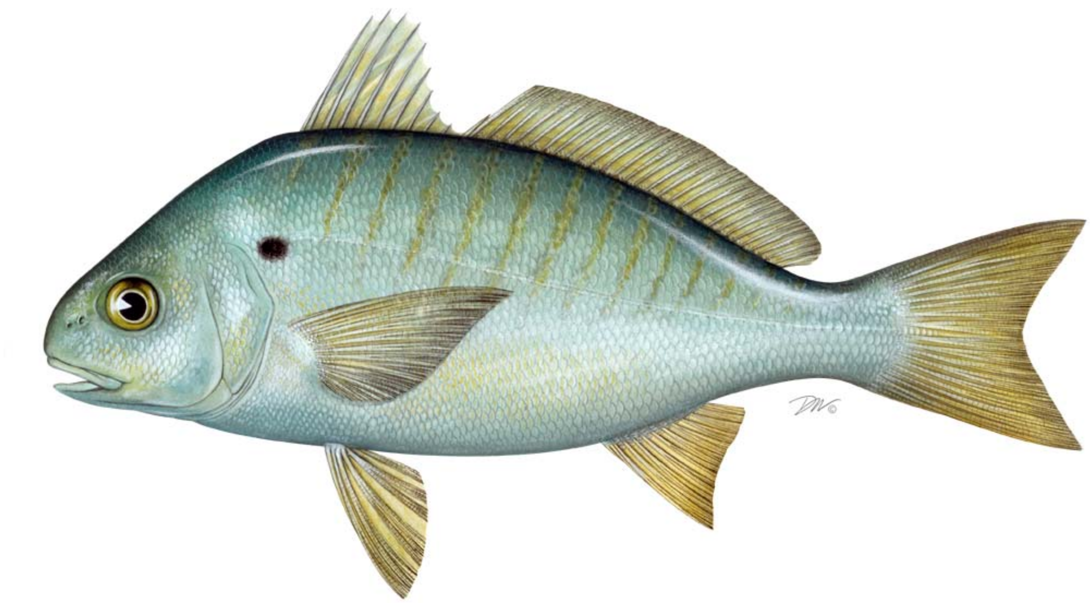
Atlantic States Marine Fisheries Commission

2017 Spot Stock Assessment Peer Review



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Vision: Sustainably Managing Atlantic Coastal Fisheries

Atlantic States Marine Fisheries Commission

2017 Spot Stock Assessment Peer Review

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Prepared by the
ASMFC Atlantic Croaker and Spot Stock Assessment Review Panel

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Executive Summary

Spot are caught in commercial and recreational fisheries, primarily in the Chesapeake Bay and Mid-Atlantic (New York-Virginia) and South Atlantic (North Carolina-Florida) coastal waters. The majority of annual fishery removals of spot were discards in South Atlantic shrimp trawl fisheries, followed by commercial landings and recreational harvest. Data to estimate discards in South Atlantic shrimp trawl fisheries were available starting in 1989 and the terminal year of data for this assessment was 2014. From 1989-2014, total annual removals of spot from all fishery sources (landings and discards) have ranged from between 4,637 and 57,287 metric tons, or 41 and 1,324 million fish. Removals were relatively large, but variable in the 1990s. Removals since 1997 have been relatively stable, coinciding with the requirement of bycatch reduction devices (BRDs) across shrimp trawl fisheries. The long term mean removals were 12,785 metric tons, or 254 million fish. However, total removals after the peak year that occurred in 1991 averaged 9,399 metric tons, or 158 million fish.

Indices of relative abundance from the NMFS Trawl Survey and the NCDMF Pamlico Sound Trawl Survey were used in the preferred stock assessment model (modified-CSA model). The indices generally suggested a period of low abundance through the 1990s and early 2000s, followed by increasing abundance in the late 2000s and 2010s. There was a decline across indices in the assessment terminal year (2014).

Although the current stock status could not be inferred with confidence, the Panel noted that the models generally suggested spawning biomass was increasing. Therefore, the Panel agreed no immediate management actions are required. However, monitoring of abundance indices, removals, and age/length composition should continue (Traffic Light Analysis). If new information suggests the stock could be declining, a new assessment should be expedited.

The Panel noted the uncertainty of the stock assessment outcome was due to inherent data uncertainties, and to conflicting information regarding population trends contained in the various data components. The Panel agreed the assessment used the best available information, all significant removals were incorporated, the data analyses conducted were based on current best practices, the structure and application of the assessment model appeared reasonable, and that important uncertainties were identified and explored.

Terms of Reference

1. **Evaluate the thoroughness of data collection and the presentation and treatment of fishery-dependent and fishery-independent data in the assessment, including the following but not limited to:**
    a. **Presentation of data source variance (e.g., standard errors).**
    b. **Justification for inclusion or elimination of available data sources,**
    c. **Consideration of data strengths and weaknesses (e.g., temporal and spatial scale, gear selectivities, aging accuracy, sample size),**
    d. **Calculation and/or standardization of abundance indices.**

The Review Panel commended the analytical team for their concise and comprehensive presentation of data inputs used in the stock assessment. The Panelists agreed the written report and summary presentations were unusually complete which greatly facilitated evaluation.

All major sources of removals of Spot were thoroughly described including: discards in the shrimp trawl fisheries, commercial landings, and recreational harvest. Discards from the shrimp trawl fisheries accounted for 31-70% of annual removals, commercial landings for 10-40% most years, while recreational harvest typically accounted for approximately 10% each year. The remaining sources of fishery removals were typically 5% or less of total annual removals over the last 20+ years (e.g., scrap fishery). The assessment period was 1989-2014. This timeframe was used because fishery dependent and independent data sets were more widely available. The Panelists noted that important removals began much earlier than 1989. Therefore, it may be useful to attempt to recover or estimate historical removals to improve initial estimates of depletion in the stock assessment.

Data strengths and weaknesses – temporal and spatial scale, sample sizes, coefficients of variation (CV) – were described in the stock assessment report, and input directly in assessment models when possible with an adjustment applied for the CVs of the indices. The justification for inclusion or elimination of available data sources was evaluated, particularly criteria for inclusion of abundance indices. A total of 35 fishery-independent surveys that encountered Spot were reviewed during the assessment. Of these, five met most of the criteria for inclusion. The criteria included the length and continuity of the time series, the spatial scale (population-wide/regional/local) and the constancy of survey methodologies. The Panelists agreed index selection criteria were adequate and suitably applied. The base model application (Catch-Survey Analysis or CSA Model) used indices of abundance for Age 0 and Age 1+ Spot from two sources, the NMFS NEFSC Groundfish Trawl Survey and the NCDMF Pamlico Sound Trawl Survey. The effect of index selection was explored through sensitivity runs.

Some potential data sources were not considered during the assessment, including fishery-dependent catch rate indices and annual effort estimates from the commercial and recreational fleets. It was not mandatory to include these inputs in the assessment, and some reviewers would not recommend including fishery-dependent indices in assessment models if high quality fishery independent indices are available. However, the availability of fishery-dependent catch-per-unit-effort (CPUE) inputs may have facilitated better interpretation of the commercial and recreational catch series in the context of increasing stock biomass predicted by the assessment model. I.e. catch in some fisheries has declined while the indices of abundance have increased. Typically, catches are expected to increase with increasing population abundance.

All but one of the indices of relative abundance were developed using a statistical standardization (e.g., delta-logormal, negative-binomial). The exception was the NMFS/Northeast Fisheries Science Center fall groundfish trawl survey which was a non-standardized, nominal index developed from design-based estimates. The Panelists noted many expert reviewers recommend a non-standardized approach, but also suggested that a standardized index be developed for future assessments, and that the sensitivity of the model results to these alternative approaches be considered.

Spot are an important component of Atlantic coast scrap (bait) landings. Quantifying the amount of spot landed as scrap fish along the coast is problematic due to the limited availability of sampling data. The Panel agreed the methods used during the assessment appear reasonable, but noted the resulting estimates from the scrap fishery are quite uncertain due to the number of required assumptions. However, as the magnitude of scrap landings is very small relative to total removals, the Panel agreed the assessment is not likely to be sensitive to these assumptions.

2. Evaluate methods used to develop discard and bycatch estimates.

Estimates of spot discard rates in South Atlantic shrimp trawl fisheries were developed using discard rate data from the Shrimp Trawl Observer Program to estimate the magnitude of discard rates and the SEAMAP Trawl Survey to estimate the trend of discards prior to (1989-2000) and during the observer program (2001-2014). Discard rate estimates were then applied to effort data from state trip ticket programs and the South Atlantic Shrimp System (SASS) to estimate total discards in these fisheries from 1989-2014 (Walter and Isley, 2014). Discard rates were applied to effort estimates summarized by "strata" (combinations of factors included in the model). Because there were no observer data before Bycatch Reduction Devices (BRDs) were required in the penaeid shrimp fishery, discard estimates prior to 1997 were adjusted for the reduction in catch due to the required use of certified BRDs on observed tows. Adjustments were based on a weighted average of Atlantic croaker catch reductions in the Gulf of Mexico shrimp trawl fishery estimated depending on the distance of fisheye BRDs from tie-off rings (Helies et al. 2009).

Discards from the Mid-Atlantic gill net and trawl fisheries were estimated using observer data from the Northeast Fisheries Science Center's Northeast Fisheries Observer Program (NEFOP) and At-Sea Monitoring Program (ASM). Annual ratios of observed discarded spot to observed landings of all species by gillnets and bottom trawls were calculated, then applied to reported gillnet and bottom trawl landings of all species to estimate total discards of spot.

The Panelists recognized discard/bycatch estimates are unusually uncertain due to data insufficiencies, but agreed the method used to develop estimates of spot bycatch from the southern shrimp trawl fishery was current, supported, and similar (or identical) to methods used in SEDAR assessments of South Atlantic king mackerel, and Gulf of Mexico red snapper, king mackerel, gray triggerfish and domestic sharks. The Panel also agreed the method used to estimate spot discards from the commercial and recreational fisheries were acceptable given the available data, and noted the relatively small contribution of these discards to total removals.

3. **Evaluate the methods and models used to estimate population parameters (e.g., F, biomass, abundance) and biological reference points, including but not limited to:**

    a. **Evaluate the choice and justification of the preferred model(s). Was the most appropriate model (or model averaging approach) chosen given available data and life history of the species?**

The Assessment Team chose a catch-survey analysis (CSA) model as their preferred base model. The Review Panel agreed with the choice of the CSA model over the surplus production model because the CSA model uses more of the available information. However, the Review Panel also noted that the CSA (and production model) results did not follow the same pattern as catch-curve estimates of the total mortality rates; catch curves indicated relatively stable total mortality, while the CSA model indicated declining total mortality. Additionally, the CSA model had some difficulties reconciling differences in trends between the two primary indices, which was why the models that allowed catchability to change over time improved the model fits. The NMFS trawl survey index of Age 1+ biomass indicated about a 6.4X increase between 1990-1993 and 2011-2014, while the SEAMAP index of Age 1+ biomass indicated about a 10% increase. Given the inherent conflicts in the data (among the indices) and the conflicts between the catch curve and CSA estimates of Z, a more complicated model that can make fuller use of the available data may allow future progress in spot stock assessments. In future efforts the Assessment Team may want to consider simple age-length structured models (e.g., SCALE) that can use all of the available data or a simple Stock Synthesis model.

    b. **If multiple models were considered, evaluate the analysts' explanation of any differences in results.**

The Assessment Team applied CSA and surplus production models. The base CSA model and the base surplus production model generally agreed on the trend and stock status determinations. The approach of fitting multiple models is considered best practices.

c. **Evaluate model parameterization and specification (e.g., choice of CVs, effective sample sizes, likelihood weighting schemes, calculation/specification of M, stock-recruitment relationship, choice of time-varying parameters, plus group treatment).**

In general, the Review Panel agreed the approaches used by the Assessment Team for specifying the assessment models were appropriate and followed best practices. The Assessment Team used the approach of adding a constant to the CV of the index for each year to represent the process error in the indices of abundance. CSA models separate the population into pre-recruits (Age 0) and fully recruited (Age 1+) age classes, which seems reasonable for a short-lived species like spot. The Assessment Team used a maximum age approach combined with a Lorenzen size-based adjustment to calculate natural mortality, M. The CSA model included a Beverton-Holt stock-recruitment relationship. The base CSA model did not include time-varying parameters, but allowing catchability to change was explored in sensitivity analyses. These choices by the Assessment Team appear to be well founded and follow standard practices used in the region. One of the assumptions that caused fairly large changes in the results was whether catchability changes were allowed in the indices. See TOR 8 below for research recommendations from the Review Panel that would support research to better understand the need for time-varying catchability.

4. Evaluate the diagnostic analyses performed, including but not limited to:

a. **Sensitivity analyses to determine model stability and potential consequences of major model assumptions**

Sensitivity analyses were conducted for both assessment models including evaluations of sensitivity described in the Stock Assessment Report Table 95 for the CSA and sensitivity analyses around the assumed initial level of biomass relative to carrying capacity (i.e., initial depletion) for the surplus production model. During the Review Workshop, the Panel requested additional sensitivity runs for the penalty on total instantaneous mortality (Z) that was calculated outside the CSA, and alternative initial depletion levels. The CSA was sensitive to the time trend in Z because the catch curves indicated a relatively stable Z, but the model without the time series of Z values estimated declining Z. The model that used the time series of Z values resulted in the stock being overfished in the last year, while the CSA that only used mean Z during the period resulted in no concerns about stock status. The surplus production model was sensitive to the assumed initial depletion level and values of initial depletion below about 0.16 of carrying capacity resulted in the stock being overfished in the most recent year. However, the overfishing determination was less sensitive to these alternative assumptions.

b. Retrospective analysis

The Assessment Team conducted retrospective analyses for the base CSA model. The results of the retrospective analyses indicated no concerning patterns in estimates of static Spawning Potential Ratio (sSPR), fishing mortality, recruitment, or spawning stock biomass. The calculated Mohn's Rho statistics and visual inspection of plotted patterns are standard best practices used by the Assessment Team.

5. Evaluate the methods used to characterize uncertainty in estimated parameters. Ensure that the implications of uncertainty in technical conclusions are clearly stated.

The Assessment Team used asymptotic standard errors and Markov Chain Monte Carlo (MCMC) to estimate uncertainty for the CSA. The Review Panel thought the asymptotic standard errors were a reasonable approach for quantifying uncertainty for this model. Although MCMC is a justifiable approach, there were some issues with its diagnostics for select parameters (particularly the parameters of the stock-recruitment relationship). Specifically, the chains for these parameters showed very high autocorrelation that indicates the distribution derived from the MCMC chain likely does not fully describe the distributions for those parameters.

6. Recommend best estimates of stock biomass, abundance, and exploitation from the assessment for use in management, if possible, or specify alternative estimation methods.

The Review Panel recommends against using specific estimates of stock biomass, abundance, and exploitation for management purposes because of the sensitivity of the models to several key assumptions. Specifically, the differences in estimates were quite large between CSA models that used the time series for Z from models that only used the average Z value and indicated the estimates of abundance and fishing mortality rates were very sensitive to a range of reasonable assumptions. The surplus production model showed similar issues, but the key assumption appeared to be the initial level of depletion in 1989.

Despite the inability to arrive at a new base model, several patterns seem clear from the data:

1) The indices of abundance for spot appear to be stable or increasing across most of the stock's range.
2) Catch appears to be stable or declining over time.
3) The combination of these two patterns indicates it is likely that fishing mortality rates have also declined over time such that the relative status of the stock in the most recent years is likely better than it was in the late 1980s – early 1990s.
4) Shrimp fishery effort and spot bycatch magnitude appear to be declining. The Stock Assessment Subcommittee should consider adding shrimp bycatch estimates to annual Traffic Light analyses. The new estimates of shrimp bycatch are a notable improvement from previous spot assessments and should be reviewed annually given their substantial contribution to overall spot removals and mortality.

7. **Evaluate the choice of reference points and the methods used to estimate them. Recommend stock status determination from the assessment, or, if appropriate, specify alternative methods/measures.**

The Spawning Potential Ratio (SPR) reference points appeared to be appropriate for the species (30% threshold, 40% target) and are consistent with reference points used for similar species in the region. However, given uncertainties in fishing mortality and biomass estimates exhibited by the sensitivity analyses, stock status cannot be reliably determined. In particular, models with different sets of plausible assumptions resulted in estimates of biomass above and below the limit reference point. The result of whether the stock was overfished in the most recent year depended on how low stock size was at the beginning of the time series. In contrast, all of the models indicated that overfishing is unlikely in the most recent years and that stock size appears to be increasing over the time series.

8. **Review the research, data collection, and assessment methodology recommendations provided by the TC and make any additional recommendations warranted. Clearly prioritize the activities needed to inform and maintain the current assessment, and provide recommendations to improve the reliability of future assessments.**

The Panel thoroughly reviewed the research recommendations identified by the Technical Committee, and noted additional research and data collection priorities. Following discussions with the SASC at the Review Workshop, the Panel worked closely with the SASC chair to refine and prioritize a final set of research recommendations, adapted from the stock assessment report and provided here as High or Medium Priorities, within Short-term vs. Long-term research categories.

<u>Short-term</u>

HIGH PRIORITY

- 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.

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 Sp/Cr 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.

Long-term

HIGH PRIORITY

- 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

- 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.

9. Recommend timing of the next benchmark assessment and updates, if necessary, relative to the life history and current management of the species.

A benchmark stock assessment is recommended in five years. No assessment updates are called for given challenges with the current model, and the existing annual use of Traffic Light analyses. Despite uncertainty in the assessment model results and an inability to confidently determine stock status, trends in landings and indices do not indicate immediate cause for concern, and therefore do not call for a subsequent new stock assessment in the short-term.

Literature Cited

Helies, F., and J. Jamison. 2009. Reduction rates, species composition, and effort: assessing bycatch within the Gulf of Mexico shrimp trawl fishery. Gulf & South Atlantic Fisheries Foundation, Inc., Tampa, FL, 182 pp.

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