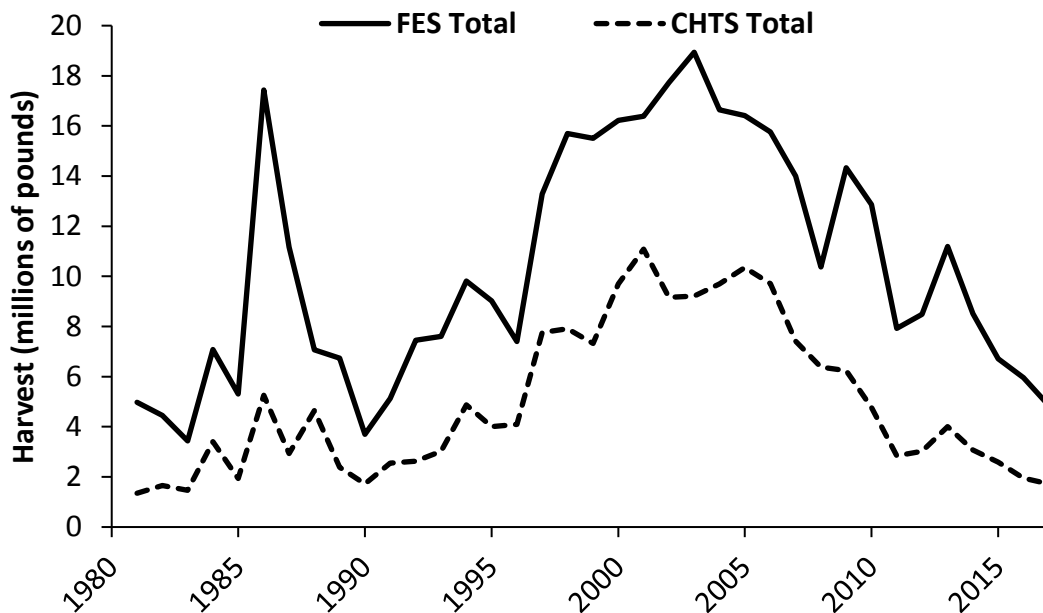


Figure 1. Recreational harvest in pounds, estimated using the Coastal Household Telephone Survey (CHTS) and the mail-based Fishing Effort Survey (FES). (Source: personal communication with NOAA Fisheries, Fisheries Statistics Division. [07/18/2018])

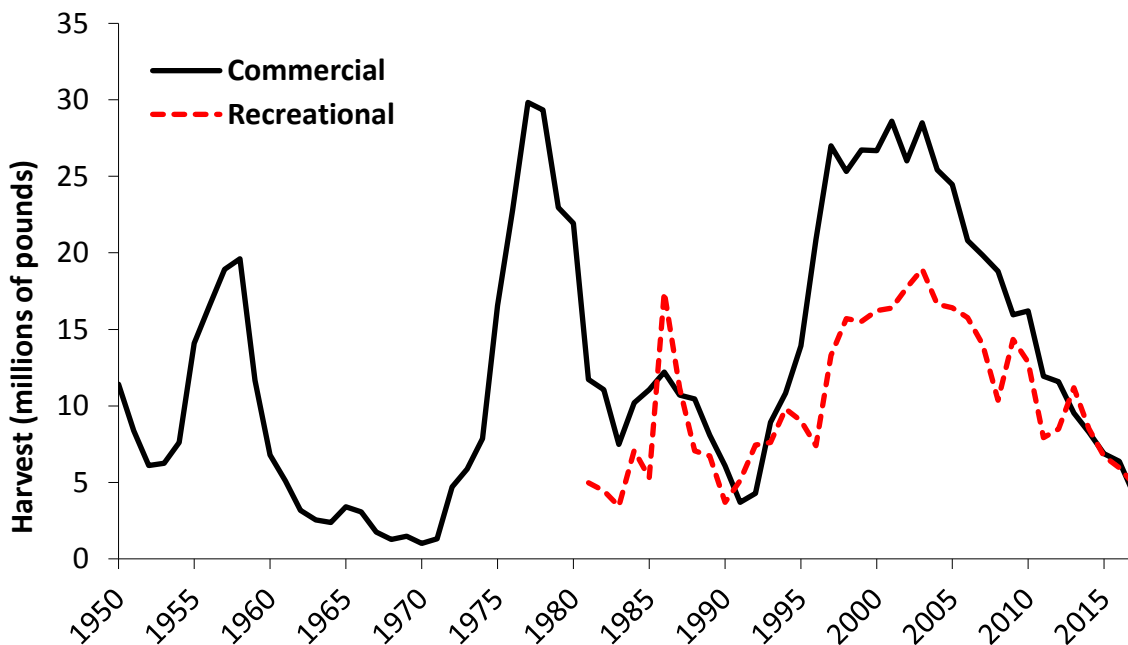


Figure 2. Atlantic croaker commercial and recreational landings (pounds) from 1950-2017. (See Tables 2 and 3 for source information. Commercial landings estimate for 2017 is preliminary. Reliable recreational landings estimates are not available prior to 1981. Recreational landings estimates are based on the mail-based Fishing Effort Survey.)

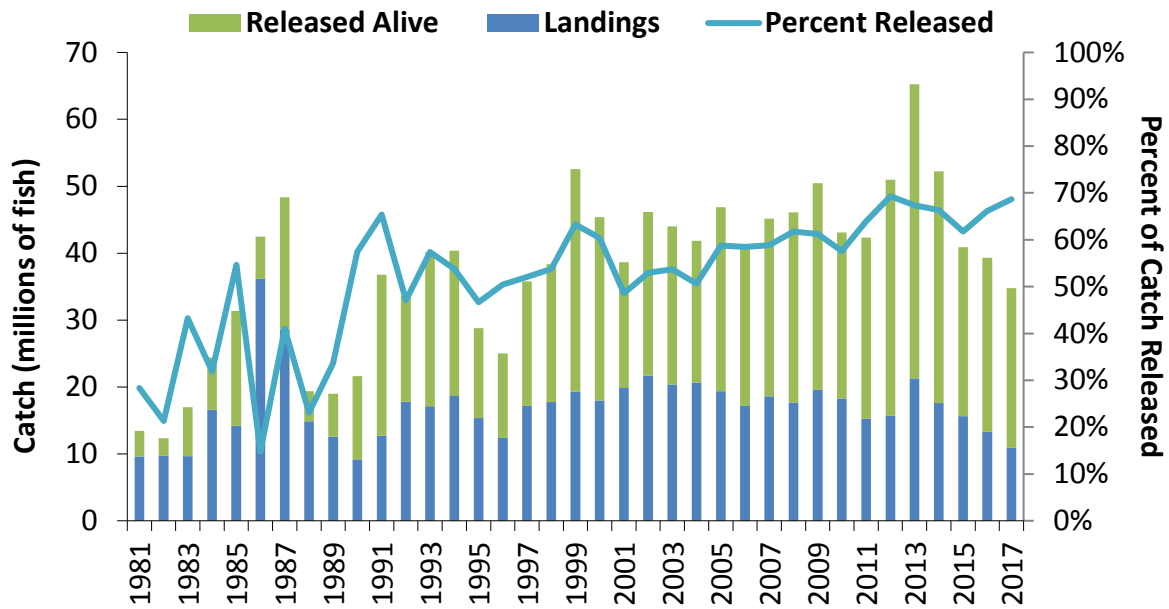


Figure 3. Recreational catch (landings and alive releases, in numbers) and the percent of catch that is released, 1981-2017, based on the mail-based Fishing Effort Survey calibration. (See Tables 4 and 5 for values and source information.)

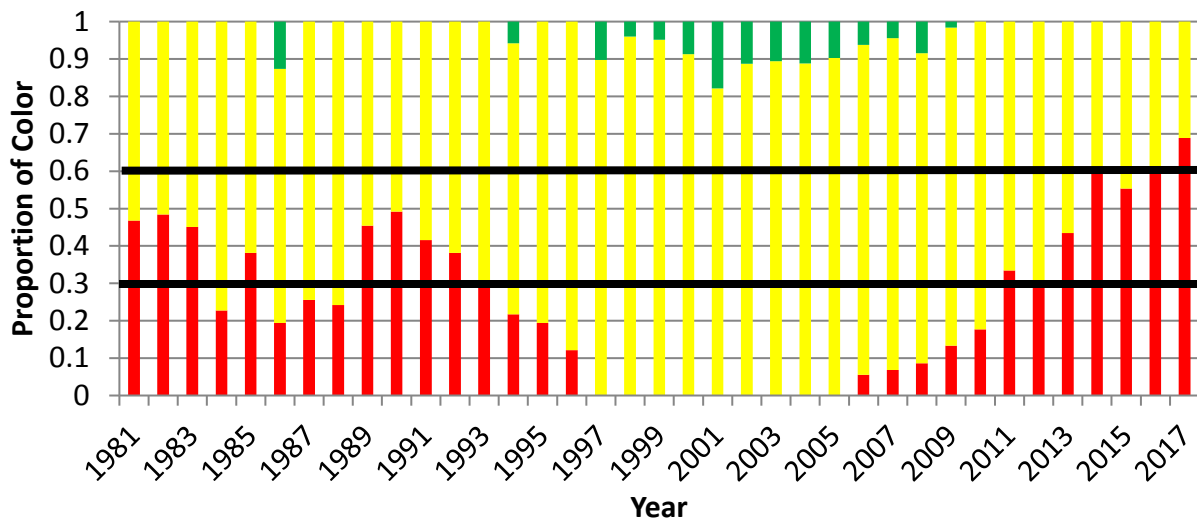


Figure 4. Annual color proportions for the harvest composite TLA of Atlantic croaker recreational and commercial landings.

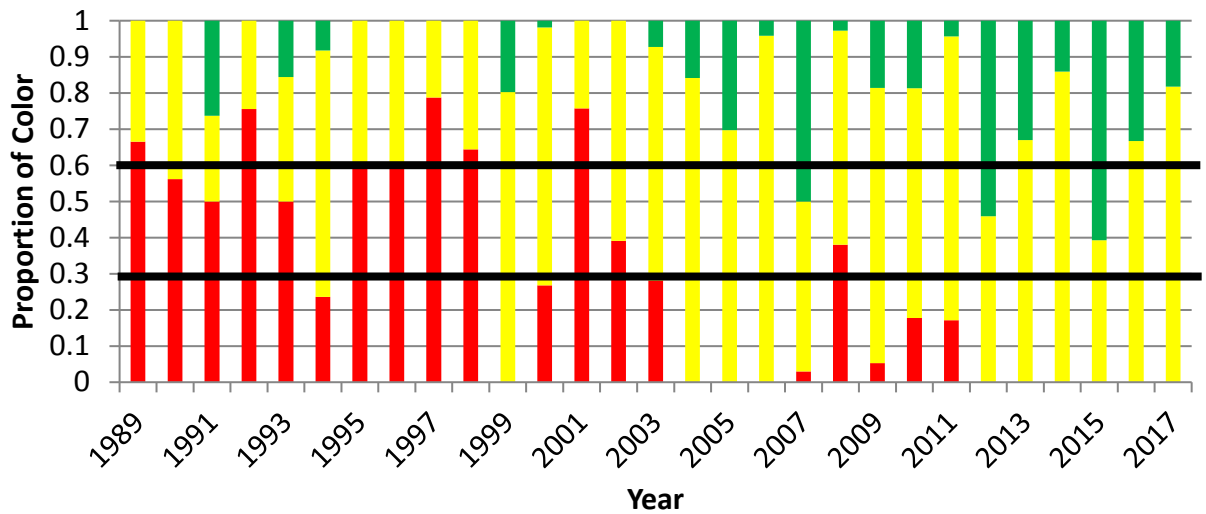


Figure 5. Adult croaker TLA composite characteristic index (NEFSC and SEAMAP surveys). The NEFSC survey was not conducted in 2017 due to mechanical problems with the RV Bigelow. The 3-year average of 2014-2016 values was imputed to estimate the 2017 value for this index.

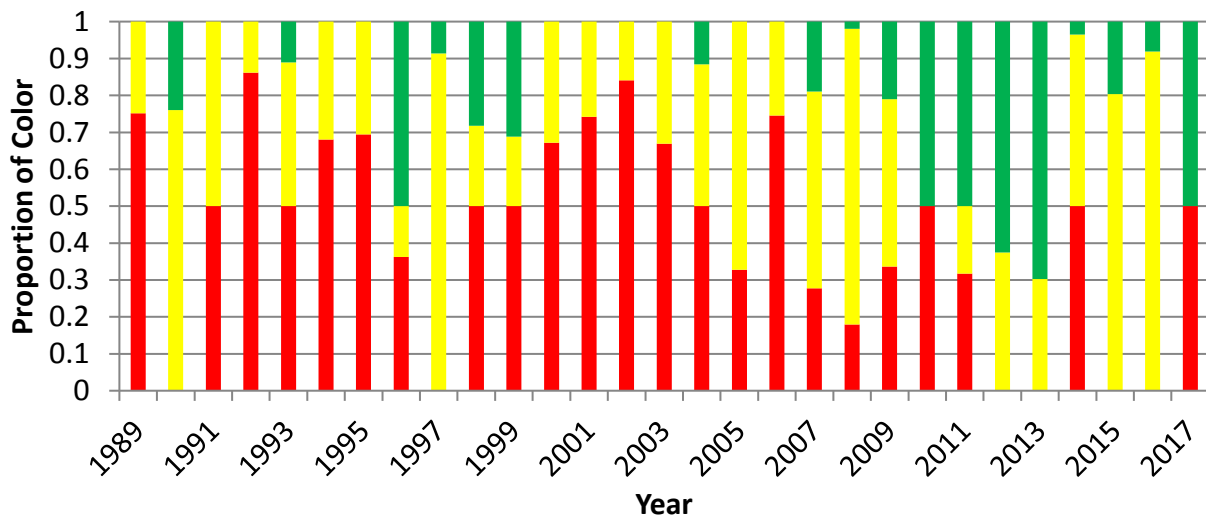


Figure 6. Juvenile croaker TLA composite characteristic index (NC 195 and VIMS surveys).

XI. Tables

Table 1. Summary of state regulations for Atlantic croaker in 2017.

State	Recreational	Commercial
NJ	none	otter/beam trawl mesh restriction for directed croaker harvest (>100 lbs in possession)
DE	8" minimum; recreational gill nets (up to 200 ft.) with license	8" minimum
MD	9" min, 25 fish/day, charter boat logbooks	9" minimum; open 3/16 to 12/31
PRFC	25 fish/day	pound net season: 2/15 to 12/15
VA	none	none
NC	recreational use of commercial gears with license and gear restrictions	
SC	mandatory for-hire logbooks, small Sciaenidae species aggregate bag limit of 50 fish/day	
GA	25 fish/day	25 fish/day limit except for trawlers harvesting shrimp for human consumption (no limit)
FL	none	none

* A commercial fishing license is required to sell croaker in all states with fisheries. For all states, general gear restrictions affect commercial croaker harvest.

Table 2. Commercial harvest (pounds) of Atlantic croaker by state, 2008-2017.

(Estimates for 2017 are preliminary. Sources: 2018 state compliance reports for 2017 fishing year and for years prior to 2017, personal communication with ACCSP, Arlington, VA [07/18/2018], except PRFC [compliance reports only].)

Year	NJ	DE	MD	PRFC	VA	NC	SC	GA	FL	Total
2008	946,339	10,486	608,859	337,062	11,066,482	5,791,766	116	*	30,407	18,791,517
2009	585,552	*	448,589	234,101	8,489,772	6,135,437	75		32,151	15,925,677
2010	342,116	*	542,233	162,571	7,796,179	7,312,159	*		37,229	16,192,487
2011	458,397	*	714,347	243,196	5,415,432	5,054,186	*		47,649	11,933,205
2012	363,381	*	915,432	273,849	6,842,005	3,106,616	*		74,527	11,575,809
2013	332,813	*	820,777	130,285	6,237,602	1,927,938	*		76,463	9,525,878
2014	265,166	*	443,661	177,777	4,697,381	2,629,908	247		45,587	8,259,726
2015	81,311	*	294,038	118,996	4,508,892	1,819,067	*		39,096	6,861,400
2016	55,210	*	101,949	168,889	3,899,990	2,092,135	302		57,538	6,376,012
2017	1,068	*	41,663	114,319	2,933,080	1,007,963	256		42,689	4,141,038

* confidential data

Table 3. Recreational harvest (pounds) of Atlantic croaker by state, 2008-2017. State values are shown using mail-based Fishing Effort Survey (FES)-calibrated estimates, while coastwide totals are shown for both FES estimates and Coastwide Household Telephone Survey (CHTS) estimates. (Source: personal communication with NOAA Fisheries, Fisheries Statistics Division. [07/18/2018])

Year	NJ	DE	MD	VA	NC
2008	911,380	542,545	825,062	7,244,645	275,052
2009	662,763	615,692	3,012,580	8,282,280	359,703
2010	79,889	106,268	2,472,032	9,295,413	638,817
2011	50,153	123,487	1,188,916	4,584,599	360,390
2012	259,645	147,737	1,980,417	4,664,264	307,338
2013	1,637,516	253,447	1,581,384	6,442,166	453,881
2014	750,580	427,615	1,265,217	4,354,046	758,751
2015	263,749	189,320	871,596	3,514,410	557,735
2016	7,133	10,959	407,010	2,998,022	443,728
2017	0	26,429	238,659	3,383,506	237,160
Year	SC	GA	FL	FES Total	CHTS Total
2008	41,864	24,414	503,549	10,368,511	6,372,427
2009	214,212	69,031	1,120,776	14,337,037	6,233,412
2010	27,184	35,593	209,519	12,864,715	4,768,844
2011	583,280	38,219	995,506	7,924,550	2,837,034
2012	30,149	29,815	1,063,337	8,482,702	3,017,384
2013	84,248	89,781	642,887	11,185,310	4,000,931
2014	104,434	138,423	712,090	8,511,156	3,075,053
2015	181,909	248,431	881,185	6,708,335	2,584,350
2016	81,896	116,313	1,893,203	5,958,264	1,949,944
2017	310,621	100,565	555,389	4,852,329	1,715,421

Table 4. Recreational harvest (numbers) of Atlantic croaker by state, 2008-2017. State values are shown using mail-based Fishing Effort Survey (FES)-calibrated estimates, while coastwide totals are shown for both FES estimates and Coastwide Household Telephone Survey (CHTS) estimates. (Source: personal communication with NOAA Fisheries, Fisheries Statistics Division. [07/18/2018])

Year	NJ	DE	MD	VA	NC
2008	1,025,804	639,436	1,057,946	12,901,813	678,638
2009	1,059,267	983,173	2,586,887	10,789,517	958,128
2010	142,887	207,601	2,994,889	12,961,723	1,280,446
2011	91,014	212,613	1,530,723	8,891,276	873,659
2012	830,891	202,283	2,565,599	8,786,350	848,495
2013	2,707,410	530,236	2,308,987	12,517,286	1,300,804
2014	852,733	806,256	2,197,125	9,533,829	1,935,961
2015	339,021	334,676	1,738,576	8,024,381	1,437,019
2016	8,236	24,546	659,318	7,276,719	1,109,570
2017	0	65,575	425,987	7,637,843	666,930
Year	SC	GA	FL	FES Total	CHTS Total
2008	190,181	72,912	1,055,906	17,622,636	10,849,419
2009	733,845	185,129	2,252,473	19,548,419	8,436,509
2010	88,399	121,252	470,168	18,267,365	6,711,636
2011	949,132	129,941	2,593,963	15,272,321	5,109,533
2012	132,264	104,944	2,190,268	15,661,094	5,732,227
2013	336,140	264,984	1,332,465	21,298,312	7,554,404
2014	600,482	289,781	1,359,207	17,575,374	6,218,185
2015	555,263	790,014	2,429,723	15,648,673	5,663,615
2016	268,470	402,254	3,553,777	13,302,890	4,278,373
2017	765,227	371,301	969,146	10,902,009	3,920,875

Table 5. Recreational releases (number) of Atlantic croaker by state, 2008-2017. State values are shown using mail-based Fishing Effort Survey (FES)-calibrated estimates, while coastwide totals are shown for both FES estimates and Coastwide Household Telephone Survey (CHTS) estimates. (Source: personal communication with NOAA Fisheries, Fisheries Statistics Division. [07/18/2018])

Year	NJ	DE	MD	VA	NC
2008	4,777,481	1,162,992	3,644,105	12,806,082	3,274,873
2009	406,639	1,284,262	2,424,818	16,732,646	5,623,278
2010	380,916	1,056,528	3,060,983	13,470,836	4,571,287
2011	252,419	214,603	937,220	14,160,124	7,005,152
2012	3,336,964	1,036,383	7,090,976	15,140,369	3,878,710
2013	2,980,744	1,811,661	7,557,223	18,480,099	6,729,556
2014	703,031	1,396,970	2,806,693	10,314,405	10,347,332
2015	240,840	309,389	1,236,293	6,815,343	9,632,560
2016	139,085	390,655	726,662	6,993,470	7,254,382
2017	152,540	230,934	2,833,760	8,443,528	4,631,445
Year	SC	GA	FL	FES Total	CHTS Total
2008	531,919	527,977	1,743,548	28,468,977	15,662,602
2009	1,232,519	1,169,782	2,015,296	30,889,240	12,673,959
2010	621,497	651,984	1,014,552	24,828,583	8,469,416
2011	1,187,686	748,696	2,559,976	27,065,876	8,143,558
2012	1,070,703	781,302	2,999,225	35,334,632	10,709,525
2013	3,754,143	1,361,943	1,265,571	43,940,940	13,916,551
2014	4,742,718	2,057,898	2,265,961	34,635,008	9,996,064
2015	3,236,774	1,320,939	2,451,253	25,243,391	7,662,983
2016	5,233,835	1,178,630	4,073,001	25,989,720	6,929,781
2017	4,755,853	1,059,539	1,770,846	23,878,445	6,724,829