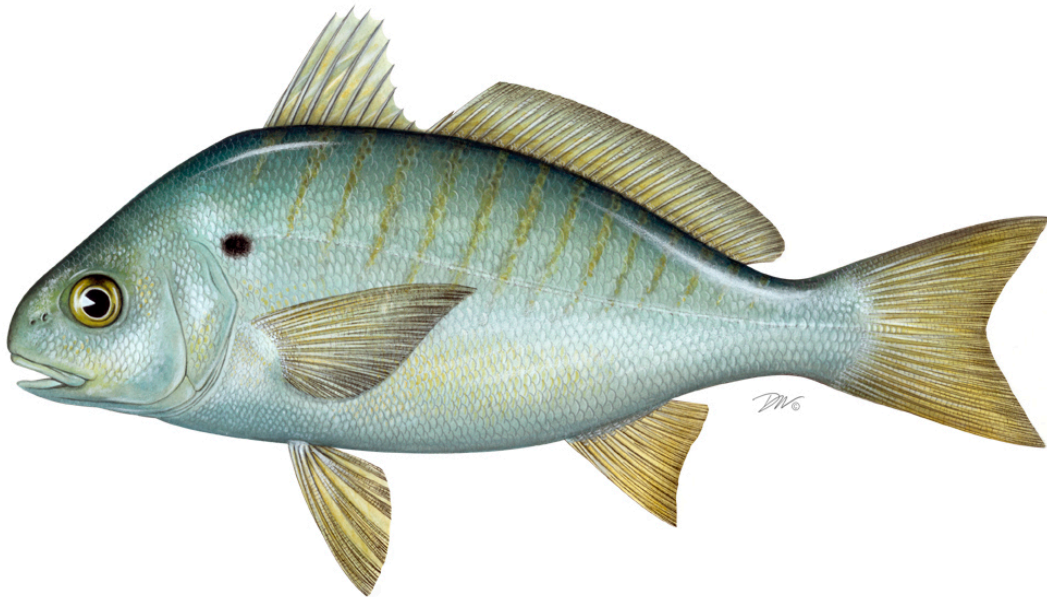


# ATLANTIC STATES MARINE FISHERIES COMMISSION

## REVIEW OF THE INTERSTATE FISHERY MANAGEMENT PLAN

FOR SPOT  
*(Leiostomus xanthurus)*

2016 FISHING YEAR



Prepared by the Plan Review Team

Approved by the South Atlantic Management  
Board February 2018

## Table of Contents

I.	Status of the Fishery Management Plan .....	1
II.	Status of the Stock.....	2
III.	Status of the Fishery.....	2
IV.	Status of Assessment Advice .....	3
V.	Status of Research and Monitoring.....	4
VI.	Status of Management Measures and Issues .....	7
VII.	Implementation of FMP Compliance Requirements for 2015 .....	8
VIII.	Recommendations of the Plan Review Team .....	9
X.	Figures .....	12
XI.	Tables.....	14

## I. Status of the Fishery Management Plan

Date of FMP Approval: October 1987; Omnibus Amendment August 2011

Management Area: The Atlantic coast distribution of the resource from Delaware through Florida

Active Boards/Committees: South Atlantic State/Federal Fisheries Management Board; Spot Plan Review Team; South Atlantic Species Advisory Panel; Omnibus Amendment Plan Development Team

The Fishery Management Plan (FMP) for Spot was adopted in 1987 and includes the states from Delaware through Florida (ASMFC 1987). In reviewing the early plans created under the Interstate Fisheries Management Plan process, the ASMFC found the Spot FMP to be in need of evaluation and possible revision. A Wallop-Breaux grant from the U.S. Fish and Wildlife Service was provided to conduct a comprehensive data collection workshop for spot. The October 1993 workshop at the Virginia Institute of Marine Science was attended by university and state agency representatives from six states. Presentations on fishery-dependent and fishery-independent data, population dynamics, and bycatch reduction devices were made and discussed. All state reports and a set of recommendations were included in the workshop report (Kline and Speir 1993).

Subsequent to the workshop and independent of it, the South Atlantic State/Federal Fisheries Management Board (Management Board) reviewed the status of several plans in order to define the compliance issues to be enforced under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). The Management Board found recommendations in the plan to be vague and perhaps no longer valid, and recommended that an amendment be prepared to the Spot FMP to define the management measures necessary to achieve the goals of the FMP. In their final schedule for compliance under the ACFCMA, the ISFMP Policy Board adopted the finding that the FMP does not contain any management measures that states are required to implement. In August 2009, the Management Board expanded the initiated amendment to the Spanish Mackerel FMP to include Spot and Spotted Seatrout, creating the Omnibus Amendment for Spot, Spotted Seatrout and Spanish Mackerel. The goal of the Omnibus Amendment was to update all three plans with requirements specified under the Atlantic Coastal Fisheries Cooperative Management Act (1993) and the Interstate Fishery Management Program Charter (1995). In August 2011, the Management Board approved the Omnibus Amendment for Spot, Spotted Seatrout, and Spanish Mackerel. This Amendment did not set specific management measures for Spot but it did align management of the species with the requirements of ACFCMA.

In August 2014, the Board approved Addendum I to the Omnibus Amendment. The Addendum establishes use of a Traffic Light Analysis (TLA) to evaluate fisheries trends and develop state-specified management actions (e.g., bag limits, size restrictions, time and area closures, and gear restrictions) when harvest and abundance thresholds are exceeded for two consecutive years.

## II. Status of the Stock

A benchmark stock assessment for spot was completed in 2017 but was not recommended for management use by the Peer Review Panel. Therefore, stock status is unknown. The stock is monitored annually using the Traffic Light Analysis, described below.

### *Traffic Light Approach*

As part of the requirements under the 2011 Omnibus Amendment, for years in-between benchmark stock assessments, the Spot PRT was tasked with conducting annual monitoring analysis. These trigger exercises compared five data sources to the 10<sup>th</sup> percentile of the data sets' time series. If two terminal values of the five data sources (at least one of which must be fishery independent) fell below the 10<sup>th</sup> percentile, the Management Board would be prompted to consider management action.

In August 2014, the Board approved Addendum I to the Omnibus Amendment. The Addendum established the Traffic Light Approach (TLA) as the new precautionary management framework to evaluate fishery trends and develop management actions. The TLA framework replaces the management trigger stipulated in the Omnibus Amendment after concern that the triggers were limited in their ability to illustrate long-term declines or increases in stock abundance. In contrast, the TLA is a statistically-robust way to incorporate multiple data sources (both fishery-independent and -dependent) into a single, easily understood metric for management advice. It is an effective method to illustrate long-term trends in the fishery.

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 abundances thresholds of 30% and 60% red were established in Addendum I, representing moderate and significant concern for the fishery. If thresholds for both population characteristics achieve or exceed a threshold for a two year period, then management action is enacted.

Analysis of the composite harvest index showed a general decline beginning in 2005 (Figure 1). This decline was driven mostly by the decline in commercial landings rather than the recreational harvest. The composite harvest index tripped in 2015-2016 with a 2-year red proportion greater than 30%.

The TLA composite abundance index for adult spot (NMFS and SEAMAP surveys) was run using the 1989-2016 time period since that was when the two surveys overlapped (Figure 1). The TLA composite characteristic did not trigger in 2016 and has not tripped in a single year since 2007.

The TLA composite characteristic indices tripped for juvenile spot index (60% threshold) but not for the adult composite characteristic index. The harvest composite characteristic also triggered at the 30% threshold in 2016 due to declines in both commercial and recreational harvest. Because the harvest index and adult composite index did not both trip for 2015-2016, management action is not triggered by the TLA. With the benchmark stock assessment now complete, further refinement of the TLA for spot is under consideration. The PRT and Atlantic

Croaker TC have submitted several adjustments to the TLA for Board consideration, which include incorporation of additional indices and alterations to the TLA metrics and triggering mechanism.

### **III. Status of the Fishery**

Total landings of spot from NY to FL in 2016 are estimated at 1.39 million pounds, a decrease of approximately 3 million pounds from 2015 and roughly 4.6 million pounds less than the average of the last 10 years (Tables 1 and 3). The recreational fishery harvested more than the commercial fishery (54% and 46% respectively, by pounds). Although, historical commercial harvests were larger than recreational harvests, over the last 10 years proportions of commercial and recreational harvests have been more even (57% and 43% respectively, by pounds).

Commercial spot landings have ranged between 632,000 and 14.52 million pounds from 1950-2016 (Figure 2), with 2016 landings (632,790 pounds) being the lowest commercial harvest on record. Coastwide, gill nets were used to capture 59% of commercially harvested spot (Table 2). Virginia landed approximately 45% of the commercial harvest (by pounds) in 2016, followed by North Carolina with 37% of the harvest. Spot are a major component of Atlantic coast scrap landings (NCDMF 2001). A scrap fishery is one in which fish species that are unmarketable as food, due to size or palatability, are sold unsorted, usually as bait. The largest bycatch component for spot comes from the South Atlantic shrimp trawl fishery.

The recreational harvest of spot along the Atlantic coast from 1981 to 2016 has varied between 2.8 and 20.1 million fish (or 753,000 and 6.9 million pounds; Tables 3 and 4). There was an increasing trend in the recreational harvest from a low in 1999 of 3.6 million fish to 15.7 million fish in 2007. Since then, harvest has generally declined, with a 2016 harvest of 2.8 million fish (753,353 pounds), down 3.4 million fish (1.5 million pounds) from 2015 and the lowest recreational harvest on record by both numbers of fish and pounds (Figure 3). Anglers in Virginia were responsible for 38% of the total number of fish harvested in 2016, followed by anglers in South Carolina (25%) and North Carolina (18%). Many anglers are known to catch spot to use as bait, as well as for other recreational purposes. The estimated number of spot released annually by recreational anglers has varied between 1.9 and 11.2 million fish, with 2016 releases estimated at 1.9 million fish, the second lowest year on record (Figure 3).

### **IV. Status of Assessment Advice**

A benchmark stock assessment for spot was completed in 2017 but was not recommended by the Peer Review Panel for management use due to uncertainty in biomass estimates due to conflicting signals among abundance indices and catch time series, as well as sensitivity of model results to assumptions and model inputs. The Review Panel recommended continued annual monitoring of spot through the TLA, with incorporation of shrimp trawl discard estimates, and another benchmark assessment in 5 years.

## V. Status of Research and Monitoring

Catch and effort data are collected by the commercial and recreational statistics programs conducted by the states and the National Marine Fisheries Service (NMFS). Biological characterization data from fishery landings are also available from several states. Specifically, age data are now available from Maryland, Virginia, North Carolina, and South Carolina. Recruitment indices are available from surveys in Delaware, Maryland, Virginia, North Carolina, and South Carolina. Adult or aggregate (mix of juvenile and older spot) relative abundance indices are available from New Jersey, Delaware, North Carolina, South Carolina, Georgia, and SEAMAP (covering North Carolina through Florida). These surveys, in addition to the Northeast Fisheries Science Center Bottom Trawl Survey, the Northeast Area Monitoring and Assessment Program (NEAMAP), the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP), and the Chesapeake Bay Fishery-Independent Multispecies Survey (CHESFIMS), collect a variety of biological data elements.

*Below is a description of the fishery dependent sampling conducted by states.*

Maryland: Maryland conducts an onboard commercial pound net survey on the Potomac River and the Chesapeake Bay, sampling once per week from May through September and collecting length and age data.

Virginia: Virginia's Marine Resources Commission collects biological data from Virginia's commercial and recreational fisheries, with total length, weight, sex, and age measured whenever possible. The fish are aged by examining otoliths, which is done by Old Dominion University's Center for Quantitative Fisheries Ecology.

North Carolina: Commercial fishing activity is monitored through fishery-dependent sampling conducted under Title III of the Interjurisdictional Fisheries Act and has been ongoing since 1982. Data collected in this program allows the size distribution of spot to be characterized by gear/fishery. Further sub-sampling is conducted to procure samples for age determination (whole otoliths), sex ratio, reproductive condition, and weight.

South Carolina: South Carolina's Spot fishery is generally recreational in nature. Fishery dependent data related to Spot has been available primarily through the SCDNR State Finfish Survey (SFS), the National Marine Fisheries Service's Marine Recreational Information Program (MRIP), and a SCDNR managed mandatory trip reporting system for licensed charterboat operators. Beginning in 2013, the SCDNR took over the MRIP data collection in South Carolina. Since the data previously coming from the SC-SFS is now incorporated into the MRIP data set they will not be reported separately. The one exception to this occurs during wave 1 (Jan-Feb) sampling. The MRIP survey had not sampled during this wave in the past and so the SC-SFS will still be used to cover this time period.

Georgia: The Marine Sportfish Carcass Recovery Project, a partnership with recreational anglers along the Georgia coast, was used to collect biological data from finfish. In 2016, a total of 3,555 fish carcasses were donated through this program. Spot are not on the list of requested species and none were donated in 2016.

*Below is a description of fishery independent sampling conducted by states.*

New Jersey: The New Jersey Bureau of Marine Fisheries conducts an Ocean Trawl Survey, Delaware River Seine Survey, and Delaware Bay Trawl Survey. Respective indices of abundance (GM) for the three surveys in 2016 were: 0.12, 0.00, and 0.05 (2014 values were: 0.63, 0.02, and 0.19, respectively).

Delaware: Annual relative abundance estimates (number/nautical mile) of spot in Delaware are monitored through the Division's adult ground fish bottom trawl survey. The relative abundance of spot increased to 3.97 (#/nm). The Division monitors juvenile fish abundance through a 16-ft bottom trawl survey which has been conducted annually since 1980. Separate spot young of the year (YOY) indices are generated for the Delaware Estuary (Bay and River) and Delaware's "Inland Bays" (Indian River and Rehoboth Bays). YOY spot recruitment, 0.44 per tow (geometric mean), increased in 2016 relative to 2015 for the Delaware Estuary and was below the time series mean and median. The Inland Bays YOY index decreased to 1.77 per tow, and remained below the time series mean in 2016.

Maryland: Maryland conducted an onboard commercial pound net survey on the Potomac River and the Chesapeake Bay, sampling once per week from May 24, 2016 through September 7, 2016. Spot mean length from onboard sampling decrease in 2016 to 175 mm total length (TL). Seventy percent of spot encountered in the onboard pound net survey were between 170 and 209 mm TL, and the length frequency distribution remained truncated relative to the distributions of the early to mid-2000s. In 2016, 57% of sampled fish were age zero and 43% were age one, with no age two plus fish being sampled (111 ages and 137 lengths). 2016 was the first year that age one spot did not account for a majority of the age distribution, and only the second year no age two plus spot were sampled.

Finfish collected by Maryland's Chesapeake Bay Blue Crab Trawl Survey have been enumerated since 1980, (Davis et al.1995). Spot juvenile trawl index values from 1989-2016 were quite variable. The 2010 GM value of 104.5 spot per tow was the highest value of the time series, the 2011 value declined to the second lowest of the 27 year time series, and the 2012 value increased to nearly the time series mean. The index values declined since 2012 to the time series low in 2015 (0.29 fish per tow). The 2016 value increased to 1.36 fish per tow, but was still the 7th lowest value of the 28 year time series. A second JI was derived from the Striped Bass Juvenile Seine Survey (JSS). The 2016 GM catch per haul of 0.32 was the second lowest value of the 50 year time series, and well below the mean value of 1.44 fish per haul. A 4.9-m semi-balloon otter trawl has also been used to sample Maryland's Atlantic coastal bays since 1972. The 2016 GM of 5.4 spot per hectare increased for the second consecutive year, but was still below the 28 year time series mean of 8.9 fish per hectare. The final juvenile index is derived from the coastal bays seine survey. The coastal bays seine survey increased in 2016 to 9.6 spot per haul, and was above the time series mean of 7.4 for the first time since 2012.

Virginia: The Virginia Institute of Marine Science (VIMS) has been conducting a monthly juvenile trawl survey since 1955 to monitor the abundance and seasonal distribution of finfish and invertebrates in the Chesapeake Bay and its tributaries. An index of age-0 spot abundance is available from 1988 up to 2016, with sampling coming from tributaries of the Chesapeake Bay

(fixed and random sites) as well as the bay itself (random sites). The average index value from 1988 through 2016 is 13.43, and the geometric mean value for 2016 was 2.39. This represents an increase from the 0.83 in 2015, but is still one of the lowest values in the time series. Note that the values for 2015 and 2016 were calibrated due to a change in vessel/gear.

North Carolina: North Carolina has no current fishery-independent monitoring programs specifically for spot. However, the NCDMF has conducted a stratified random trawl survey in Pamlico Sound (Pamlico Sound Survey, Program 195) since 1987 to obtain juvenile abundance indices (JAI) for several economically important species, including spot. Spot less than 120 mm from the June portion of the Pamlico Sound Survey are considered in calculating the JAI. The 2016 spot JAI (mean number of individuals/tow) was 291.0, a decline from the 2015 JAI of 405.5. From 1987-2016 the average JAI was 413.1 with many large fluctuations.

South Carolina: While Spot are not necessarily a specifically targeted species for SCDNR monitoring programs or projects, they are a common component species of four fishery independent monitoring efforts conducted by the SCDNR. The Southeast Area Monitoring and Assessment – South Atlantic Program (SEAMAP-SA) is a shallow water (15 to 30 ft depth) trawl survey that monitors status and trends of numerous coastal species within the South Atlantic Bight seasonally (spring, summer and fall) from Cape Canaveral, FL to Cape Hatteras, NC. The annual stratified mean catch per tow in weight for the entire survey in 2016 declined by 9.2% (11.1kg/tow) over 2015 (12.2 kg/tow). The second survey is an inshore estuarine trammel net survey conducted by the SCDNR. In 2016, CPUE decreased (68.8%) from 2015 representing the lowest annual value in the time series. Catch levels in 2016 remained below the long term mean for a seventh year. The overall trend for Spot in the trammel survey has been in decline since 1999, with only 5 years exceeding the long term mean catch since 2000. The third survey was an electroshock survey conducted in low salinity brackish and tidal freshwater portions of different South Carolina estuaries. The CPUE in 2016 ( $3.98 \pm 0.78$  fish per set) declined from 2015 by 24% and was the lowest annual CPUE on record for the survey. The fourth survey is the South Carolina Estuarine and Coastal Assessment Program (SCECAP). The CPUE increased (27.9%) in 2016 from 2015, although both years represent the lowest values in the time series (0.5 and 0.7 fish per hectare, respectively) and remained well below the series long term mean.

Georgia: Spot are occasionally observed during the red drum gillnet survey and the trammel net survey. Lengths of captured spot were recorded and then fish were released. During 2016, 150 trammel and 216 gill net sets captured 193 and 324 spot, respectively. Average fork length of spot in trammel nets was 209 mm and in the gillnet survey was 197 mm. The 2016 geometric mean (#/net set) from trammel nets (0.81) was greater and the mean from gillnets (0.59) was less than those of 2015 (0.54 and 0.89, respectively). The monthly Ecological Monitoring Survey (EMS) samples estuarine finfish from a total of 42 stations, distributed amongst 6 estuaries, from January to December. In 2016, a total of 416 tows were completed with an estimated 12,673 Spot captured. Lengths ranged from 11 to 223 millimeters fork length with a mean of 130.5 millimeters fork length

Florida: The FWC-FWRI's FIM program initiated surveys on estuarine, bay and coastal systems of the Florida Atlantic at northern Indian River Lagoon in 1990, southern Indian River Lagoon in 1997, and northeast Florida (Jacksonville study area) in 2001. Indices of abundance (IOAs) data



for juvenile (YOY) spot (<30 mm standard length, SL) were available from 21.3-m seine and 6.1-m trawl samples. IOAs for YOY and sub-adult/adult spot have been low and showed little variations; except in 2010 and 2011.

## **VI. Status of Management Measures and Issues**

The FMP for Spot identified two management measures for implementation: 1) promote the development and use of bycatch reduction devices through demonstration and application in trawl fisheries, and 2) promote increases in yield per recruit through delaying entry to spot fisheries to age one and older.

Considerable progress has been made in developing bycatch reduction devices (BRDs) and evaluating their effectiveness. Proceedings from a 1993 spot and croaker workshop summarized much of the experimental work on bycatch reduction, and many states have conducted subsequent testing. For example, North Carolina Division of Marine Fisheries (NCDMF) conducted research on the four main gear types (shrimp trawl, flynet, long haul seine, and pound net) responsible for the bulk of the scrap fish landings in order to reduce the catch of small fish. State testing of shrimp trawl BRDs achieved finfish reductions of 50-70% with little loss of shrimp, although total bycatch numbers relative to shrimp fishery effort are still unknown. The Virginia Marine Resources Commission investigated the use of culling panels in pound nets and long haul seines to release small croaker, spot, and weakfish. The Potomac River Fisheries Commission (PRFC) also investigated the use of culling panels in pound nets, finding that the panels allowed the release of 28% of captured spot less than six inches in length.

Following favorable testing, devices have been made mandatory or recommended in several state fisheries. The use of BRDs is required in all penaeid shrimp trawl fisheries in the South Atlantic. The PRFC recommends the use of culling panels in pound nets and allows those nets with panels to keep one bushel of bycatch of flounder and weakfish. In North Carolina, escapement panels have been required in the bunt nets of long haul seines in an area south and west of Bluff Shoals in the Pamlico Sound since April 1999. However, evaluation of the beneficial effects of BRDs to spot stocks continues to need further study.

General gear restrictions, such as minimum mesh sizes or area trawling bans, have helped protect some age classes of spot. Georgia has implemented a spot creel limit (25 fish, both recreational and commercial, except for shrimp trawlers). South Carolina has also implemented an aggregate bag limit (50 fish) for hook and line fishing of spot, Atlantic croaker, and kingfish/whiting (*Menticirrhus* sp.).

### *Omnibus Amendment (Interstate)*

In August 2011, the Management Board approved the development of an amendment to the Spot FMP to address three issues: compliance measures, consistency with federal management in the exclusive economic zone, and alignment with Commission standards. The updated FMP's objectives are to: (1.) Increase the level of research and monitoring on spot bycatch in other fisheries, in order to complete a coastwide stock assessment (2.) Manage the Spot fishery stock to maintain the spawning stock biomass above the target biomass levels. (3.) Develop research

priorities that will further refine the spot management program to maximize the biological, social, and economic benefits derived from the spot population. The Omnibus Amendment does not require specific fishery management measures in either the recreational or commercial fisheries for states within the management unit.

#### *Addendum I*

In August 2014, the Board approved Addendum I which establishes a new management framework (i.e., Traffic Light Approach) to evaluate fisheries trends and develop state-specified management actions (i.e., bag limits, size restrictions, time & area closures, and gear restrictions) when harvest and abundance thresholds are exceeded over two years. Management measures would remain in place for two years.

#### *Recent Changes in State Regulations*

North Carolina: There are no direct restrictions on the commercial harvest of spot within coastal, joint, or inland waters of North Carolina. There are however numerous indirect restrictions that effect the commercial harvest and bycatch of spot in North Carolina. Changes to such restrictions for 2016 include: Gill net restrictions for Internal Coastal Waters pertaining to area closures/openings, gear modifications and attendance rules to avoid interactions with endangered species, and requiring the use of an additional BRD for shrimp trawlers (Proclamation SH-2-2015).

South Carolina: In 2015, the SCDNR established a trip ticket monitoring system for all commercial bait harvesters in South Carolina. The purpose of the program is to track which species are being harvested for use in state and federal waters for commercial fishermen holding a commercial bait harvesting license. Previously, there was some monitoring of which species might be captured by bait harvesters through voluntary reporting, but there was no record of the actual quantities harvested unless they were sold to wholesale seafood dealers who would have reported fish utilized as bait in that system. Small Sciaenidae species (including spot) were one of the species of concern and why the program was initiated.

#### *De minimis Guidelines*

A state qualifies for *de minimis* status if its past 3-years' average of the combined commercial and recreational catch is less than 1% of the past 3-years' average of the coastwide combined commercial and recreational catch. Those states that qualify for *de minimis* are not required to implement any monitoring requirements, none of which are included in the plan.

### **VII. De Minimis Requests**

Georgia requests *de minimis* status. The PRT notes that Georgia meets the requirements of *de minimis*.

### **VIII. Implementation of FMP Compliance Requirements for 2016**

All states within the management unit have submitted compliance reports for the 2016 fishing year. The PRT found no compliance issues.

## **IX. Recommendations of the Plan Review Team**

### Management and Regulatory Recommendation

The Spot PRT will continue to monitor the fishery through the Traffic Light Approach. The Spot PRT recommends that the Board consider incorporation of adjustments to the TLA submitted in their collaborative memo with the Atlantic Croaker Technical Committee.

### Research and Monitoring Recommendations

#### *High Priority*

- Explore adjustments to the annual TLA that can reduce or explain the conflict between harvest and abundance metrics. Potential adjustments may include incorporation of additional indices, region-specific metrics, age-partitioned indices, or alteration of the management-triggering mechanism.
- Expand collection of life history data for examination of lengths and age, especially fishery-dependent data sources.
- Organize an otolith exchange and develop an ageing protocol between ageing labs.
- Increase observer coverage for commercial discards, particularly the shrimp trawl fishery. Develop a standardized, representative sampling protocol and pursue collection of individual lengths and ages of discarded finfish.
- 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.
- Continue to develop estimates of length-at-maturity and year-round reproductive dynamics throughout the species range. Assess whether temporal and/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, ME) and coastal data sets (MARMAP, EcoMon).

#### *Medium Priority*

- Develop and implement sampling programs for state-specific commercial scrap and bait fisheries in order to monitor the relative importance of Spot. Incorporate biological data collection into program.
- Conduct studies of discard mortality for commercial fisheries. Ask commercial fishermen about catch processing behavior for spot when trawl/gillnets brought over the rail to determine if the discard mortality rate used in the assessment is reasonable.
- Conduct studies of discard mortality for recreational fisheries.
- Collect data to develop gear-specific fishing effort estimates and investigate methods to develop historical estimates of effort.
- Identify stocks and determine coastal movements and the extent of stock mixing, via genetic and tagging studies.
- Investigate environmental and recruitment/ natural mortality covariates and develop a time series of potential covariates to be used in stock assessment models.

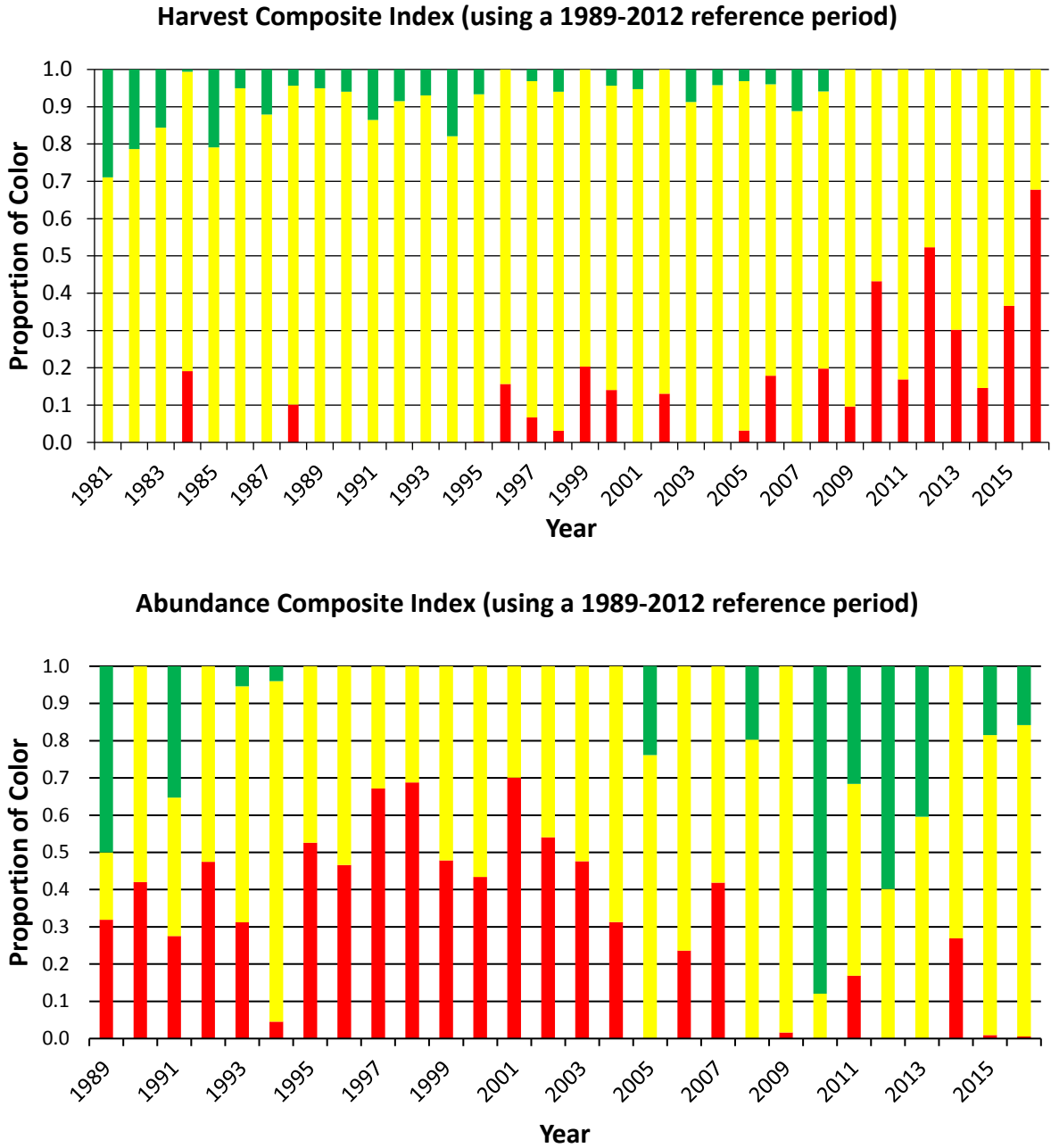
- Investigate environmental covariates in stock assessment models, including climate cycles (e.g., Atlantic Multi-decadal Oscillation, AMO, and El Nino Southern Oscillation, El Nino) and recruitment and/or year class strength, spawning stock biomass, stock distribution, maturity schedules, and habitat degradation.
- Investigate the effects of environmental changes (especially climate change) on maturity schedules for spot, particularly because this is an early-maturing species, and because the sSPR estimates are sensitive to changes in the proportion mature.
- Investigate environmental and oceanic processes in order to develop better understanding of larval migration patterns into nursery grounds.
- Investigate the relationship between estuarine nursery areas and their proportional contribution to adult biomass. I.e., are select nursery areas along Atlantic coast contributing more to SSB than others, reflecting better juvenile habitat quality?
- Develop estimates of gear-specific selectivity.

## X. References

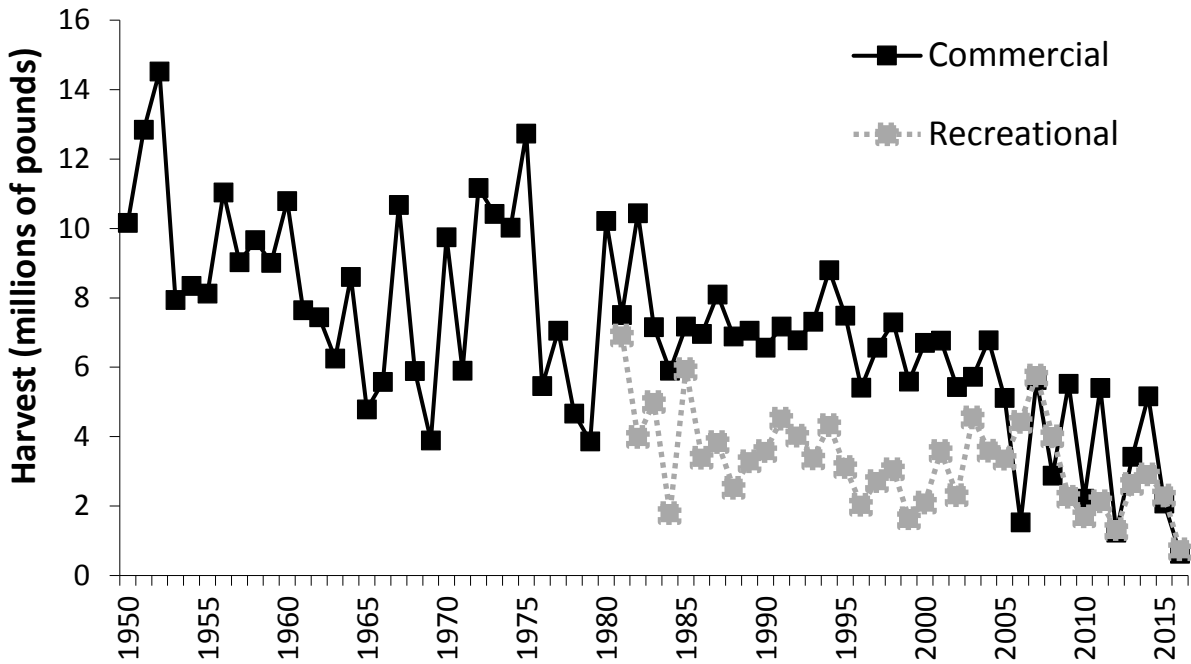
- Atlantic States Marine Fisheries Commission (ASMFC). 1987. Fishery Management Plan for Spot. Washington (DC): ASMFC. Fisheries Management Report #11. 90 p.
- Kline LL, Speir H (editors). 1993. Proceedings of a Workshop on Spot (*Leiostomus xanthurus*) and Atlantic Croaker (*Micropogonias undulatus*). Washington (DC): Atlantic States Marine Fisheries Commission. Special Report #25. 175 p.
- NCDMF. 2001. Assessment of North Carolina commercial finfisheries, 1997–2000. Final Report, North Carolina Department of Environment and Natural Resources, Division of Marine Fisheries, Award Number NA 76 FI 0286, 1-3.
- Spot Plan Review Team (PRT). 2012. Spot Data Availability and Stock Monitoring Report, 2009. Washington (DC): Atlantic States Marine Fisheries Commission. Report to the South Atlantic State-Federal Fisheries Management Board. 85 p.

X. Figures

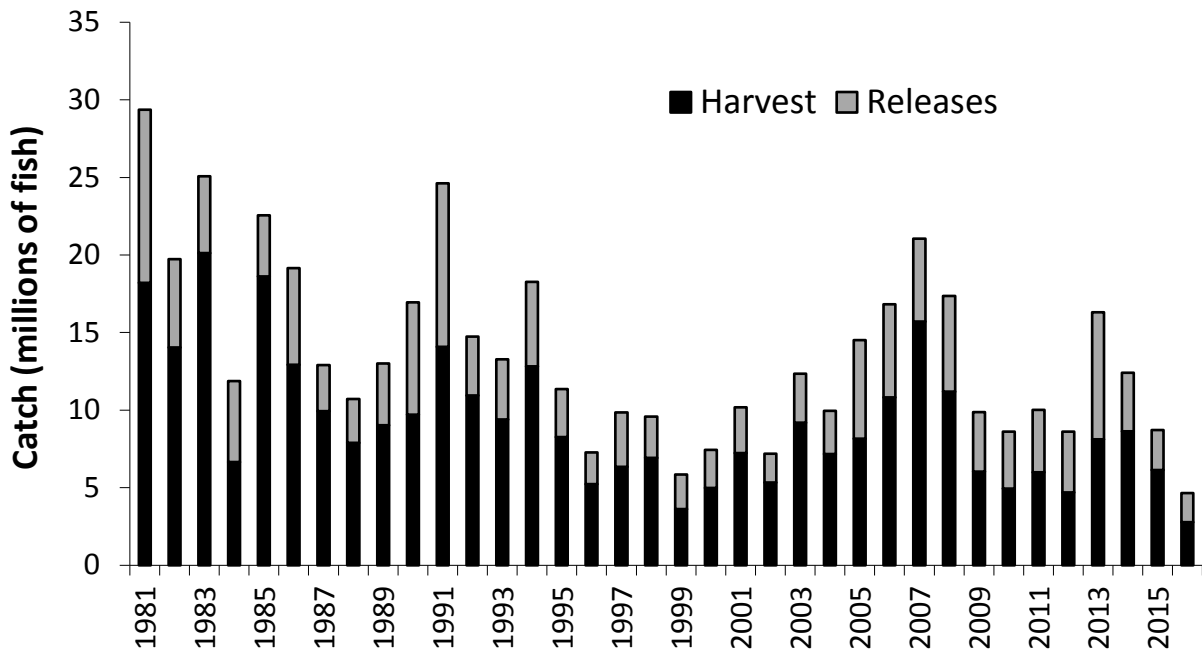
Figure 1: Traffic Light Approach for spot, 2016. Top figure shows the harvest composite index and the bottom figure shows the abundance composite index.



**Figure 2: Spot commercial and recreational landings (pounds), 1950-2016.** (Recreational landings available from 1981-present; see Tables 1 and 3 for state-by-state values and data sources)



**Figure 3. Spot recreational harvest and releases (numbers of fish), 1981-2016.** (See Tables 4 and 5 for state-by-state values and data source)



## XI. Tables

**Table 1. Commercial landings (pounds) of spot by state 1997-2016.** (Source: ACCSP for 2015 and earlier for all jurisdictions, except PRFC; annual compliance reports for 2016 and for all PRFC years. Starred values are confidential. Total values adhere to the ACCSP rule of 3, i.e. totals are reflective of the true total if 0 or at least 3 states' data are confidential in a given year. Otherwise, they are sums of non-confidential data. Data dating back to 1950 are available upon request to ACCSP.)

Year	NY	NJ	DE	MD	PRFC	VA	NC	SC	GA	FL	Total
1997	189	6,175	35,686	*	134,591	3,343,884	*	87,170	*	227,097	6,570,132
1998	*	27,582	140,363	*	117,580	4,170,072	2,396,979	*	*	161,205	7,293,859
1999		7,822	*	*	108,326	2,860,784	2,262,175	9,393	*	73,018	5,589,288
2000	939	13,852	*	*	120,642	3,677,628	2,829,843	8,519		57,957	6,709,380
2001	160	20,034	*	*	176,546	3,131,044	3,093,872	12,950	*	33,029	6,770,093
2002	5,737	1,326	*	132,346	140,776	2,927,729	2,184,032	22,628	*	21,258	5,435,832
2003	35	6,003	*	170,009	227,430	3,258,482	2,043,387	17,059		9,260	5,731,665
2004	*	1,652	58,502	27,131	131,605	4,223,075	2,317,169	2,649	*	12,681	6,774,463
2005	435	769	157,563	84,841	95,350	3,037,612	1,714,485	10,468		21,154	5,120,448
2006	3,099	3,646	62,934	27,908	40,777	*	1,364,743	5,691	*	22,501	1,531,299
2007	1,080	4,474	128,207	387,420	70,514	4,259,469	879,082	6,357		14,334	5,637,154
2008	650	1,942	32,650	121,201	29,835	1,949,319	736,484	1,492	*	9,177	2,882,748
2009	317	34,065	*	522,659	63,470	3,852,408	1,006,500	22,557		22,057	5,524,033
2010	447	6,048	*	587,028	44,025	984,892	572,315	3,957	*	13,420	2,212,132
2011	*	54,890	*	618,569	60,106	3,687,377	936,970	12,162		33,889	5,403,962
2012	90,141	9,935	*	*	14,563	600,351	489,676	541		36,744	1,241,950
2013	156,751	48,324	*	332,692	41,286	2,044,538	768,592	2,446		31,368	3,425,996
2014	2,112	29,683	*	348,435	148,908	3,843,869	765,824	5,917	*	16,742	5,161,490
2015	901	86	*	96,102	86,972	1,490,127	377,135	1,619		27,969	2,080,911
2016	1,895	105	*	18,110	8,480	284,596	235,670	1,059		82,875	632,790



**Table 2. Commercial landings (pounds) by gear, 2016.**

[Source: NMFS Fisheries Statistics Division (queried 1/25/2018)]

<b>Gear</b>	<b>Percent of Total</b>
Gill nets	58.9%
Haul Seines	15.2%
Pound Net	2.9%
Trawl	2.1%
Other	20.9%

**Table 3. Recreational harvest (pounds) of spot by state, 1997-2016.** (Source: MRIP for 2015 and earlier and annual compliance reports for 2016. Data dating back to 1981 are available upon request to the NMFS Fisheries Statistics Division via MRIP.)

Year	NY	NJ	DE	MD	VA	NC	SC	GA	FL	Total
1997		8,608	50,781	401,275	1,263,447	722,869	254,795	2,071	13,961	2,717,807
1998			36,659	631,421	866,618	1,249,542	228,503	2,087	47,195	3,062,025
1999			10,886	272,293	244,498	646,663	391,402	2,275	84,511	1,652,528
2000	130,650	46,244	32,968	600,302	252,886	893,834	128,669	1,403	14,129	2,101,085
2001			20,110	629,862	523,202	1,773,671	346,879	1,719	284,706	3,580,149
2002			10,870	336,661	829,973	984,899	140,164	2,857	7,839	2,313,263
2003			14,386	1,690,502	875,729	1,714,159	227,821	5,711	26,504	4,554,812
2004			6,867	433,825	1,132,309	1,749,843	272,056	448	1,706	3,597,054
2005		24,612	68,743	656,191	1,373,341	1,102,398	124,954	945	8,344	3,359,528
2006		24,896	34,616	991,192	1,869,212	1,059,852	444,709	688	2,696	4,427,861
2007	600	0	74,548	1,276,466	3,239,708	982,463	174,059	2,026	13,697	5,763,567
2008		21,862	40,835	618,950	1,827,978	670,511	809,205	3,771	18,835	4,011,947
2009		2,222	48,269	805,894	823,928	363,998	209,974	5,895	9,081	2,269,261
2010		227,812	74,457	442,890	566,838	260,341	98,155	214	34,881	1,705,588
2011		755	52,095	313,721	1,091,139	410,317	215,960	171	51,760	2,135,918
2012	32,917	104,028	21,558	253,103	410,777	230,250	264,795	91	19,090	1,336,609
2013	6,131	119,348	107,362	277,173	1,321,886	460,928	301,307	1,614	42,267	2,638,016
2014		6,477	210,001	404,080	1,255,500	704,445	157,258	3,968	165,159	2,906,888
2015	0	0	3,274	187,061	378,959	395,268	1,202,646	575	134,444	2,302,227
2016		385	2,766	118,442	242,657	151,352	211,292	3,968	22,491	753,353

**Table 4. Recreational harvest (numbers) of spot by state, 1997-2016.** (Source: MRIP for 2015 and earlier and annual compliance reports for 2016. Data dating back to 1981 are available upon request to the NMFS Fisheries Statistics Division via MRIP.)

Year	NY	NJ	DE	MD	VA	NC	SC	GA	FL	Total
1997		20,148	126,089	713,657	3,328,144	1,440,661	680,842	5,471	31,987	6,346,999
1998		0	96,389	1,327,259	2,023,756	2,865,190	489,068	6,788	120,389	6,928,839
1999			19,911	655,289	569,250	1,308,167	801,785	5,578	264,233	3,624,213
2000	498,470	281,481	65,952	1,389,505	527,259	1,924,107	246,291	2,950	40,908	4,976,923
2001		0	51,096	1,088,997	1,056,365	3,650,711	735,551	3,681	652,975	7,239,376
2002	0	0	22,013	690,515	1,601,837	2,586,313	393,597	6,987	25,907	5,327,169
2003		0	30,165	3,300,594	1,441,002	3,796,557	524,513	11,524	84,685	9,189,040
2004			17,494	867,589	1,717,416	3,825,768	729,851	1,563	6,789	7,166,470
2005		46,795	150,772	1,788,679	2,781,973	3,012,872	358,550	3,199	23,795	8,166,635
2006		68,168	110,608	2,895,783	3,584,930	2,978,506	1,170,610	1,761	7,990	10,818,356
2007	1,813	0	176,997	3,615,346	8,203,377	3,078,346	605,024	6,529	30,184	15,717,616
2008		132,473	133,996	1,892,115	4,398,473	1,843,343	2,731,815	8,903	58,731	11,199,849
2009		6,720	128,799	2,064,326	2,146,607	1,056,346	589,027	17,948	25,391	6,035,164
2010		650,259	214,180	1,164,091	1,669,843	834,560	322,885	851	94,670	4,951,339
2011		1,370	150,650	912,704	2,967,030	1,207,335	596,680	968	152,329	5,989,066
2012	39,912	627,663	65,555	766,145	1,350,153	784,272	1,001,664	348	65,598	4,701,310
2013	13,365	329,162	248,456	935,539	4,264,524	1,464,592	732,413	6,573	132,204	8,126,828
2014		13,062	344,930	1,254,029	3,832,452	2,111,880	466,106	15,620	608,813	8,646,892
2015	0	0	10,277	524,079	867,365	1,081,083	3,258,544	1,800	391,653	6,134,801
2016		1,164	9,474	466,856	1,058,410	513,320	690,469	15,620	27,579	2,782,892

**Table 5. Recreational releases (numbers) of spot by state, 1997-2016.** (Source: MRIP for 2015 and earlier and annual compliance reports for 2016. Data dating back to 1981 are available upon request to the NMFS Fisheries Statistics Division via MRIP.)

Year	NY	NJ	DE	MD	VA	NC	SC	GA	FL	Total
1997		21,512	88,751	1,316,341	1,365,809	450,663	245,349	990	18,102	3,507,517
1998		12,542	75,985	633,914	900,352	650,157	307,480	12,286	58,264	2,650,980
1999			15,789	618,742	339,988	633,112	86,894	10,675	530,849	2,236,049
2000	157,991	16,633	30,522	1,080,310	502,923	481,995	115,682	17,376	54,388	2,457,820
2001		2,040	13,139	577,417	968,976	1,143,695	154,077	11,714	74,232	2,945,290
2002	2,127	3,331	27,220	501,111	481,765	671,669	103,914	20,038	44,584	1,855,759
2003		39,049	13,273	670,382	933,842	1,132,992	231,612	31,055	106,918	3,159,123
2004			39,998	383,292	882,136	1,257,887	210,215	12,536	9,427	2,795,491
2005		5,772	157,445	2,135,086	2,456,981	1,334,559	183,819	25,117	41,773	6,340,552
2006		65,244	92,864	1,355,280	1,371,751	2,588,647	496,870	3,774	21,755	5,996,185
2007	535	119,976	44,455	1,618,690	2,156,839	1,197,005	151,481	17,600	26,675	5,333,256
2008		1,166,532	98,304	1,737,665	1,487,665	1,322,408	188,746	25,908	128,942	6,156,170
2009		7,691	140,014	632,595	1,457,588	1,222,053	326,065	10,486	40,890	3,837,382
2010		191,745	72,216	1,155,003	1,155,882	871,054	166,679	562	57,924	3,671,065
2011		1,370	66,661	296,513	2,245,221	1,000,566	222,623	9,766	196,294	4,039,014
2012	37634	477938	60,334	919,896	1,145,960	759,081	142,093	3,968	373,916	3,920,820
2013	332	747,906	214,067	2,622,037	2,214,061	1,314,199	957,781	8,623	110,865	8,189,871
2014		15,323	78,691	565,679	1,185,087	890,831	427,049	27,224	575,251	3,765,135
2015	512	74,530	11,404	242,912	509,194	708,122	772,410	34,884	238,078	2,592,046
2016		1,903	7,300	229,987	489,621	498,424	384,284	27,224	238,647	1,877,390