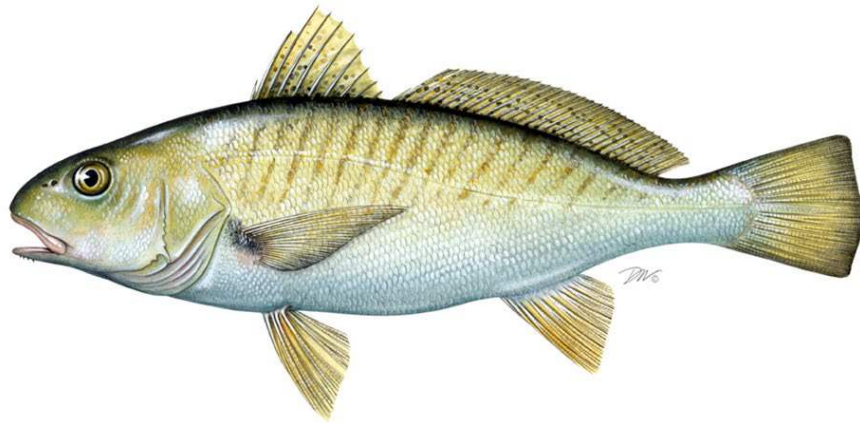


ATLANTIC STATES MARINE FISHERIES COMMISSION

2022 TRAFFIC LIGHT ANALYSIS REPORT FOR ATLANTIC CROAKER (*Micropogonias undulatus*)

2021 Fishing Year



Prepared by the Technical Committee
July 2022



Sustainable and Cooperative Management of Atlantic Coastal Fisheries

EXECUTIVE SUMMARY

Background

The purpose of this report is to evaluate the current status of Atlantic croaker using the annual Traffic Light Analysis (TLA). Atlantic croaker is managed under Addendum III (2020) which outlines the population characteristics evaluated, management triggers, and management responses. Annually, the Technical Committee (TC) conducts a TLA to evaluate a Mid-Atlantic and a South Atlantic harvest metric, combining commercial and recreational landings in the region. The TC also evaluates a Mid-Atlantic (NJ-VA) and South Atlantic (NC-FL) abundance metric, combining indices of abundance from fishery-independent surveys in each region. Each metric is evaluated using a color proportion of green, yellow, or red based on comparing that year to a 2002-2012 reference period. Addendum III defined 30% red threshold as a moderate concern and 60% red threshold as a significant concern to the fishery. Management action is triggered according to the 30% red and 60% red thresholds if both the adult abundance and harvest thresholds are exceeded for either region in any three of the four terminal years.

Data Availability Issues

There have been several data availability issues in recent years due to the COVID-19 pandemic and other factors. The Mid-Atlantic abundance index is based on the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) and the Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey. ChesMMAP has not had available data for 2019-2021 due to lack of calibration factors from a change in survey methodology, but should be available in 2023. NEFSC's survey did not operate in 2020 but did operate in 2021. Because of the missing survey data in the Mid-Atlantic region, the NorthEast Area Monitoring and Assessment Program (NEAMAP) was evaluated for trends in the region despite it not being accepted for use in the TLA due to having a shorter time series (2007-2021) that does not include the reference period (2002-2012). The South Atlantic abundance index is based on the South Carolina Department of Natural Resources (SCDNR) Trammel Net Survey and Southeast Area Monitoring and Assessment Program (SEAMAP) Coastal Trawl Survey. SEAMAP did not operate in 2020 and spring 2021. Therefore, the Mid-Atlantic abundance metric is unavailable for 2019-2021 and the South Atlantic abundance metric is unavailable for 2020-2021.

2021 Harvest Metrics

The Mid-Atlantic harvest metric has exceeded the 60% red threshold in all four terminal years (2018-2021) and the South Atlantic harvest metric has exceeded the 30% red threshold in all four terminal years (2018-2021). This is the second consecutive year the harvest metric in both regions have exceeded the 30% threshold, although the harvest metrics in 2021 cannot be used as a trigger mechanism since they represent a year with catch restrictions in place.

2021 Abundance Metrics

The Mid-Atlantic metric could not be updated due to missing ChesMMAP data from 2019-2021. The NEFSC index, an index used in the Mid-Atlantic metric, was available in 2021 and while it was below average, showed an increase from 2019. The South Atlantic composite could not be updated past 2019 due to missing SEAMAP data, so it is unknown if it triggered. The SC Trammel Net Survey increased 24% in 2021 compared to 2020. When the South Atlantic

composite metric was calculated using P195 instead of SEAMAP, all four years (2018-2021) were below the 30% threshold.

Conclusions

The harvest metric triggered in both the Mid-Atlantic (60% threshold) and South Atlantic (30% threshold) from 2018 to 2020 indicating continued concern. Harvest restrictions were in place in 2021 and the harvest metric cannot be used as a trigger mechanism in that year. The abundance composite metrics are unknown for the Mid-Atlantic and South Atlantic due to missing data, and so it could not be determined if further management would be triggered. Addendum III requires management action taken in 2021 to remain in place for a minimum of three years (through and including the 2023 season). The TC recommends maintaining management enacted in 2021.

1 INTRODUCTION

Atlantic croaker are managed under Amendment 1 to the Interstate Fishery Management Plan for Atlantic Croaker (2005) and Addendum I (2011), Addendum II (2014), and Addendum III (2020). The Amendment does not require any specific measures restricting harvest but encourages states with conservative measures to maintain them. It also implemented a set of management triggers, based on an annual review of certain metrics, to respond to changes in the fishery or resource, and initiate a formal stock assessment on an accelerated timeline if necessary. Addendum I revised the management program's biological reference points to assess stock condition on a coastwide basis as recommended by the 2010 stock assessment.

In August 2014, the South Atlantic State/Federal Fisheries Management Board (SAB) approved Addendum II to Amendment I to the Atlantic Croaker Fishery Management Plan (FMP). The Addendum established the Traffic Light Approach (or TLA) to evaluate fisheries trends and develop state-specific management actions (i.e., bag limits, size restrictions, time and area closures, and gear restrictions) when harvest and abundance thresholds are exceeded. Addendum II established the TLA as a precautionary management framework to evaluate fishery trends and develop management actions. Starting in the late 2000s, there were inconsistent signals in the data used to examine the resource. The lack of clear information from the TLA and the assessment made it difficult to provide management advice.

The most recent benchmark stock assessment for Atlantic croaker was completed in 2017 and provided more data for further refinement and modification of the existing TLA, as recommended by the Atlantic Croaker Technical Committee (TC). However, the 2017 stock assessment was not recommended for management use. In February of 2020, the SAB approved Addendum III to Amendment I allowing modification of the TLA to use a regional approach as well as establishing management actions to be taken if the TLA triggers were tripped. Addendum III addressed several issues by modifying the TLA to better reflect stock characteristics and identifying achievable management actions based on stock conditions.

The TLA is a way to incorporate multiple data sources (both fishery-independent and -dependent) into a single, easily understood metric for management advice. It is often used for data-limited species, or species that are not assessed on a frequent basis. As such, it is a

valuable management tool for Atlantic croaker. The name comes from assigning a color (red, yellow, or green) to categorize relative levels of indicators on the condition of the fish population (abundance metric) or fishery (harvest metric). For example, as harvest or abundance increase relative to their long-term mean (LTM), the proportion of green in a given year will increase, and as harvest or abundance decrease, the amount of red in that year becomes more predominant. Under Addendum II, state-specific management action would be initiated when the proportion of red exceeds specified thresholds (30% or 60%), for both harvest and abundance, over three consecutive years. The thresholds were maintained in Addendum III but the trigger mechanism was changed as described below.

Addendum III incorporated the following changes into the TLA:

1. Incorporation of 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 to the currently used indices from the Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey and Southeast Area Monitoring and Assessment Program (SEAMAP).
2. Use of revised adult abundance indices from the surveys mentioned above, in which age-length keys and length composition information are used to estimate the number of adult (age 2+) individuals caught by each survey.
3. Use of regional metrics to characterize the fisheries north and south of the Virginia-North Carolina state border. The ChesMMAP and NEFSC surveys will be used to characterize abundance north of the border, and the SCDNR Trammel Net and SEAMAP surveys will be used to characterize abundance south of the border.
4. Change/establish the reference time period for all surveys to be 2002-2012.
5. Change the triggering mechanism to the following: Management action will be triggered according to the current 30% red and 60% red thresholds if both the abundance and harvest thresholds are exceeded in either region in any three of the four terminal years.

Addendum III retained the TC's ability to alter the TLA as needed to best represent trends in Atlantic croaker harvest and abundance, including selection of surveys and methods to analyze and evaluate these data. Such changes may be made without an addendum, but Addendum III was necessary because of the change to the management-triggering mechanism. Since the implementation of Addendum III, Atlantic croaker management has been moved to the newly formed Sciaenids Management Board.

In 2020, the TLA for Atlantic croaker had red proportions that exceeded the threshold of 30% in both the harvest and abundance metrics in the Mid-Atlantic. The South Atlantic region harvest metric also triggered at 30% threshold in 2020. Exceeding the 30% threshold represents moderate concern to the fishery and initiated a moderate management response. All non-*de minimis* states were required to institute a recreational bag limit of no more than 50 Atlantic

croaker per person per day. States with more restrictive measures in place were encouraged to maintain those measures. For commercial fisheries, states had to set a regulation that, if applied to the state's 2010-2019 average commercial harvest, would have produced at least a 1% reduction. States established different measures by trip limits or season modifications, as long as measures implemented were quantifiable and are projected to achieve this 1% reduction. All states have submitted state implementation plans to meet the required recreational and commercial management measures. Management measures were initiated in 2021 and are required to remain in place for three years, through 2023.

In addition to triggering management, the COVID-19 pandemic occurred in 2020, which had far reaching impacts including limited or no sampling in state and federal fishery-independent monitoring programs. For the TLA, the impact was felt most significantly for the larger scale regional monitoring surveys (NEFSC groundfish survey and the SEAMAP survey) which were not able to sample at all in 2020. In 2021, the only survey that was directly impacted by COVID was SEAMAP which could not complete the spring 2021 cruise, but was able to finish the full summer and fall cruises. Additionally, the ChesMAMAP survey has not completed the calibration estimates for converting the index for use over the entire time series due to the vessel and gear change that occurred in 2019, so data are unavailable from 2019-2021. It is not clear when ChesMAMAP anticipates having the calibration estimates completed.

This report includes the harvest and abundance composite indices in Sections 2 and 3 which are the TLAs that were approved in Addendum III to trigger management action. Individual TLAs for commercial and recreational harvest by region as well as effort and discards of Atlantic croaker in the South Atlantic Shrimp Trawl Fishery are described in Section 4. TLAs for each fishery-independent index that go into the abundance composite or juvenile composite are described in Section 5. The discard data and juvenile indices are included as supplementary information to be reviewed by the TC and are not considered in trigger mechanisms. Supplemental information with NEAMAP incorporated into the Mid-Atlantic composites and NCDMF P195 incorporated into the South Atlantic adult composite are provided in Section 6.

2 TRAFFIC LIGHT ANALYSIS (COMPOSITE INDEXES)

2.1 Harvest Composite Index

- The mean red proportion for the most recent three year time period (2019-2021) in the Mid-Atlantic was 77% with the red proportion being above 60% since 2018 which indicates a significant level of concern (Figure 1). Since catch restrictions were in place in 2021, this year cannot be used as a trigger mechanism for additional management measures.
- The harvest composite TLA index for the South Atlantic also triggered in 2021 at the 30% threshold and represented the eighth consecutive year above 30% (Figure 2). Similar to the Mid-Atlantic, 2021 was consistent with the most recent trends in data but it should not be interpreted as a trigger mechanism since catch restrictions were in place that year.

- Both regions show a continuing decline in recreational and commercial landings for Atlantic croaker.
- The TLA 30% threshold triggers were tripped in 2020 for the period of 2017-2019, leading to restrictive management measures put into place in the commercial and recreational fisheries in the Mid- and South Atlantic. Therefore, the current harvest composite index may be affected by these new management measures and thus cannot be considered when determining if continued management action is necessary.

Figure 1. Annual color proportions for the harvest composite TLA of Mid-Atlantic (NJ-VA) Atlantic croaker recreational and commercial landings from 1989-2021 using a 2002-2012 reference period.

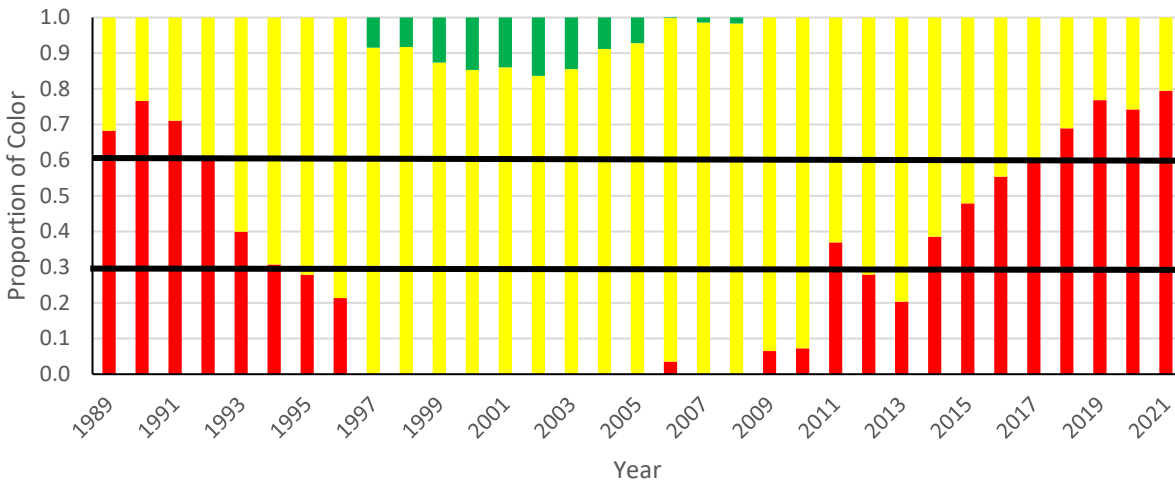
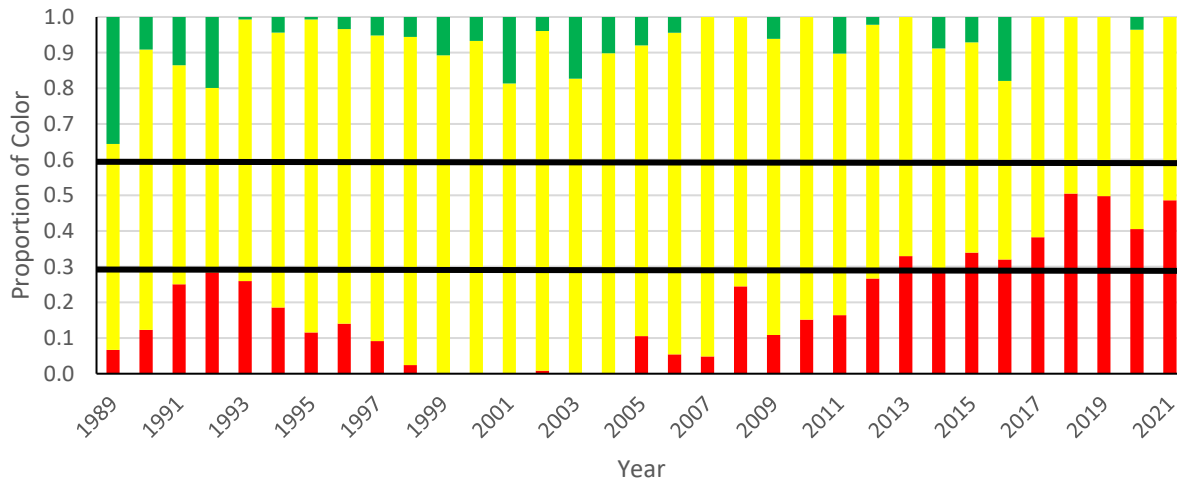


Figure 2. Annual color proportions for the harvest composite TLA of South Atlantic (NC-FL) Atlantic croaker recreational and commercial landings from 1989-2021 using a 2002-2012 reference period.



2.2 Abundance Composite Characteristic Index

The abundance composite TLA index in each region is broken into two components based on age composition, including an adult index (ages 2+) and a juvenile index (ages 0-1). Only adult abundance is used to determine if management action is triggered. Juvenile data is presented as supplementary information only (Section 5.7). The adult composite index was generated from the NEFSC and ChesMMAP surveys for the Mid-Atlantic and SEAMAP and SCDNR trammel net survey in the South Atlantic since the majority of Atlantic croaker captured in these surveys were ages 2+.

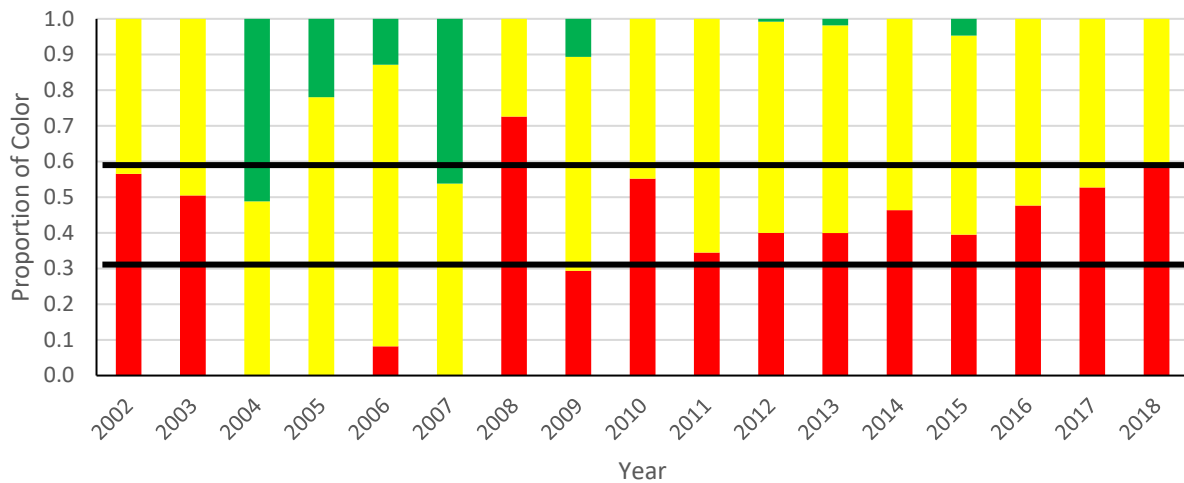
Calculating the abundance indices for the TLA has been challenging since many surveys could not operate during COVID and ChesMMAP has not provided data since 2018. Neither the NEFSC fall ground fish survey nor the SEAMAP survey were able to complete any sampling cruises/trips in 2020. In 2021, SEAMAP also was not able to complete its spring survey sampling which is the season in which adults are typically captured. The ChesMMAP survey has not completed the calibrations necessary to convert the 2019-2021 index values that would allow full use of the entire time series after the vessel and gear changes that occurred in 2019. Therefore, at this time, ChesMMAP only goes through 2018.

2.2.1 Mid-Atlantic

- The adult Mid-Atlantic composite index (Figure 3) could only be calculated through 2018 since ChesMMAP data was not available for 2019-2021. The NEFSC index was available in 2021 and showed an increase from 2019 (Section 5.1). However, it was still below the long-term mean and had a red proportion of 15%.

- The adult composite TLA characteristic for the Mid-Atlantic (Figure 3) shows a trend of increasing red proportions beginning approximately in 2009. The continued declining trend is cause for concern in the Mid-Atlantic region. The juvenile composite (Section 5.7) also shows a continued decline, potentially indicating poor recruitment, which does not bode well for changes in the adult population.
- Results of the TLA for the Mid-Atlantic abundance are inconclusive due to missing data.

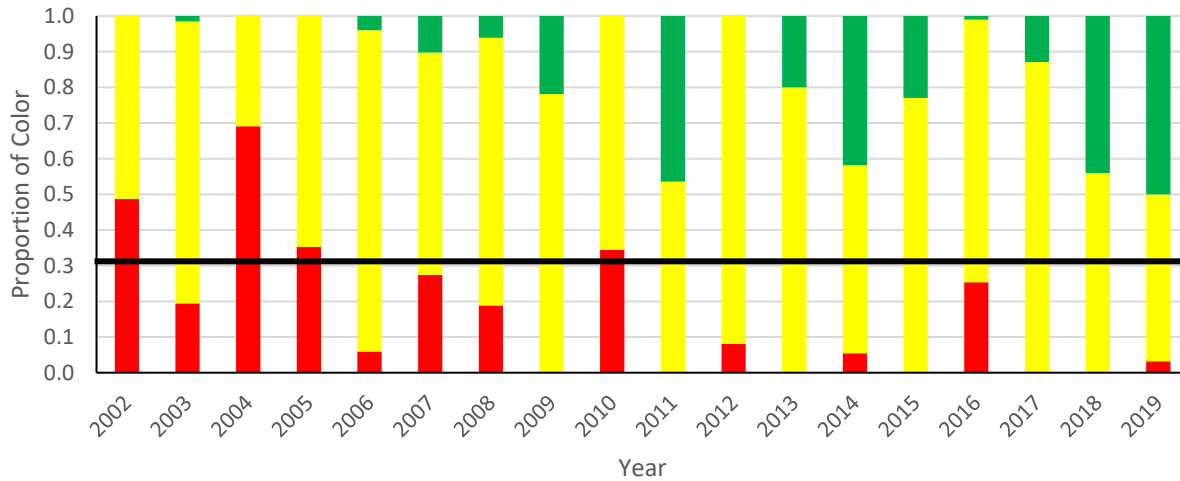
Figure 3. Adult (age 2+) Atlantic croaker TLA composite characteristic index for the Mid-Atlantic (NEFSC and ChesMMAAP surveys) from 2002-2018.



2.2.2 South Atlantic

- The adult composite TLA for the South Atlantic region is presented using SEAMAP and SCDNR Trammel Net survey data and did not include data from 2020 and 2021 from SEAMAP due to lack of data for spring cruises in both those years. The SCDNR trammel survey had an increase in abundance in 2021 and was above the long-term mean.
- Results of the TLA for the South-Atlantic abundance are inconclusive due to missing data.

Figure 4. Adult (age 2+) Atlantic croaker TLA composite characteristic index for the South Atlantic (SEAMAP and SCDNR trammel survey) from 2002-2019.



3 SUMMARY

- The harvest composite TLA characteristic remained above triggered thresholds in both the Mid-Atlantic (60% threshold) and South Atlantic (30% threshold) in 2021 indicating continued concern, although 2021 had catch restrictions in place. Therefore, the TLA harvest composite should not be interpreted as a trigger year.
- The continued declining trend in the commercial and recreational harvest for the Atlantic coast is a concern since the decline has become greater in the last two years. However, several states implemented more restrictive management measures in 2021 as required by Addendum III, which may have impacted harvest. According to Addendum III, until the management measures are lifted, further management action can only be triggered based on the abundance composites.
- The Mid-Atlantic abundance composite characteristic did not have 2019-2021 data points, so no determination could be made for these years.
- The South Atlantic abundance composite characteristics are missing 2020-2021 data, so no determination could be made for these years.
- Table 1 provides an overview of the past four years of trigger thresholds for each region, as well as the current TLA status. The adult abundance indices currently have an unknown status; as discussed above, ChesMMAP will be available in the future once calibration factors are developed.

Table 1. Traffic light metrics for the Mid- and South Atlantic regions with known and unknown values, given missing 2019-2021 data. Management action is triggered according to the current 30% red and 60% red thresholds if both the adult abundance and harvest thresholds are exceeded in any three of the four terminal years within either region.

TLA Metric	Atlantic Croaker			
	2018	2019	2020	2021
Mid-Atlantic Harvest	69% red	77% red	74% red	79% red*
South Atlantic Harvest	51% red	50% red	41% red	49% red*
Mid-Atlantic Adult Index	58% red	Unknown	Unknown	Unknown
South Atlantic Adult Index	44% green	50% green	Unknown	Unknown
2022 TLA Status	Status Unknown			

*Harvest metrics should not be interpreted as a trigger mechanism in the TLA since catch restrictions to lower harvest were in place for these years

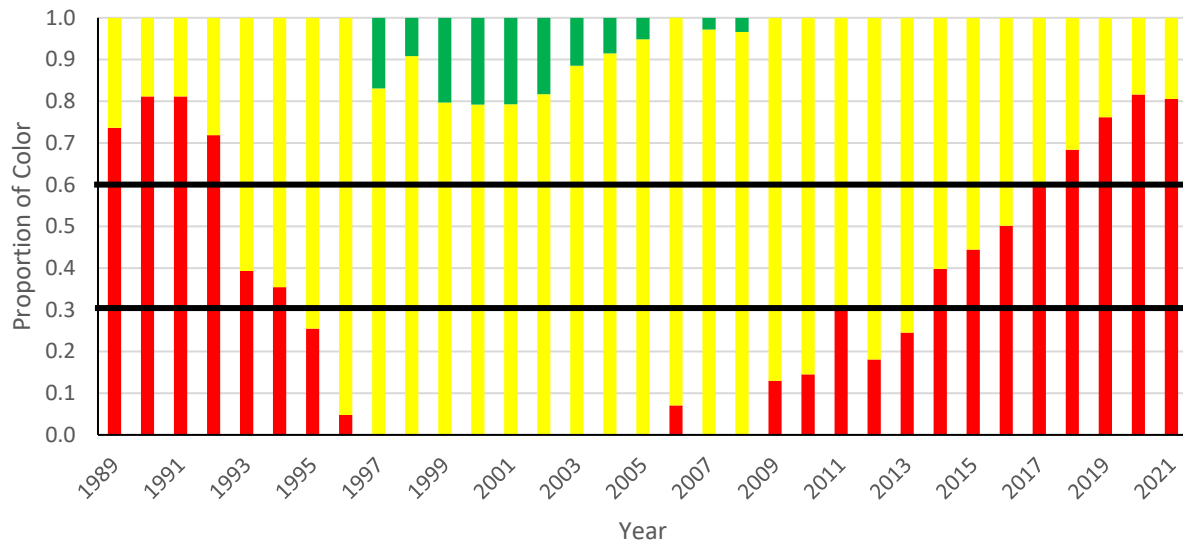
4 TRAFFIC LIGHT ANALYSIS (FISHERY-DEPENDENT)

4.1 Commercial Landings

4.1.1 Mid-Atlantic

- Commercial landings in the Mid-Atlantic increased 98% in 2021 from 2020, but remained low and represented the fourth lowest year of commercial croaker landings in the data series (Figure 5). Several states implemented more restrictive management measures in 2021 as required by Addendum III, which may have impacted harvest.
- The proportion of red for commercial landings has been above the 30% threshold every year since 2014 (Figure 5) and 2021 was the fourth year in a row where landings were above the 60% threshold.

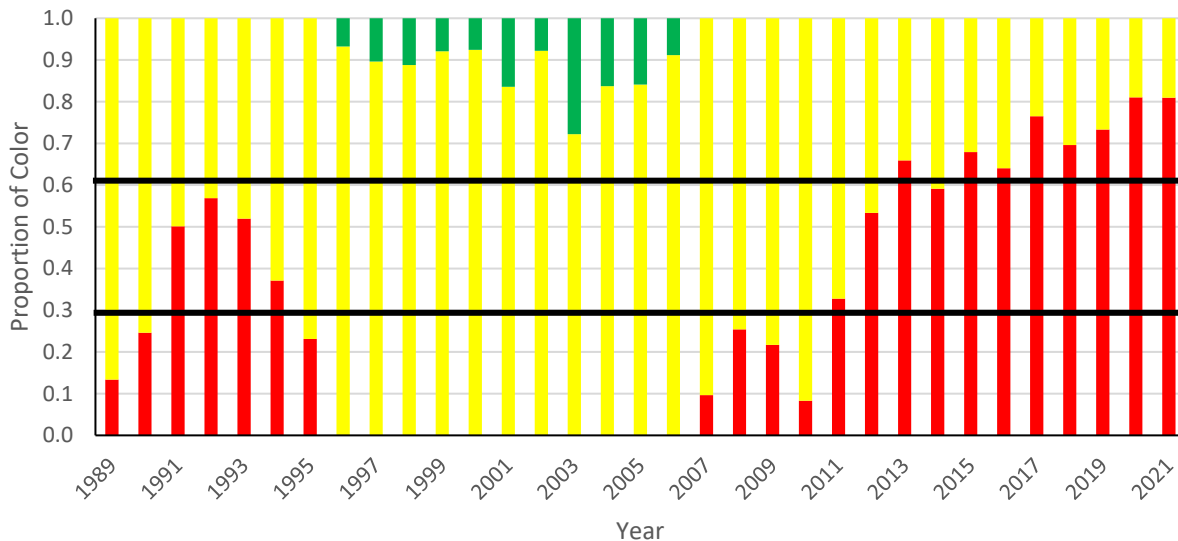
Figure 5. Annual TLA color proportions for Atlantic croaker commercial landings for the Mid-Atlantic (NJ-VA) coast of the U.S. from 1989-2021.



4.1.2 South Atlantic

- Commercial landings in the South Atlantic increased slightly in 2021 from 2020, but remained low and represented the 14th year of decline in commercial croaker landings in the South Atlantic (Figure 6). Several states implemented more restrictive management measures in 2021 as required by Addendum III, which may have impacted harvest.
- The proportion of red for commercial landings in the South Atlantic has been above the 30% threshold every year since 2011 and been above the 60% red threshold for every year since 2015 (Figure 6). This past year, 2021, was the 11th year in a row where landings were above the 30% threshold.

Figure 6. Annual TLA color proportions for Atlantic croaker commercial landings for the South Atlantic (NC-FL) coast of the U.S. from 1989-2021.



4.2 Commercial Discards

4.2.1 South Atlantic

- Discard estimates of Atlantic croaker in the South Atlantic Shrimp Trawl Fishery are informed by catch rates observed during the SEAMAP survey and South Atlantic Shrimp Trawl Fishery Observer Program, and total effort of the South Atlantic Shrimp Trawl Fishery. Increases in discards could be an indicator of higher abundance of juveniles in the region, an increase in effort by the fishery, or a combination of both.
- Total effort (net hours) in the South Atlantic Shrimp Trawl Fishery declined from a time series high in 1991 to a time series low in 2005 (Figure 7). Effort then varied around an increasing trend through 2017 and was variable and lower through 2020. Effort declined slightly from 786,172 net hours in 2020 to 780,515 net hours in 2021.
- Total discards of Atlantic croaker in the South Atlantic Shrimp Trawl Fishery were high during the late 1980s and early 1990s, declined to relatively low levels in the early to mid-2000s, and then increased to levels similar to the beginning of the time series during the 2010s (Figure 7). Discards declined from some of the highest levels of the time series in 2018-2020 to the lowest level since 2009 in 2021.
- There were no SEAMAP survey tows conducted in 2020, so the trend for the 2020 discard estimate relative to previous years is solely informed by South Atlantic Shrimp Trawl Fishery Observer catch rates. Further, there was reduced observer coverage of shrimp trawl fisheries during 2020. Sampling occurred January-March and August-November at levels similar to prior years which includes months in both seasons (off-season and peak-season) used as a factor in the model to estimate catch rates, but there was no observer coverage from April-July. The observer catch rates of Atlantic

croaker over the reduced sampling season in 2020 increased relative to 2019 catch rates (Figure 8). The 2020 discard estimate was likely influenced by the lack of SEAMAP tows and reduced observer coverage. The SEAMAP survey did not sample in spring 2021, but began operations again during the peak of the shrimping season in July. The 2021 catch rates from both data sets show declines relative to 2019, though the SEAMAP survey shows a greater magnitude of decline during this period. As in all years, the magnitude of the 2020 and 2021 discard estimates are informed by the observer data (magnitude of catch rates) and shrimp trawl effort data (expansion factor to expand catch rates to total discards).

- For additional information on the South Atlantic Shrimp Trawl Fishery discard estimation, please see Appendix 1 of the 2020 TLA Update Report.

Figure 7. Total net hours fished (left) and discards of Atlantic croaker (right) in the South Atlantic Shrimp Trawl Fishery.

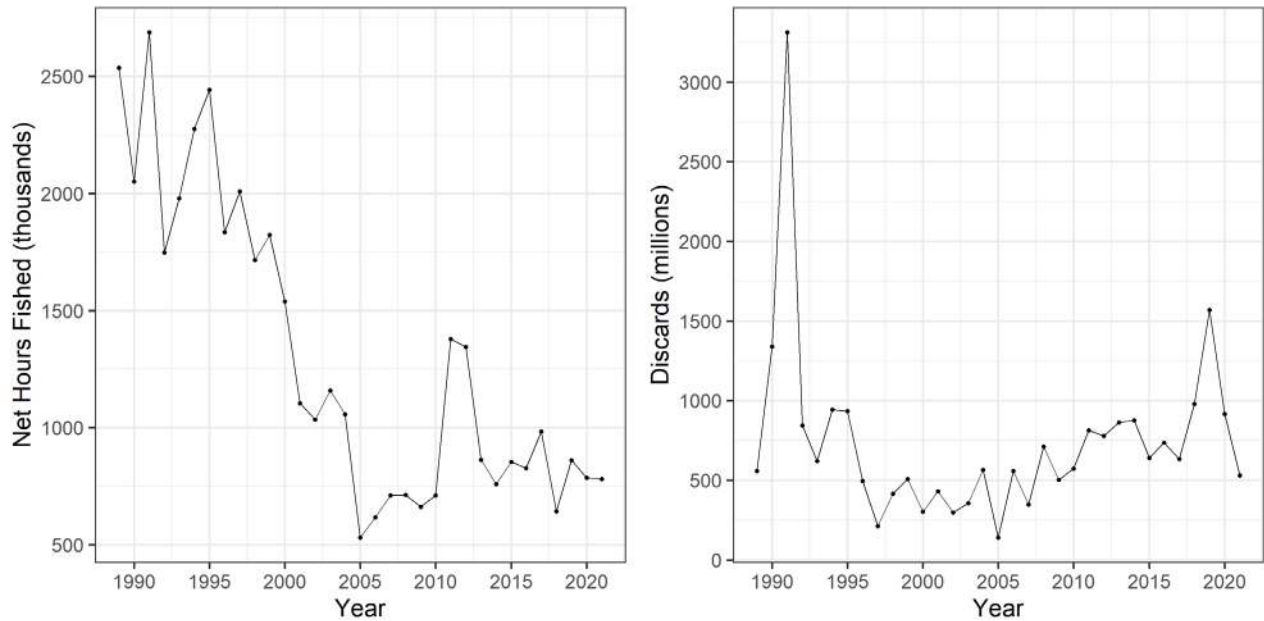
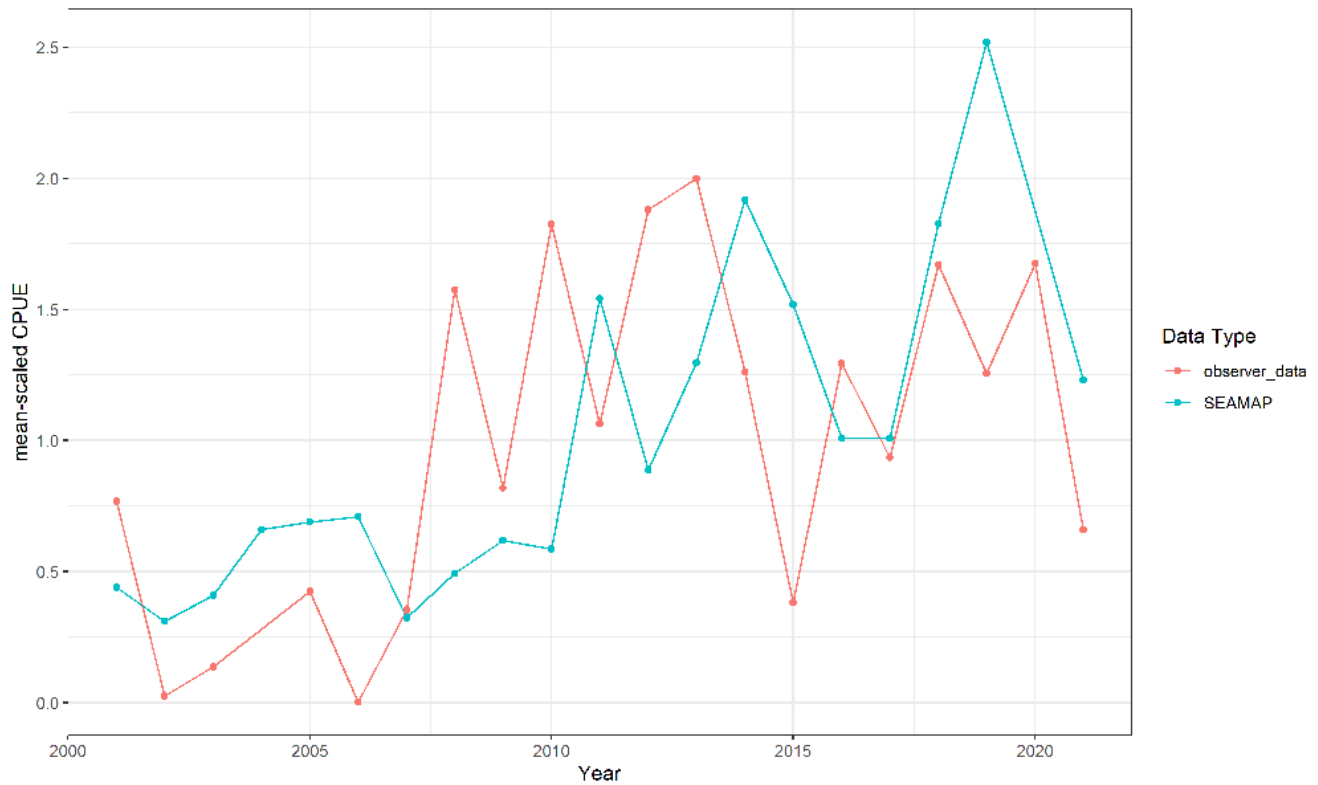


Figure 8. Comparison of Atlantic croaker mean-scaled catch-per-unit-effort from SEAMAP Coastal Trawl Survey data and South Atlantic Shrimp Trawl Fishery Observer data.



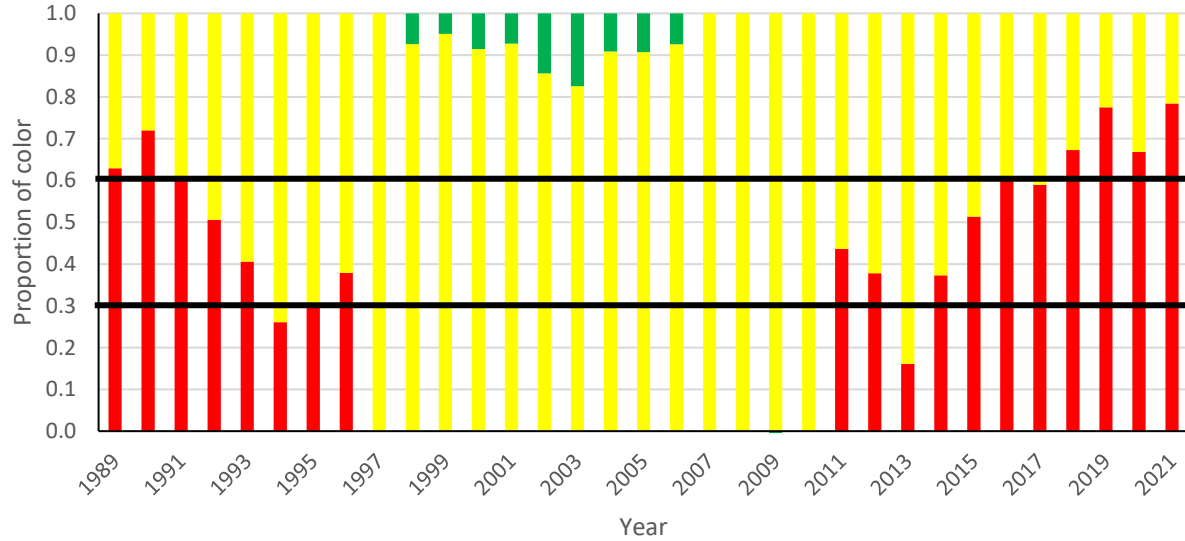
4.3 Recreational Harvest

In July 2018, the Marine Recreational Information Program transitioned from the catch estimates based on effort information from the Coastal Household Telephone Survey (CHTS) to effort information from the mail-based Fishing Effort Survey (FES). FES estimates are used in this and future reports, so recreational estimates and analyses may be different from previous years that used CHTS estimates.

4.3.1 Mid-Atlantic

- The recreational harvest decreased by 64% in 2021 compared to 2020, and is the lowest value in the time series. Several states implemented more restrictive management measures in 2021 as required by Addendum III, which may have impacted harvest.
- The recreational index has been above the 30% level since 2014 and has been above the 60% level for the last four years.
- As with commercial landings, the continued decline in harvest levels for Atlantic croaker in the recreational fishery are also cause for concern.

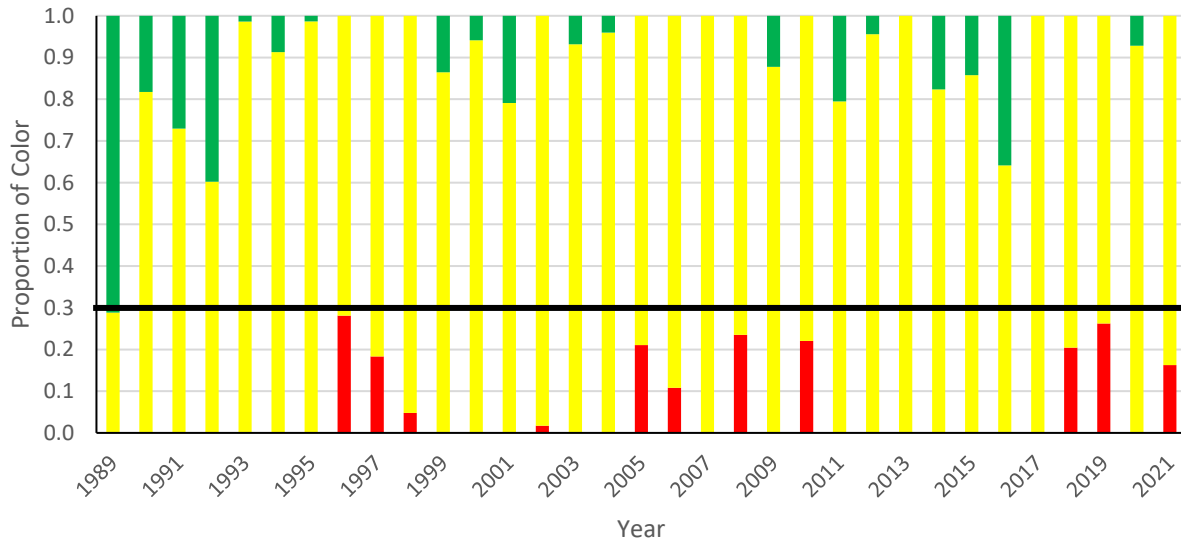
Figure 9. Annual TLA color proportions for Atlantic croaker from the Mid-Atlantic (NJ-VA) coast recreational harvest of the U.S. from 1989-2021 based on a 2002-2012 reference period.



4.3.2 South Atlantic

- The recreational harvest index for the South Atlantic decreased 33% in 2021 compared to 2020. Several states implemented more restrictive management measures in 2021 as required by Addendum III, which may have impacted harvest.
- The index has been below the 30% threshold for the entire time series. However, recreational harvest has been below the long-term mean for 3 of the 4 terminal years in the index (Figure 10).

Figure 10. Annual TLA color proportions for Atlantic croaker for the South Atlantic (NC-FL) recreational harvest of the U.S. from 1989-2021 based on a 2002-2012 reference period.

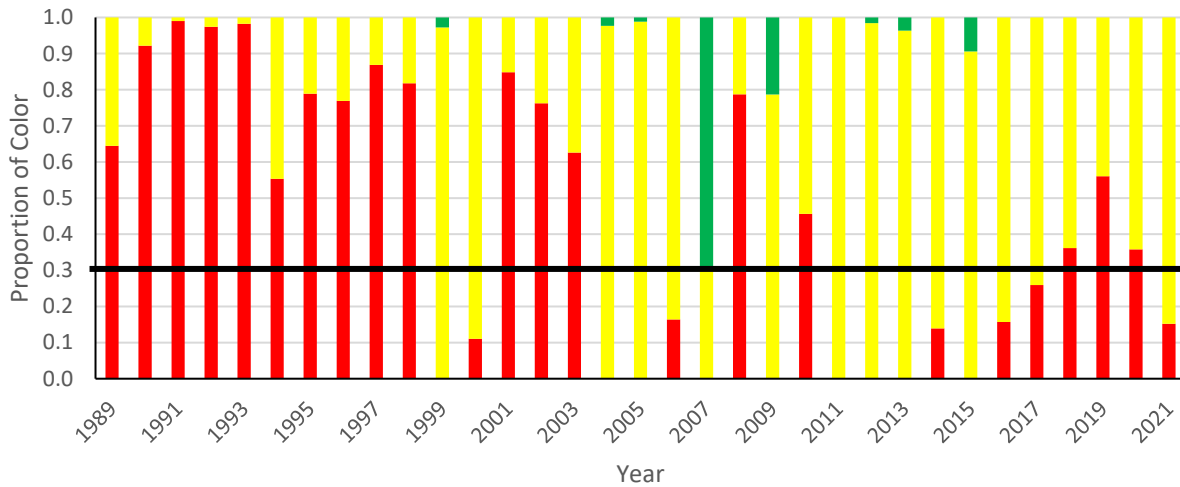


5 TRAFFIC LIGHT ANALYSIS (FISHERY-INDEPENDENT SURVEYS)

5.1 NEFSC Fall Groundfish Survey

- The index value for 2021 represented a 95% increase from 2019, the last sampled year of the survey (Figure 11).
- The NEFSC was not carried out in 2017 due to mechanical problems with the RV Bigelow. An imputed index for 2017 was calculated as the mean of 2015-2016 and 2018. An intermediary placeholder value was also estimated for 2020 (as the mean of 2018-2019 and 2021), when sampling wasn't conducted due to COVID.
- While the red proportion in 2021 did not exceed the 30% threshold, the index has been below the long-term mean for three of the past four years, with the general trend being a decline since the series peak in 2007.

Figure 11. Annual TLA color proportions for Atlantic croaker from NEFSC ground-fish trawl survey from 1989-2021 based on 2002-2012 reference period.



5.2 ChesMMAP Survey

- The ChesMMAP survey made major changes to the survey in 2019 (vessel change, gear change, altered protocols, etc.) but maintained the same sampling strata and design. Side-by-side comparison tows are in the process of being conducted between the new and old vessels/gears and the survey is in the process of producing conversion factors by species so that historic survey index values can be compared to ongoing survey values in the future. Since the conversion factor determination won't likely be finished until 2023, the ChesMMAP index is only available through 2018 for the adult and juvenile TLA composite characteristics.
- The overall declining trend in catch of Atlantic croaker was evident in both the adult (age 2+) and juvenile (ages 0-1) indices, although the adult index was higher than the juvenile index in the early years of the survey (Figure 12 and Figure 13).
- The series peak for juveniles occurred in 2007 and the series peak for adults occurred in 2004. From 2008-2018, abundances for both age groups have remained relatively low.
- Red proportions exceeded 60% since 2010 in the juvenile index and since 2008 in the adult index (Figure 12 and Figure 13).

Figure 12. ChesMMAP survey annual TLA color proportions for Atlantic croaker ages 0-1 from 2002-2018 using a 2002-2012 reference period.

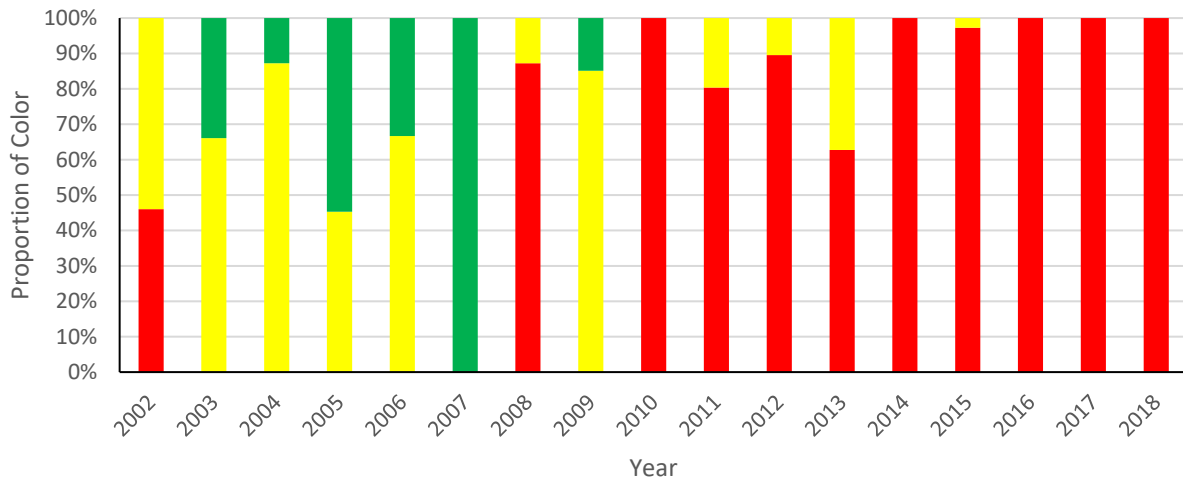
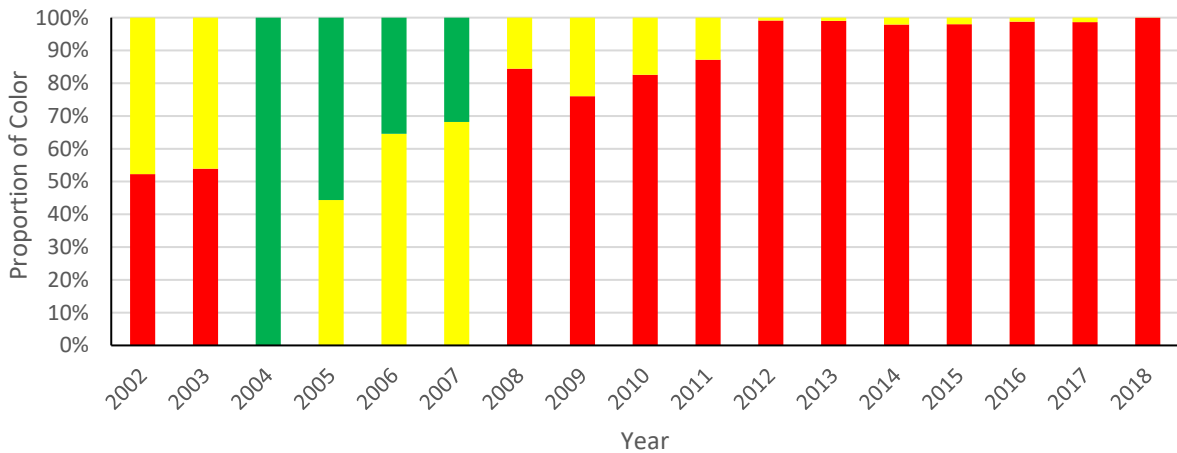


Figure 13. ChesMMAP survey annual TLA color proportions for Atlantic croaker ages 2+ from 2002-2018 using a 2002-2012 reference period.

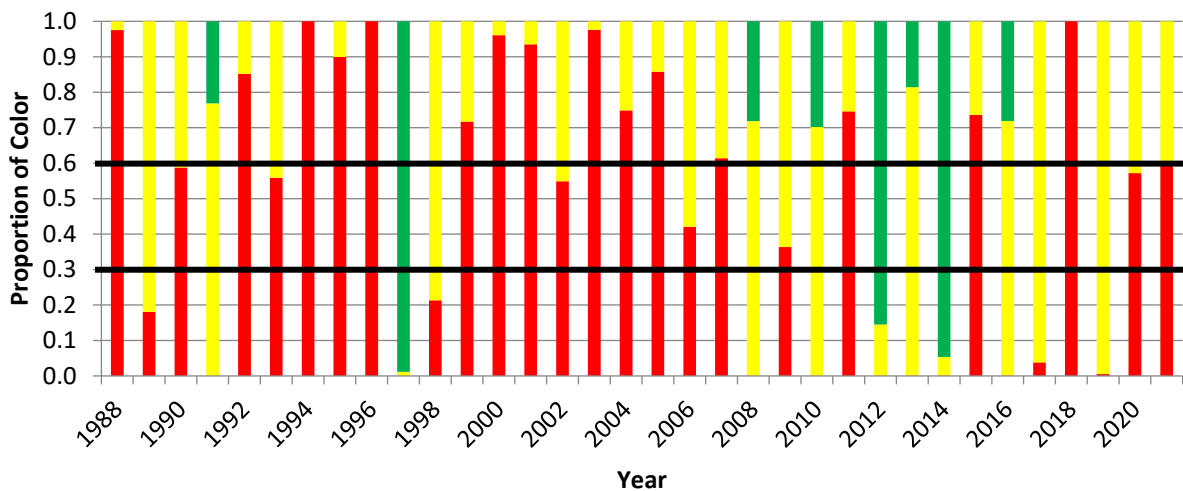


5.3 VIMS Survey

- Due to COVID-19 restrictions, no sampling occurred in April or May 2020 and June sampling was limited to Bay and York River only. However, the index was still calibrated using April - June with the limited sampling in 2020 taken into account so that the index for the entire time series could be utilized for the TLA. The VIMS juvenile trawl survey uses the relative catch levels of 1-year-old juvenile croaker as the proxy for the previous year's recruitment index.

- The VIMS index showed a 6% decrease in 2021 from 2020. High variability in the TLA color proportions was likely due to annual recruitment variations, which would not be uncommon for a juvenile index (Figure 14).
- The index value was below average in 2021 with a red proportion at 60%. The continued high red proportions are an indication of continued poor recruitment in recent years.
- The red proportion was above the 30% threshold for 3 of the 4 terminal years.

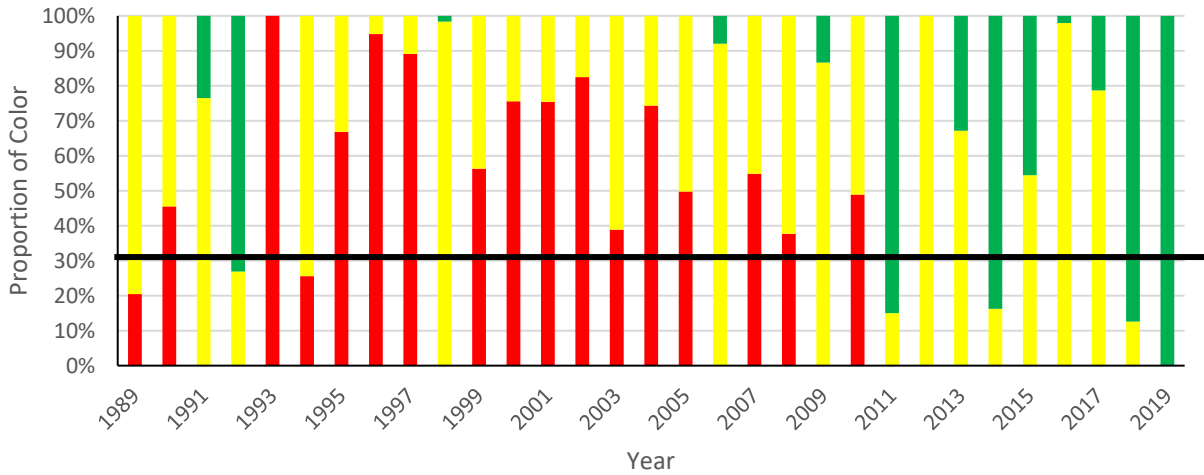
Figure 14. Annual TLA color proportions for age-0 Atlantic croaker from VIMS spring trawl survey from 1988-2021 using 2002-2012 reference period.



5.4 SEAMAP Survey

- The SEAMAP survey index used was for the spring season when adult Atlantic croaker (ages 2+) are captured.
- There were no SEAMAP cruises in 2020 and the spring of 2021 due to COVID. As such, there was no TLA values for 2020 and 2021 and the index is only presented through 2019.
- The SEAMAP index increased by 13% in 2019 from 2018, and values have remained above average since 2011 so there has been no red in the TLA for recent years (Figure 15).
- This index will be updated in 2023 with the spring 2022 survey index values.

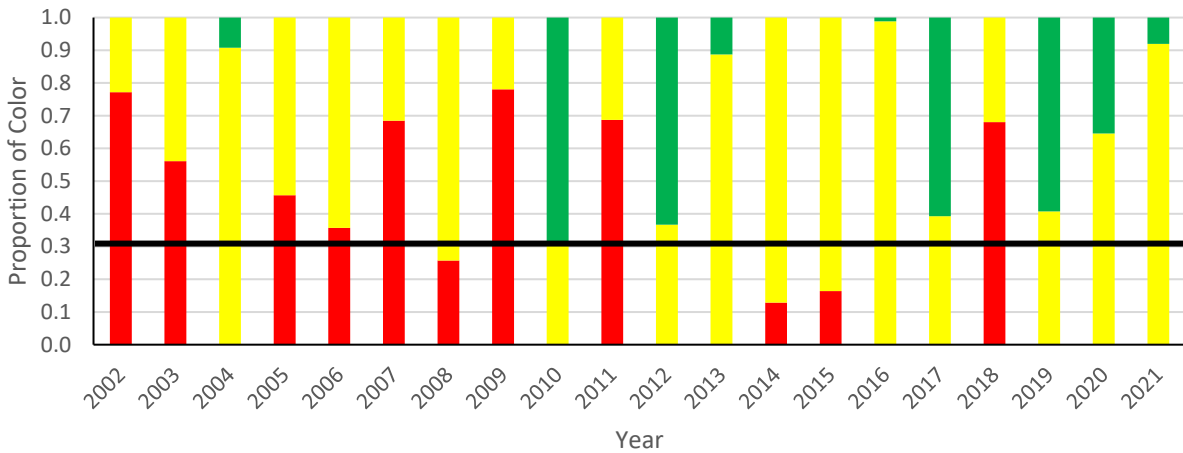
Figure 15. Traffic Light Analysis for SEAMAP catch data by weight in spring from 1989-2019 using a 2002-2012 reference period.



5.5 North Carolina Program 195 (Pamlico Sound Survey)

- The North Carolina index has been well above average the past three years (Figure 16).
- The results of the NCDMF Program 195 data analysis should be treated with caution, as not all stations were sampled due to COVID and staffing issues. Twenty-eight of the 54 stations were sampled in 2020 and 35 of the 54 stations were sampled in 2021. Limited sampling did not appear to change the trend but it appears to have elevated the magnitude.

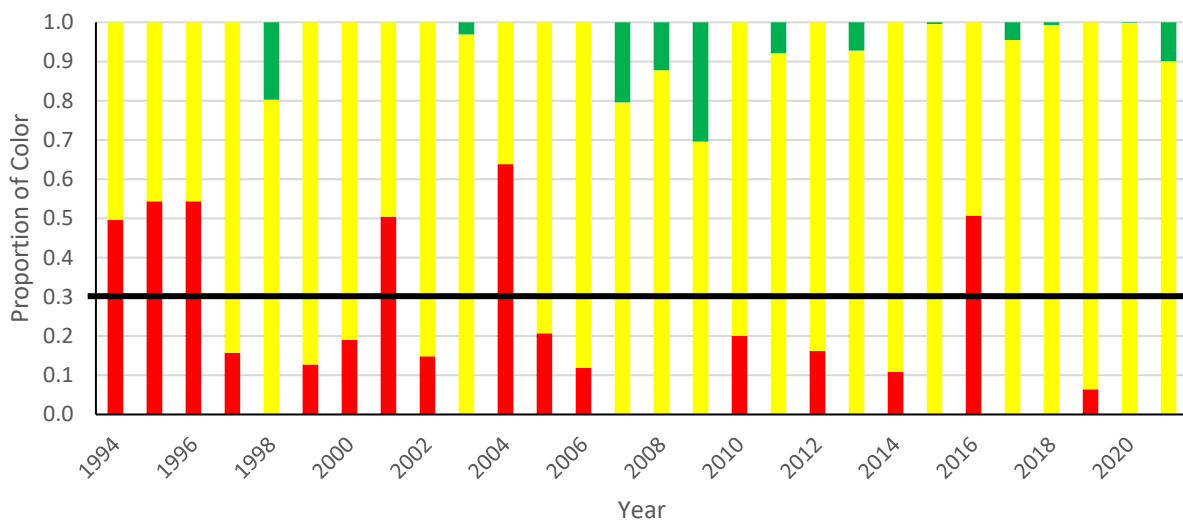
Figure 16. NCDMF Program 195 TLA color proportions for juvenile Atlantic croaker from 1989-2021 using 2002-2012 reference period.



5.6 SCDNR Trammel Net Survey

- The SCDNR trammel index increased 24% in 2021 compared to 2020. Annual CPUE has been variably above and below the average since 2009, indicated by annual alterations between red and green proportions in the TLA (Figure 17).
- Red proportions have not been above the 30% threshold since 2016.

Figure 17. SCDNR trammel net survey TLA color proportions for Atlantic croaker from 1994-2021 using a 2002-2012 reference period.



5.7 Juvenile Composite Indices

The juvenile composite index in the Mid-Atlantic was generated from the ChesMMAAP and VIMS surveys, because VIMS is a juvenile survey and ChesMMAAP has an age specific index for ages 0-1. The juvenile composite index in the South Atlantic was generated from the NCDMF Pamlico Sound Survey (Program 195) because the survey encounters age-0 croaker. As stated above, NEFSC survey data were not available for 2020 and the ChesMMAAP survey does not have the updated calibrations to use the entire time series.

- The juvenile composite TLA (Figure 18) for the Mid-Atlantic is only shown through 2018 since that was the last year with data available for ChesMMAAP. The VIMS survey was available through 2021, and continued to show a declining trend in 2021 (Section 5.3).
- The juvenile composite TLA characteristic (Figure 18) for the Mid-Atlantic in 2018 was above the 60% red threshold and was the ninth year above the 30% threshold.
- The high red proportions in recent years are indicative of continued poor Atlantic croaker recruitment in the Mid-Atlantic region.

- The juvenile index for the South Atlantic TLA composite characteristic was the NCDMF Pamlico Sound Survey. It did not trigger in 2021 with three of the four terminal years showing green proportions in the index but the proportion shows a decrease over the past three years (Figure 19).

Figure 18. Juvenile croaker (ages 0-1) TLA composite characteristic index for the Mid-Atlantic (ChesMMA and VIMS) from 2002-2018.

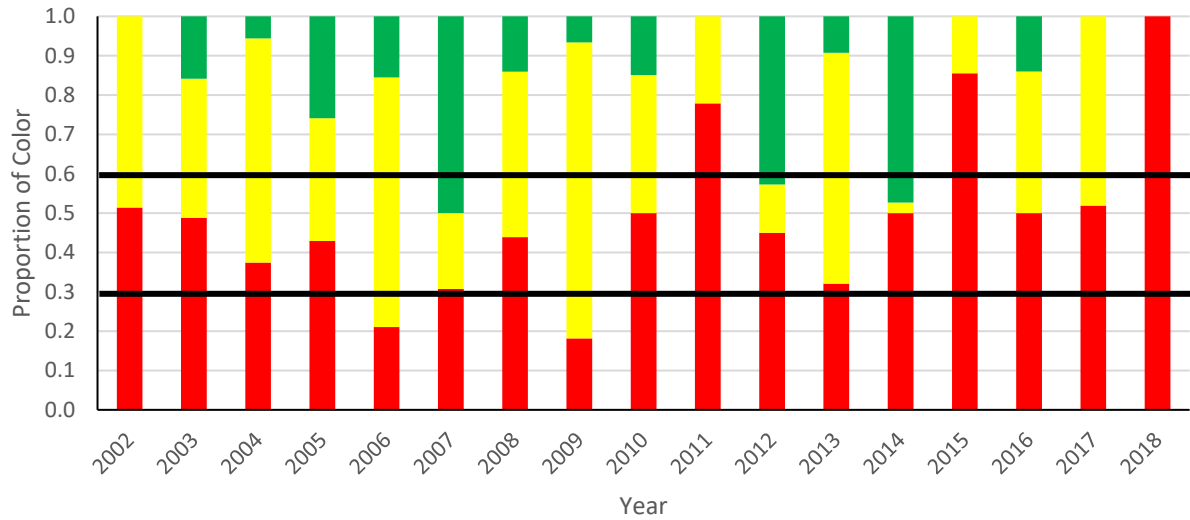
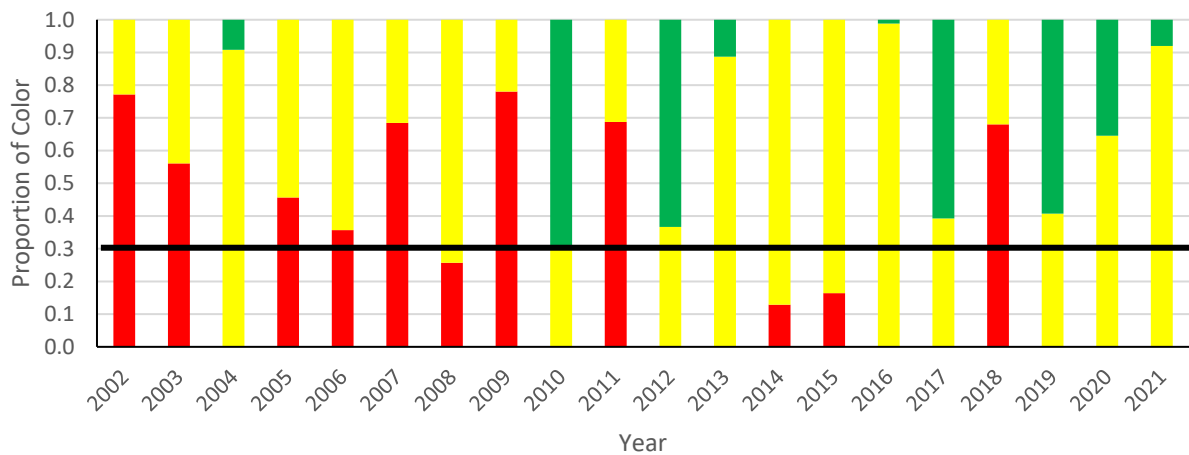


Figure 19. Juvenile (ages 0-1) Atlantic croaker index for the South Atlantic using NCDMF Program 195 from 2002-2021.



6 SUPPLEMENTAL MATERIAL

6.1 NEAMAP Survey

One additional survey that is available in the Mid-Atlantic is the Northeast Area Monitoring and Assessment Program (NEAMAP) which samples from Block Island Sound south to Cape Hatteras. The NEAMAP survey has been considered for use in the TLA but is currently not used due to the shorter time frame (2007-2021) compared to the other surveys. This survey may come into use with the TLA once it reaches a 15 year sampling time span, which corresponds approximately to the max life span of Atlantic croaker, but that will likely have to wait until the next stock assessment. This section describes the trends in the NEAMAP survey and gives composite characteristics that include NEAMAP.

- Juvenile recruitment and adult abundance has been declining since 2012 as indicated by high red proportions above the 60% threshold for the last five years (Figure 20 and Figure 21). This trend reversed in 2021 with significant increases in both juveniles and adults, indicated by high green proportions for both.
- Adult Atlantic croaker in particular showed a significant increase in 2021 (Figure 21), resulting in a green proportion of 1.0.
- Proportions of red for the juvenile index were above 30% in three of the four terminal years. The adult index only exceeded the 30% threshold in two of the four terminal years.

Figure 20. Juvenile (ages 0-1) TLA color proportions for Atlantic croaker from NEAMAP survey from 2007-2021 using a 2007-2019 reference period.

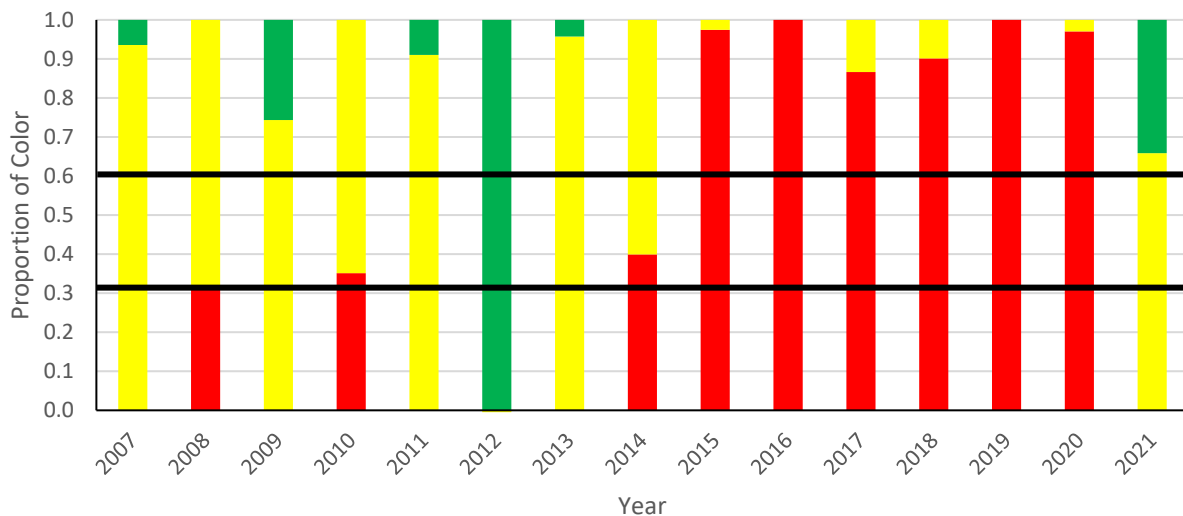
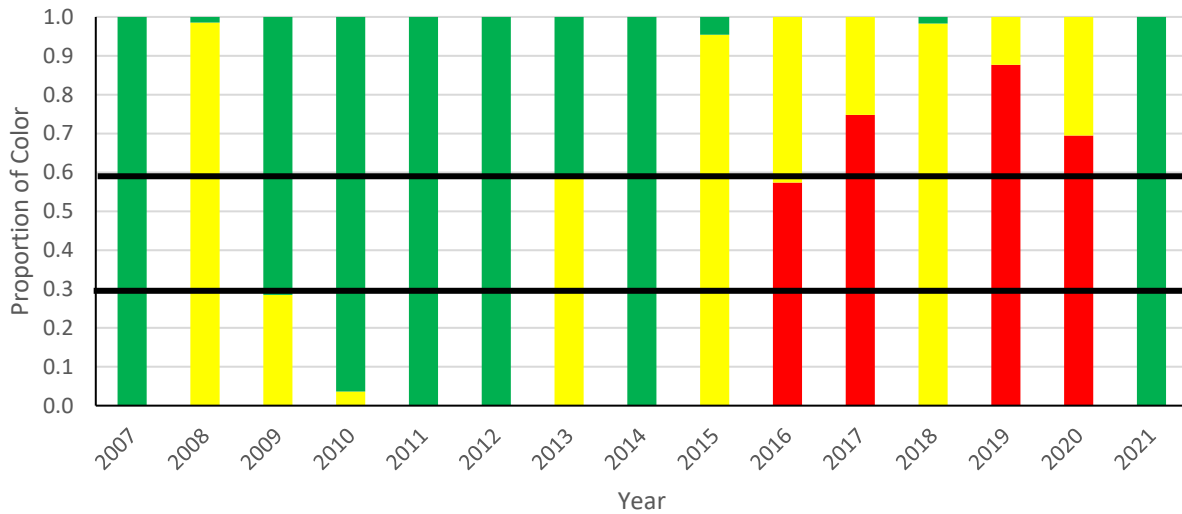


Figure 21. Adult (ages 2+) TLA color proportions for Atlantic croaker from the NEAMAP survey from 2007-2021 using a 2007-2019 reference period.



6.2 Composite TLA Characteristic for Mid-Atlantic including NEAMAP

In order to generate the composite TLA index that included NEAMAP in the Mid-Atlantic, the other Mid-Atlantic indices (NEFSC, ChesMMAP, VIMS) had to be recalculated using the common time period of all three surveys (2007-2019) in order to have a common reference. However, since both the NEFSC and ChesMMAP indices were not available in 2020 due to COVID-19 impacts, NEAMAP was the only available regional index in 2020. Additionally, the VIMS survey was not available in 2019, also due to COVID-19, so the juvenile TLA for 2020 only uses NEAMAP.

- The addition of NEAMAP to the Mid-Atlantic TLA composite characteristic for juvenile Atlantic croaker showed the same general trend of declining recruitment and high levels (> 60%) of red in recent years (Figure 22). Red proportions have been above 30% since 2015.
- The adult Atlantic croaker composite characteristic for the Mid-Atlantic with NEAMAP included also showed increasing proportions of red, but only two of the last four years were above the 30% threshold (Figure 23).

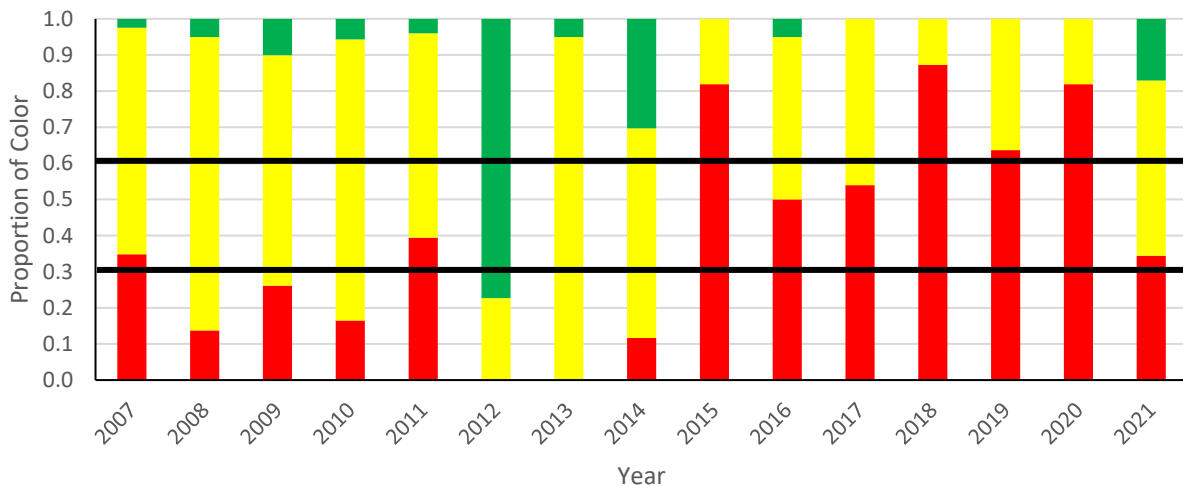
6.2.1 Summary of NEAMAP as a Composite Characteristic for the Mid-Atlantic

The addition of the NEAMAP survey to the Mid-Atlantic composite characteristics supports trends seen with the other indices used in the composite characteristic. The only limitation on the NEAMAP survey is the shorter time frame compared to the other surveys. The TC might consider adding the NEAMAP survey to the Traffic Light Analysis after the next scheduled

benchmark assessment for Atlantic croaker and re-evaluate all fishery independent surveys for use in the TLA. The impact of COVID-19 in 2020 on the different fishery independent surveys and the availability of the fully calibrated ChesMMAP index also makes it a good idea to wait on making changes on the TLA until fishing year 2022.

- The juvenile composite TLA characteristic was above the 30% threshold for red in 2021 and still had some green proportion as well. The red proportion was from the VIMS index which continues to decline and the green proportion was from the NEAMAP index.
- The Mid-Atlantic juvenile index using VIMS and NEAMAP would have triggered at the 30% threshold in 2021 with all years since 2015 exceeding that threshold.

Figure 22. Juvenile Atlantic croaker (ages 0-1) TLA composite characteristic index for the Mid-Atlantic using NEAMAP and VIMS from 2007-2021 with a 2007-2019 reference period.



- The adult composite TLA characteristic was calculated using the NEFSC and NEAMAP surveys since ChesMMAP was not available for 2019-2021.

- The adult composite TLA would not have triggered in 2021 with only two of the four terminal years exceeding the 30% threshold.
- The green proportion in the 2021 composite was primarily due to the high catch levels seen in the NEAMAP survey.

Figure 23. Adult Atlantic croaker (ages 2+) TLA composite characteristic index for the Mid-Atlantic (NJ-VA) using NEFSC, NEAMAP and ChesMMA (2007-2018), NEFSC and NEAMAP (2019) and NEAMAP only (2020) from 2007-2021 with a 2007-2019 reference period.



6.3 Composite Abundance TLA Characteristic for South Atlantic including NCDMF P195

The adult abundance composite TLA for the South Atlantic region is presented using the NCDMF Program 195 instead of SEAMAP and SCDNR Trammel Net survey data. This modified adult composite index for the South Atlantic is presented as supplemental material because the version as described in Addendum III could not be updated this year due to missing data. The modified adult composite TLA index for the South Atlantic would not have triggered any management response in 2021.

- The NCDMF survey had a significant increase in 2021 which resulted in a green proportion of 100% (Figure 24). The results of the NCDMF Program 195 data analysis should be treated with caution however, as not all stations in 2020 and 2021 were sampled due to COVID and staffing issues. Twenty-eight of the 54 stations were sampled in 2020 and 35 of the 54 stations were sampled in 2021. Limited sampling did not appear to change the trend but it appears to have elevated the magnitude.

- The SCDNR trammel survey also had an increase in abundance and was above the long-term mean.
- These increases resulted in a positive index above the long-term mean for the composite TLA, and all of the most recent four years (2018-2021) were below the 30% threshold.

Figure 24. Adult (age 2+) Atlantic croaker TLA composite characteristic index for the South Atlantic (NCDMF Program 195 and SCDNR trammel survey) from 2002-2021.

