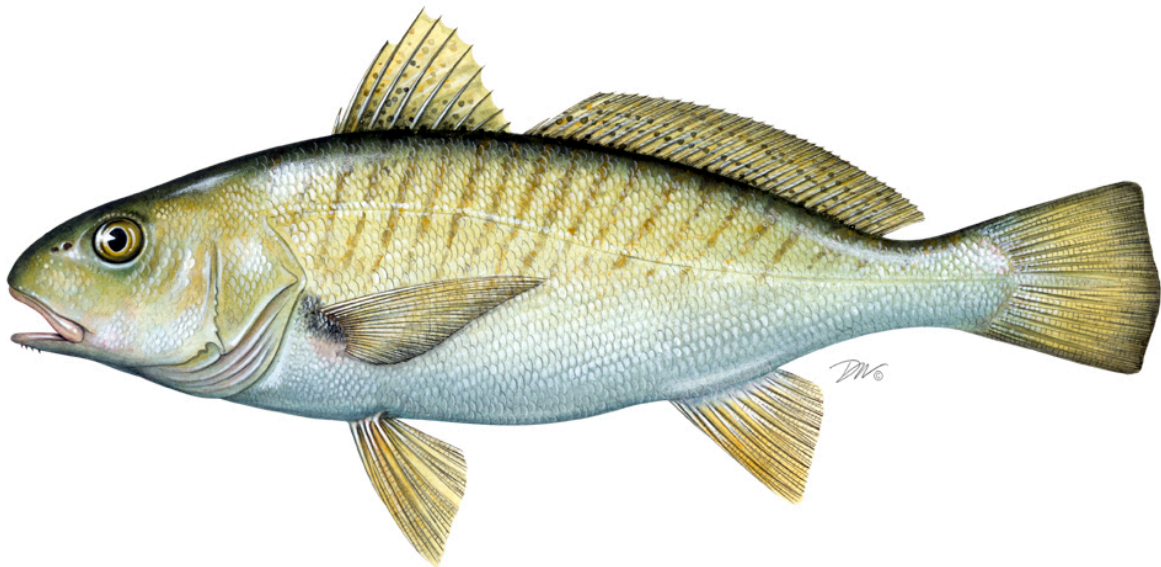


ATLANTIC STATES MARINE FISHERIES COMMISSION
REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR ATLANTIC CROAKER
(Micropogonias undulatus)

2019 FISHING YEAR



Prepared by the Plan Review Team
Approved October 2020



Sustainable and Cooperative Management of Atlantic Coastal Fisheries

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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 Addendum III – February 2020
<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 (TC) 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 was 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 2018 TC report recommended several updates to the current TLA approach (ASMFC 2018). The Board initiated an Addendum III to incorporate these updates.

In February 2020 the Board approved [Addendum III to Amendment 1](#) of the Atlantic Croaker FMP. This addenda adjusted the TLA to incorporate additional fishery-independent indices, age information, use of regional characteristics, and changes to the management triggering mechanisms. Management triggers and responses include bag limits for the recreational fishery and percentage harvest reductions from a 10 year average for the commercial fishery. The response will be defined by which percent threshold (30% or 60%) that was exceeded in any of the 3 out of 4 terminal years.

Addenda III did not add or change any management measures or requirements, unless management-triggering mechanisms are tripped. The only pre-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. The Peer Review Panel did not indicate problems in the Atlantic croaker fishery that would require immediate management action but 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 TC has recommended several changes to the annual TLA in 2019 such as additional abundance indices and survey length-composition information so that the TLA abundance metric would more accurately reflect trends in the stock.

Addendum III addressed the concerns of the TC. The addendum added indices from the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) and the South Carolina Department of Natural Resources (SCDNR) Trammel Net Survey into the adult composite characteristic index. In addition, all surveys used revised adult abundance indices and not have an established reference period of 2002-2012. Regional metrics were also used to characterize the fisheries north and south of the Virginia-North Carolina state line. The ChesMMAP and the NEFSC surveys will be used to characterize abundance north of the state line, and SCDNR Trammel Net and SEAMAP surveys will be used to characterize abundance south of the state line.

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. Past recreational estimates have been calibrated to the FES and, therefore, are different from those shown in FMP Reviews and state compliance reports prior to 2018.

Total Atlantic croaker harvest from New Jersey through the east coast of Florida in 2019 is estimated at 4 million pounds (Tables 2 and 3, Figure 1). This represents a 91% decline in total harvest since the peak of 47.4 million pounds in 2003 (92% commercial decline, 90% recreational decline). The commercial and recreational fisheries harvested 53% and 46% of the 2019 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 1). Commercial landings increased from a low of 3.7 million pounds in 1991 to 28.6 million pounds in 2001; however, landings have declined every year since 2010 to 2.1 million pounds in 2019, the lowest of the time series (1950-2019). Within the management unit, the majority of 2019 commercial landings came from North Carolina (66%) and Virginia (30%).

From 1981-2019, recreational landings of Atlantic croaker from New Jersey through Florida have varied by count between 5.6 million fish and 36.2 million fish and by weight between 1.8 million pounds and 18.9 million pounds (Tables 3 and 4, Figure 2). Landings generally increased until 2003, after which they showed a declining trend through 2019. The 2019 landings are estimated at 5.6 million fish and 1.8 million pounds, the lowest recreational harvest on record. Virginia was responsible for 54% of the 2019 recreational landings, in numbers of fish, followed by Florida (14%).

The number of recreational releases generally increased over the time series until 2013, after which numbers of releases have generally decreased through 2019 (Figure 2). However, percentage of released recreational catch has shown a slight increasing trend from the 1990s through 2019. In 2019, anglers released 19.6 million fish, a slight increase from the 18.2 million fish released in 2018. Anglers released an estimated 78% of the recreational croaker catch in 2019, the highest percentage on record (Figure 2).

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 benchmark stock assessment conducted in 2017 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. 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. 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 recommended several changes to the TLA that would help resolve some of the conflict between harvest and abundance signals which resulted in the creation of Addendum III. The Board approved Addendum III in February 2020, and the TLA reports will incorporate the changes.

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 2019 compliance reports.

Fishery-Dependent Monitoring

- New Jersey: initiated biological monitoring of commercially harvested Atlantic croaker in 2006 in conjunction with ACCSP, but was unable to do so in 2019 due to lack of commercial trips. Recreational MRIP length sampling indicated the majority of harvest was 220-229 mm FL.
- 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; seafood dealer sampling
- PRFC: has a mandatory commercial harvest daily reporting system, with reports due weekly.
- Virginia: commercial fishery biological sampling (5,357 length measurements, 5,342 weight measurements, 227 otolith ages, and 348 sex determinations in 2019)
- North Carolina: commercial fishery biological sampling since 1982 for length (2019 n=4,427), weight, otolith, sex determination, and reproductive condition.
- South Carolina: recreational fishery biological sampling via 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 (6 fish in 2019)

Fishery-Independent Monitoring

- New Jersey: 3 nearshore ocean (within 12 nm) juvenile trawl surveys (New Jersey Ocean Trawl Survey, 1988-present: 2019 CPUE (0.43) was well below time-series average (1.89); nearshore Delaware Bay juvenile trawl survey, 1991-present: 2019 survey index (0.54) was well below time series average (4.11); Delaware River juvenile seine survey, 1980-present: 2019 survey index (0.04) was well below time series average (0.21).
- Delaware: offshore Delaware Bay adult finfish trawl survey (1990-present; 2019 #/tow = 1.42; 87% decrease in relative abundance from the 2018 index, below mean for time series); nearshore Delaware Bay juvenile finfish trawl survey (1980-present; 2019 index decreased from 5.43 in 2018 to 3.89; Inland Bays index decreased from 2.41 in 2018 to 1.59 in 2019).
- Maryland: summer gill net survey was initiated in 2013 on lower Choptank (43 fish were captured in 2019); Atlantic coast bays juvenile otter trawl survey (standardized from 1989-present; 2019 GM of 2.03 fish/hectare is the first value above the long term mean since 2012 of the 30-year time series); Chesapeake Bay juvenile trawl index (standardized from 1989-present; CPUE increased from 1.13 fish/tow in 2018 to 4.895 in 2019).
- PRFC: Maryland DNR conducts an annual juvenile beach haul seine survey in the Potomac River (1954-present; YOY GM increased slightly from 0.00 in 2018 to 0.05 in 2019).
- Virginia: Virginia Institute of Marine Science (VIMS) Juvenile Finfish and Blue Crab Trawl Survey (1988-present; 2019 index was 15.64, which is up from the 2018 value of 0.61).
- North Carolina: Pamlico Sound juvenile trawl survey (1987-present; 2019 juvenile abundance index (mean number of individuals/tow) was 1,111, a 712% increase from 2018); Pamlico Sound gill net survey (2001-present; 2019 CPUE 0.4 fish per sample, below time series mean)

- South Carolina: SEAMAP shallow water (15-30 ft) trawl survey from Cape Hatteras to Cape Canaveral (1989-present; 2019 CPUE increased by 41.2% from 2018); inshore estuarine trammel net survey for adults (May-September, 1991-present; 2019 CPUE decreased 12.7% from 2018); estuarine electroshock survey for juveniles (2001-present; 2019 CPUE increased by 216% from 2018, to just above the long term mean); SCECAP estuarine trawl survey (1999-present, primarily targets juveniles, 2019: 96.8 #/hectare increased from 41.9 #/hectare in 2018, 2019 is the second highest catch level in the data series).
- Georgia: Marine Sportfish Population Health Survey (trammel and gill net surveys in the Altamaha River Delta and Wassaw estuary, 2002-present; 2019 trammel net index (GM #/standard net set): 0.1, gill net index: 0.5); Ecological Monitoring Survey (trawl, 2003-present; 2019 index (GM #/standard trawl) was 11.6).
- Florida: YOY seine survey (2002-present; 2019 index decreased by 47% from 2018); sub-adult/adult haul seine survey (2001-present; 2019 index value decreased by 9% from 2018).

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. The NEFSC survey was not carried out in 2017 due to mechanical issues with the RV Bigelow. Catch levels in 2019 (269.7 fish per tow) declined 31.5% from 2018 (394 fish per tow) and dropped below the long term mean (498 fish per tow) for the third year in a row. The CPUE for 2017 was estimated as the mean of 2015-2016 and 2017 as a place holder in the index. The estimated CPUE for 2017 (457.9 fish per tow) was just below the long term mean.

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. Addendum III was approved February 2020 and adjusted management through the TLA by incorporating additional fishery-independent indices, age information, use of regional characteristics, and changes to the management-triggering mechanisms.

Traffic Light Approach

Analysis of the harvest composite index for 2019 shows that the population characteristic tripped for a fourth consecutive year at the 30% threshold in the Mid-Atlantic (Figure 3) and for the seventh consecutive year above the 30% threshold in the South Atlantic (Figure 4). The mean proportion of red color in the Mid-Atlantic from 2017-2019 was 68.3%, with a red proportion exceeding the 60% threshold in 2018 and 2019. The mean proportion of red color in the South Atlantic from 2017-2019 was 46.2%. The harvest composite index was comprised of commercial and recreational landings.

The abundance composite TLA index was broken into the two regional components based on age composition. Due to a delay in recalibration of the ChesMMAAP survey, which is used in the annual TLA reviews, no data points were available for Atlantic croaker for 2019 for juvenile and adult abundance indices for the Mid-Atlantic region. Even without data points for 2019, the Mid-Atlantic adult composite index was generated from the NEFSC and ChesMMAAP surveys and has been above the 30% threshold since 2008 (Figure 5). Atlantic adult composite index was generated from SEAMAP and SCDNR trammel net survey and had a relatively high proportion of green (Figure 6).

The TLA harvest composite characteristic triggered in both the Mid-Atlantic and South Atlantic in 2019 at the 30% threshold for three of the last four consecutive years. Being above the 30% threshold indicates moderate concern. For the Mid-Atlantic, the adult composite characteristics exceeded 30% in 2019, hitting the requirement of exceeding the threshold for three of the four previous years. The South Atlantic adult composite characteristics did not exceed the 30% level in 2019.

Overall, there is a continued trend of disconnect between the harvest and abundance indices with the harvest metric exhibiting a decreasing trend, while the abundance metric had an increasing trend, specifically in the South Atlantic. However, because harvest indices for both regions and abundance indices for the Mid-Atlantic were above 30% in 3 of the last 4 years, management response as outlined in Addendum III management guidelines will be enacted. All non-*de minimis* states will be required to implement a 50 fish per person per day bag limit and a 1% reduction in commercial harvest from their 10 year average.

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: New Jersey (commercial and recreational), Delaware (commercial fishery), South Carolina (commercial fishery), Georgia (commercial fishery), and Florida (commercial fishery). The commercial and recreational *de minimis* criteria for 2019 are based on 1% of the average coastwide 2017-2019 landings in each fishery: 46,665 pounds for the commercial fishery and 46,176 pounds for the recreational fishery. The Delaware, South Carolina, and Georgia commercial fisheries all qualify for *de minimis* status, but landings are confidential. The Florida commercial fishery does not qualify for *de minimis* status with a three-year average of 51,141 pounds (1.6% of the coastwide three-year average). However, given Florida's longstanding *de minimis* status and the small margin above the average landings threshold, the Atlantic Croaker Plan Review Team (PRT) recommends Florida maintain *de minimis* status.

Changes to State Regulations

No state regulation changes in 2019

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.asafc.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 (Figure 7). 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 bait 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 2020

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

VIII. Recommendations

Management and Regulatory Recommendations

- Consider approval of the *de minimis* requests from New Jersey, Delaware, South Carolina, Georgia, and Florida for their commercial fisheries.
- Encourage the use of circle hooks to minimize recreational discard mortality.
- 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

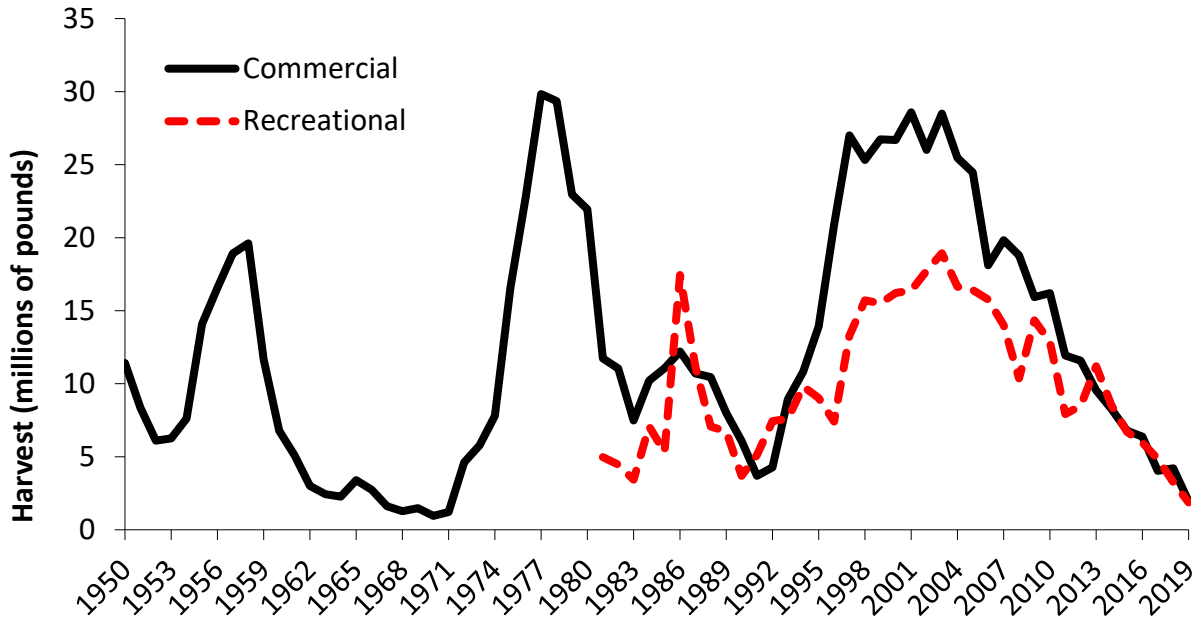


Figure 1. Atlantic croaker commercial and recreational landings (pounds) from 1950-2019.

(See Tables 2 and 3 for source information. Commercial landings estimate for 2019 is preliminary. Reliable recreational landings estimates are not available prior to 1981. Recreational landings estimates are based on the mail-based Fishing Effort Survey.)

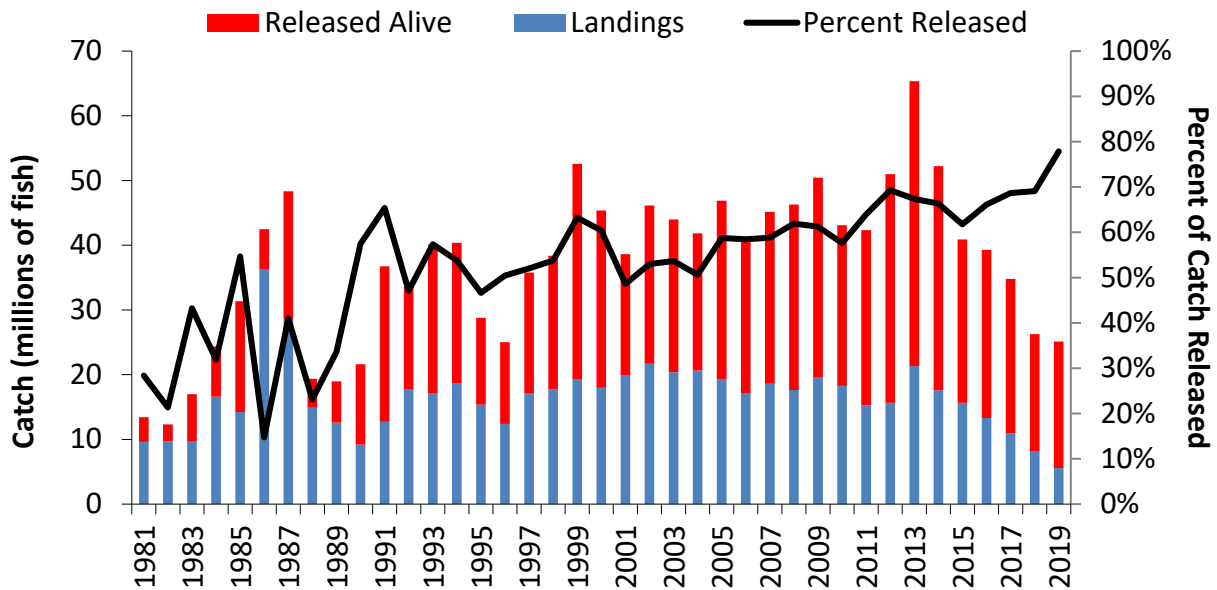


Figure 2. Recreational catch (landings and alive releases, in numbers) and the percent of catch that is released, 1981-2019, based on the mail-based Fishing Effort Survey calibration. (See Tables 4 and 5 for values and source information.)

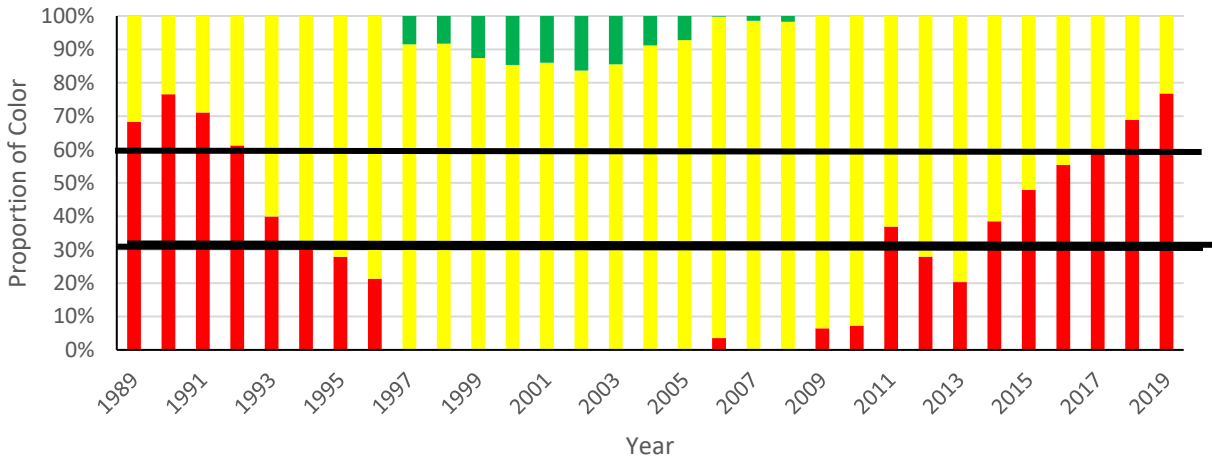


Figure 3. Annual color proportions for harvest composite TLA of Mid-Atlantic region (NJ-VA) for Atlantic croaker recreational and commercial landings

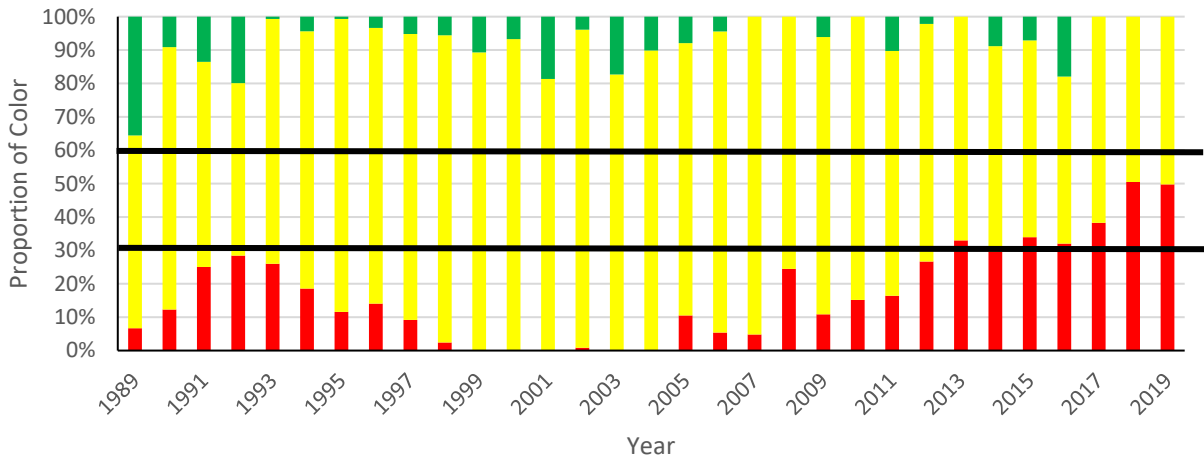


Figure 4. Annual color proportions for harvest composite TLA of South Atlantic region (NC-FL) for Atlantic croaker recreational and commercial landings using a 2002-2012 reference period

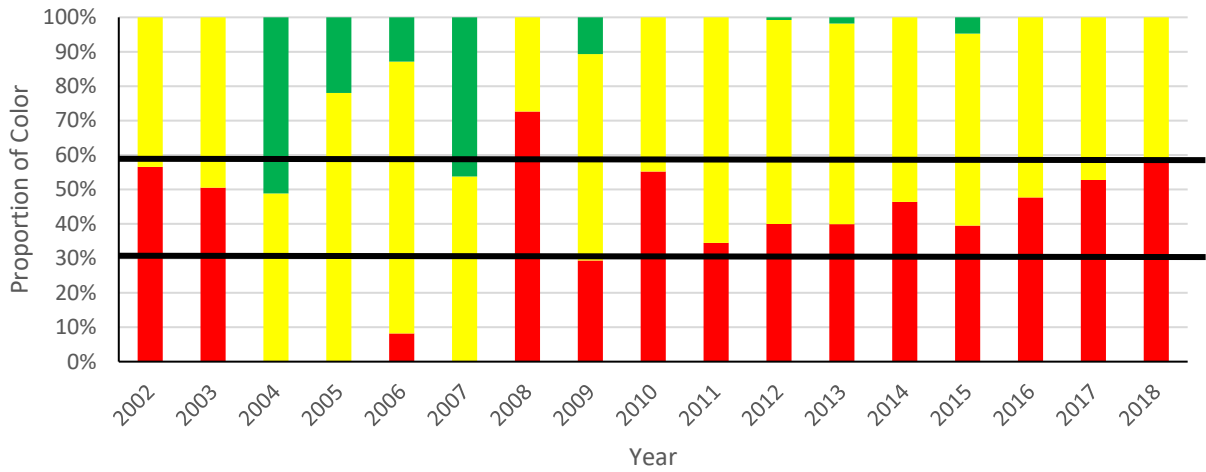


Figure 5. Adult (age 2+) Atlantic croaker TLA composite characteristic index for the Mid-Atlantic (NEFSC and ChesMMAP surveys)

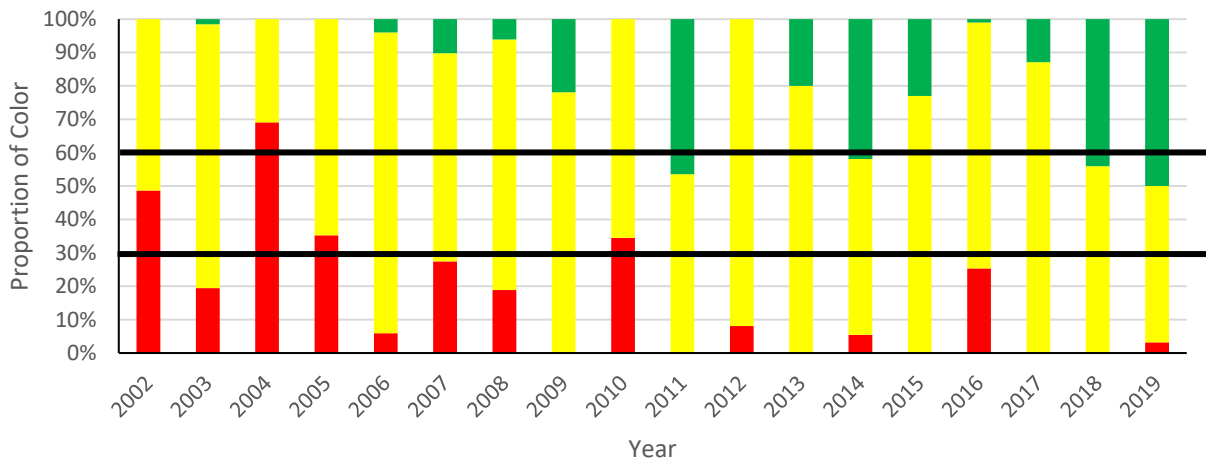


Figure 6. Adult (age 2+) Atlantic croaker TLA composite characteristic index for the South Atlantic (SEAMAP and SCDNR trammel survey)

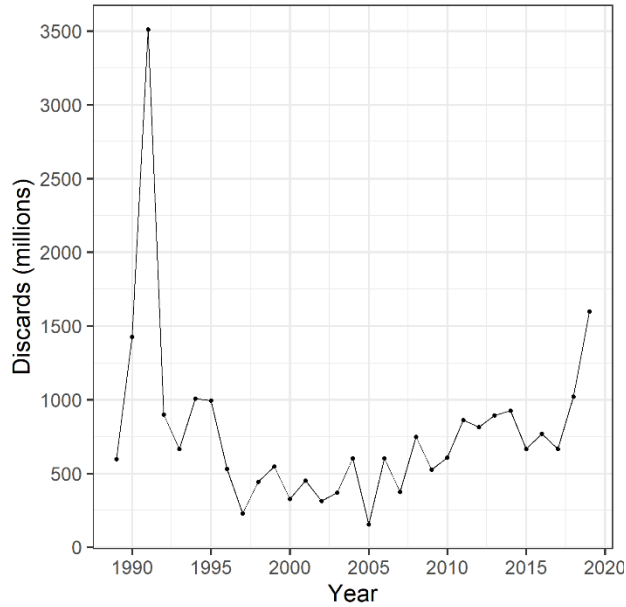


Figure 7. Discard of Atlantic croaker in the South Atlantic Shrimp Trawl Fishery

**XI.
Tables**

Table 1. Summary of state regulations for Atlantic croaker in 2019.

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	none
SC	mandatory for-hire logbooks, small Sciaenidae species aggregate bag limit of 50 fish/day	none
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, 2010-2019.

(Estimates for 2019 are preliminary. Sources: 2020 state compliance reports for 2019 fishing year and for years prior to 2019, personal communication with ACCSP, Arlington, VA, except PRFC [compliance reports only].)

Year	NJ	DE	MD	PRFC	VA	NC	SC	GA	FL	Total
2010	342,116	C	542,233	162,571	7,796,179	7,312,159	C		37,229	16,199,394
2011	458,397	C	714,347	243,196	5,415,432	5,054,186	C		47,649	11,933,396
2012	363,381	C	915,432	273,849	6,842,005	3,106,616	C		74,527	11,582,978
2013	332,813	C	820,777	130,285	6,237,602	1,927,938	C		76,463	9,538,901
2014	265,166	C	443,661	177,777	4,697,381	2,629,908	247		45,587	8,261,609
2015	81,311	C	294,038	118,996	4,426,957	1,819,067	C		39,096	6,784,146
2016	55,210	C	101,949	168,889	3,825,737	2,164,015	302		57,538	6,374,527
2017	1,068	C	42,958	114,319	2,822,005	1,007,963	256		43,033	4,032,941
2018	C	C	44,306	16,561	2,450,984	1,643,607	C		54,409	4,210,715
2019	C	C	2,865	C	846,007	1,277,829	C		68,179	2,194,902

C: Confidential data

Table 3. Recreational harvest (pounds) of Atlantic croaker by state, 2010-2019. (Sources: 2020 state compliance reports for 2019 fishing year and for years prior to 2019, personal communication with ACCSP, Arlington, VA)

Year	NJ	DE	MD	VA	NC	SC	GA	FL	Total
2010	79,889	106,268	2,472,032	9,295,413	638,817	27,184	35,593	209,519	12,864,715
2011	50,153	123,487	1,188,916	4,584,599	360,390	583,280	38,219	995,506	7,924,550
2012	259,645	147,737	1,980,417	4,664,264	307,338	30,149	29,815	1,063,337	8,482,702
2013	1,637,516	253,447	1,581,384	6,442,166	453,881	84,248	89,781	642,887	11,200,818
2014	750,580	427,615	1,265,217	4,354,046	758,751	104,434	138,423	712,090	8,511,554
2015	263,749	189,320	871,596	3,514,410	557,735	181,909	248,431	881,185	6,708,335
2016	7,133	10,959	407,010	2,998,022	443,728	81,896	116,313	1,893,203	5,958,264
2017	0	26,441	238,659	3,383,057	237,160	310,621	100,565	555,389	4,851,892
2018	34,125	5,859	191,854	2,245,518	164,644	81,251	83,258	445,663	3,252,172
2019	973	23,973	38,895	995,491	224,337	133,227	97,791	358,941	1,873,628

Table 4. Recreational harvest (numbers) of Atlantic croaker by state, 2010-2019. (Sources: 2020 state compliance reports for 2019 fishing year and for years prior to 2019, personal communication with ACCSP, Arlington, VA)

Year	NJ	DE	MD	VA	NC	SC	GA	FL	Total
2010	142,887	207,601	2,994,889	12,961,723	1,280,446	88,399	121,252	470,168	18,267,365
2011	91,014	212,613	1,530,723	8,891,276	873,659	949,132	129,941	2,593,963	15,272,321
2012	830,891	202,283	2,565,599	8,786,350	848,495	132,264	104,944	2,190,268	15,661,094
2013	2,707,410	530,236	2,308,987	12,517,286	1,300,804	336,140	264,984	1,332,465	21,328,324
2014	852,733	806,256	2,197,125	9,533,829	1,935,961	600,482	289,781	1,359,207	17,576,096
2015	339,021	334,676	1,738,576	8,024,381	1,437,019	555,263	790,014	2,429,723	15,648,673
2016	8,236	24,546	659,318	7,276,719	1,109,570	268,470	402,254	3,553,777	13,302,890
2017	0	65,606	423,790	7,644,516	666,930	765,227	371,301	969,146	10,906,516
2018	104,321	12,370	305,469	5,472,329	472,917	335,833	241,382	1,176,999	8,121,620
2019	3,031	53,048	69,771	3,055,510	651,268	593,475	332,073	801,751	5,559,927

Table 5. Recreational releases (number) of Atlantic croaker by state, 2010-2019. (Sources: 2020 state compliance reports for 2019 fishing year and for years prior to 2019, personal communication with ACCSP, Arlington, VA)

Year	NJ	DE	MD	VA	NC	SC	GA	FL	Total
2010	380,916	1,056,528	3,060,983	13,470,836	4,571,287	621,497	651,984	1,014,552	24,828,583
2011	252,419	214,603	937,220	14,160,124	7,005,152	1,187,686	748,696	2,559,976	27,065,876
2012	3,336,964	1,036,383	7,090,976	15,140,369	3,878,710	1,070,703	781,302	2,999,225	35,334,824
2013	2,980,744	1,811,661	7,557,223	18,480,099	6,729,556	3,754,143	1,361,943	1,265,571	44,025,744
2014	703,031	1,396,970	2,806,693	10,314,405	10,347,332	4,742,718	2,057,898	2,265,961	34,635,008
2015	240,840	309,389	1,236,293	6,815,343	9,632,560	3,236,774	1,320,939	2,451,253	25,243,391
2016	139,085	390,655	726,662	6,993,470	7,254,382	5,233,835	1,178,630	4,073,001	25,989,720
2017	152,540	230,455	2,829,255	8,464,305	4,631,445	4,755,853	1,059,539	1,770,846	23,894,238
2018	144,637	85,424	203,081	5,359,179	4,311,368	5,568,892	1,403,560	1,072,381	18,148,522
2019	33,333	101,523	1,243,785	6,642,685	3,634,211	3,768,288	1,893,287	2,259,705	19,576,817