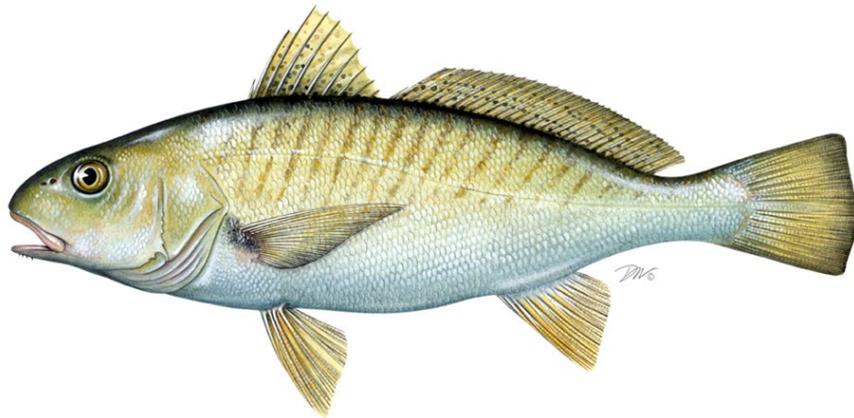


ATLANTIC STATES MARINE FISHERIES COMMISSION

2021 TRAFFIC LIGHT ANALYSIS REPORT FOR ATLANTIC CROAKER (*Micropogonias undulatus*)

2020 Fishing Year



Prepared by the Technical Committee
June 2021



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 TLA evaluates a Mid-Atlantic and a South Atlantic harvest metric, which is a combination of commercial and recreational landings in the region. It also evaluates a Mid-Atlantic and South Atlantic abundance metric, which is a combination of 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.

Impact of COVID on Data Availability

The TLA uses commercial and recreational harvest, both of which were available for 2020, although the pandemic impacted harvest and monitoring programs. The Mid-Atlantic abundance index is based on the Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) which was not available for 2020 due to lack of calibration factors and the Northeast Fishery Science Center (NEFSC) Multispecies Bottom Trawl Survey which did not sample in 2020. The South Atlantic abundance index is based on the South Carolina Department of Natural Resources (SCDNR) Trammel Net Survey which was available in 2020 and Southeast Area Monitoring and Assessment Program (SEAMAP) which did not sample in 2020. Therefore, the harvest metric was calculated in 2020 for both regions, but both the Mid-Atlantic and South Atlantic abundance metrics are incomplete for 2020.

2020 Harvest Metrics

The Mid-Atlantic harvest metric has triggered at 60% red threshold in three of the four terminal years (2018-2020) and the South Atlantic harvest metric has triggered at 30% red threshold in all four terminal years (2017-2020). This is the second consecutive year the harvest metric in both region has triggered at least at the 30% threshold.

2020 Abundance Metrics

While the abundance metrics could not be calculated due to missing 2020 data, Addendum III specifies TLA trigger based on the four terminal years so assumptions can still be made regarding abundance. For the Mid-Atlantic, two of the four terminal years triggered at 30% red (2017-2018) while two of the four are unknown (2019-2020). This metric did trigger at the 30% threshold during the 2019 TLA. For the South Atlantic, three of the four terminal years (2017-2019) did not trigger at any level and therefore the 2020 data would not change status regardless of its value.

Conclusions

The harvest triggered in both the Mid-Atlantic (60% threshold) and South Atlantic (30% threshold) in 2020 indicating continued concern. The abundance did not trigger at any level for the South Atlantic and although the last two years are undetermined for the Mid-Atlantic due to missing 2020 data, the two years that are available are below the 60% threshold. Regardless, the previous TLA indicated that the Mid-Atlantic triggered at 30%. 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 Atlantic croaker remains triggered at the 30% threshold and 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). In addition, 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 statistically-robust 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 serves as an excellent 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, 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.

From the 2020 TLA report, Atlantic croaker had red proportions that exceeded the threshold of 30% in both metrics in the Mid-Atlantic. The South Atlantic region harvest metric triggered 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.

The COVID-19 pandemic had far reaching impacts on almost all state and federal fishery independent monitoring programs at some point during 2020. These impacts ranged from short term interruptions in sampling (on the scale of weeks or a month or two) to complete shutdown for the year due to social distancing requirements on research vessels. The social distancing requirements made it impossible for programs to work in enclosed spaces and close quarters for both daily sampling as well as extended at-sea work requiring days and weeks to complete. 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 sample at all in 2020. Additionally, the ChesMMAAP 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. ChesMMAAP anticipates having the calibration estimates completed in 2022. NEFSC and SEAMAP data will be available for 2021, and future TLAs will be able to utilize the most recent years (2019-2021) of the data series beginning with the 2021 fishing year TLA report.

The COVID-19 pandemic also had far reaching impacts economically on both the recreational and commercial industries. While both **commercial and recreational harvest** datasets were available for 2020, there are caveats for the 2020 fishing year harvest metric. The component of the Marine Recreational Information Program (MRIP) that samples dockside catch rate data (Access Point Angler Intercept Survey - APAIS) was interrupted by the pandemic. Due to this interruption, catch rate data were imputed as needed from 2018 and 2019 to generate total catch estimates in 2020. The contribution of imputed data for Atlantic croaker harvest estimates by state ranged from 0-70% (Table 1). The impact of imputed data on total catch estimates is unknown. Closures and disruptions to the charter and headboat industry may have also have impacted the recreational harvest metric. Fishery performance, markets, and effort throughout the year due to the pandemic impacted the commercial fleet. While data availability was maintained, the impact of the pandemic on the accuracy harvest metrics must be considered.

Table 1. Contribution of imputed harvest rate data from 2018 and 2019 for 2020 MRIP harvest estimates of Atlantic croaker.

State	2020 Harvest (A+B1) Total Weight (lb)	PSE	Contribution of Imputed Data to Total Harvest Rate
NEW JERSEY	16,358	60.6	70%
DELAWARE	21,870	26.8	33%
MARYLAND	91,047	36.9	0%
VIRGINIA	2,410,612	20.2	50%
NORTH CAROLINA	223,685	20.6	21%
SOUTH CAROLINA	230,205	19.1	2%
GEORGIA	77,876	41.4	13%
FLORIDA	1,072,714	27.5	3%

2 TRAFFIC LIGHT ANALYSIS (COMPOSITE INDEXES)

2.1 Harvest Composite Index

- The harvest composite TLA index for the Mid-Atlantic indicates that the management response trigger would have been tripped at the 60% threshold in 2020 (Figure 1).
- The mean red proportion for the most recent three year time period (2018-2020) in the Mid-Atlantic was 73.3% with the red proportion being above 60% since 2018 which indicates a significant level of concern (Figure 1).
- The harvest composite TLA index for the South Atlantic also triggered in 2020 at the 30% threshold and represented the seventh consecutive year above 30% (Figure 2).
- The mean red proportion in the South Atlantic region for 2018-2020 was 46.9% (Figure 2).
- The important trend to point out in both regions is the continuing decline in recreational and commercial landings for Atlantic croaker with TLA red proportions now exceeding 60% for commercial landings.

Figure 1. Annual color proportions for the harvest composite TLA of Mid-Atlantic (NJ-VA) Atlantic croaker recreational and commercial landings

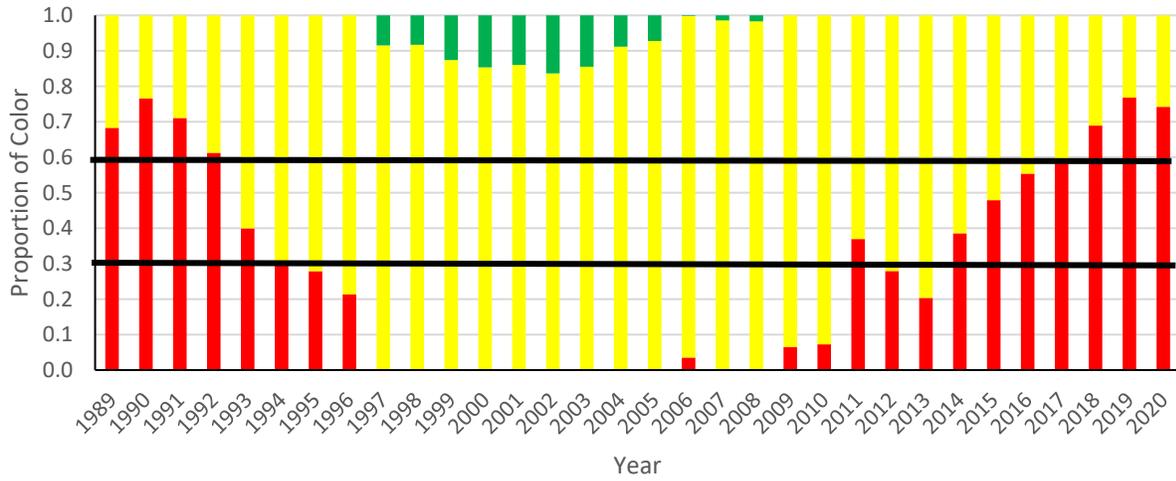
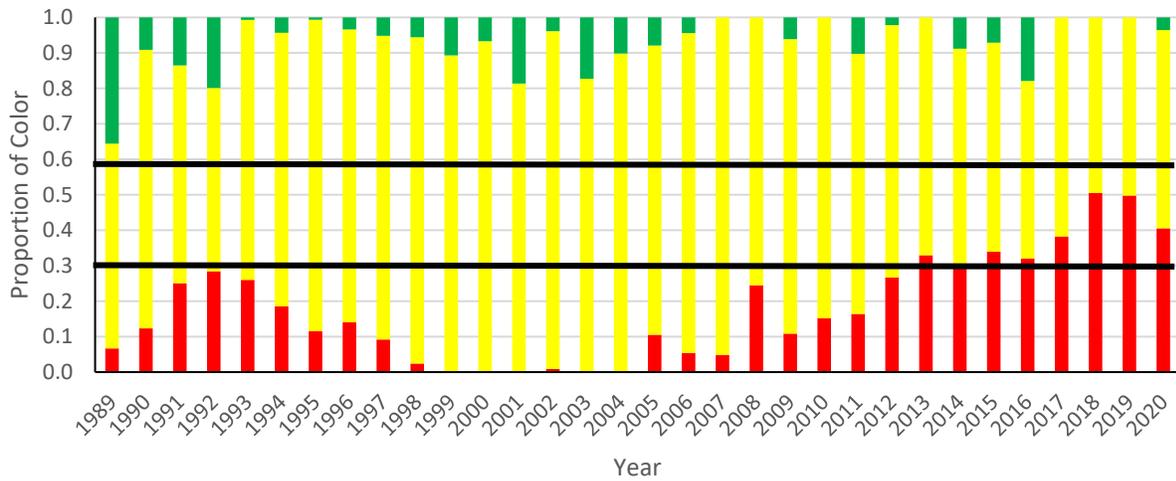


Figure 2. Annual color proportions for the harvest composite TLA of South Atlantic (NC-FL) Atlantic croaker recreational and commercial landings using a 2002-2012 reference period



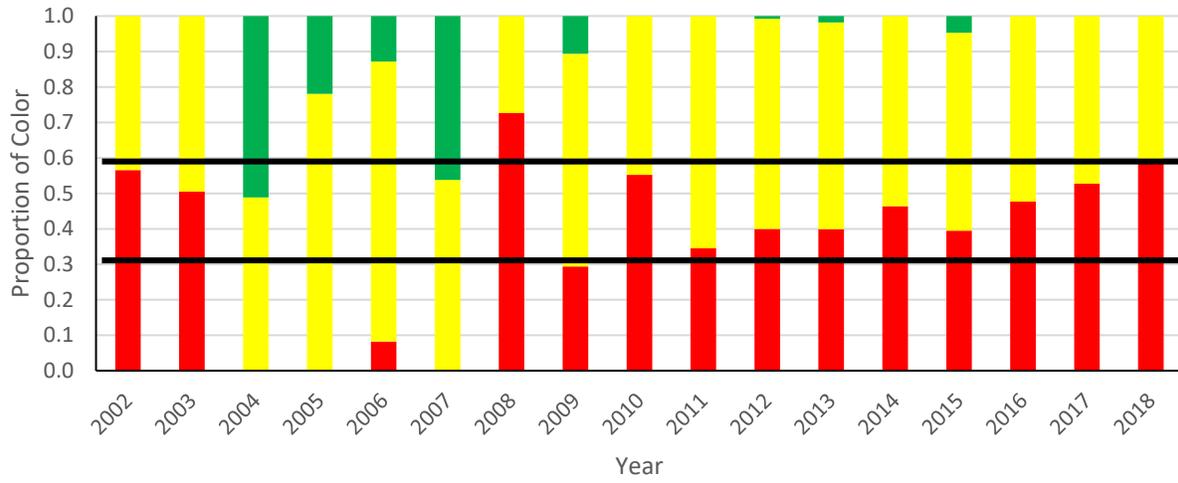
2.2 Abundance Composite Characteristic Indexes

The abundance composite TLA index in each region was broken into two components based on age composition, including an adult index and a juvenile index. 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 ChesMMAAP 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+.

The adult composite TLA characteristic for the Mid-Atlantic (Figure 3) showed a trend of increasing red proportions over the last five years, although the index has not been calculated since 2018 due to unavailable data from ChesMMAAP

- The composite index (Figure 3) has been above the 30% threshold since 2010 (only available through 2018 since there was no 2019-2020 values for ChesMMAAP).

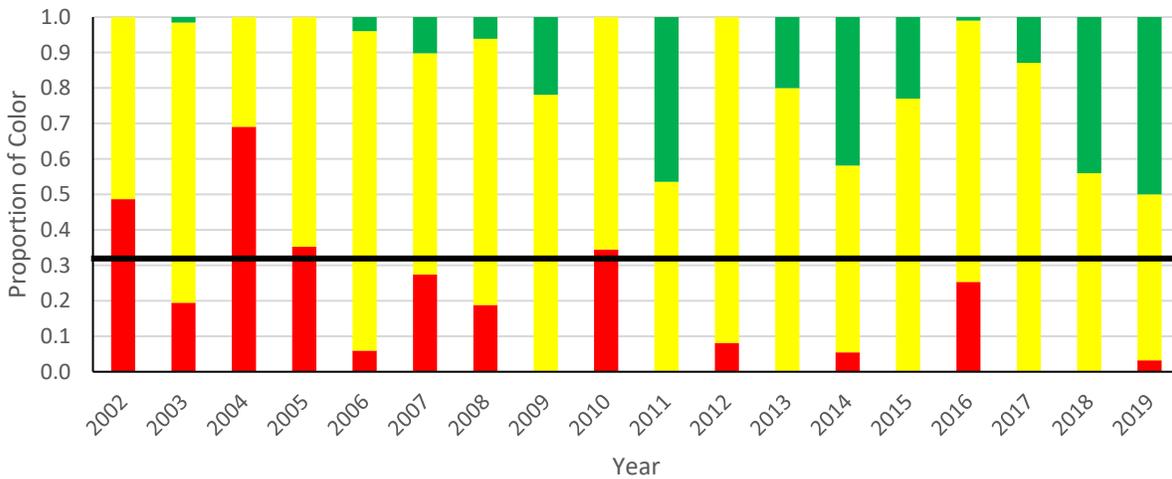
Figure 3. Adult (age 2+) Atlantic croaker TLA composite characteristic index for the Mid-Atlantic (NEFSC and ChesMMAAP surveys)



The harvest composite characteristic triggered in the Mid-Atlantic in 2020, but the lack of index data for the fishery independent composite characteristic did not allow the Mid-Atlantic TLA to be updated for 2020. However, if the downward trend in the TLA continued, then the independent composite would have likely triggered in 2020. The continued declining trend is cause for concern in the Mid-Atlantic region. The continued declining trend in the juvenile composite (Section 5.7) does not bode well for changes in the adult population if recruitment continues to decline.

The adult composite TLA did not include data from 2020 due to lack of SEAMAP data. The adult composite TLA index for the South Atlantic did not trigger any management response in 2019 for the South Atlantic region.

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



3 SUMMARY

The harvest composite TLA characteristic remained above triggered thresholds in both the Mid-Atlantic (60% threshold) and South Atlantic (30% threshold) in 2020 indicating continued concern. The continued declining trend in the commercial and recreational harvests for the Atlantic coast is a concern since the decline has become greater in the last two years, but further management measures can only be triggered based on the abundance composites. The lack of enough indices to run a mid-Atlantic TLA for the fishery independent composite in the current form (NEFSC and ChesMMAAP) made 2020 difficult to monitor. Even though the South Atlantic fishery independent indices still remained below the trigger threshold, management measures triggered in 2020 as a result of addendum III will remain in place until at least 2023. The lack of 2020 survey data to inform composite indices may impact future management triggers if the stock continues to decline, as seen in available indices. Table 2 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, ChesMMAAP will be available in the future once calibration factors are developed.

Table 2. Traffic light metrics for the Mid- and South Atlantic regions with known and unknown values, given missing 2020 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			
	2017	2018	2019	2020
Mid-Atlantic Harvest	59% red	69% red	77% red	74% red
South Atlantic Harvest	38% red	51% red	50% red	41% red
Mid-Atlantic Adult Index	53% red	58% red	Unknown	Unknown
South Atlantic Adult Index	13% green	44% green	50% green	Unknown; cannot trigger at 30% or 60% regardless of 2020 data
2021 TLA Status	Likely still triggered at 30% (Mid-Atl Harvest triggered at 60%; S. Atl Harvest triggered at 30%; Mid-Atl Index unknown; S. Atl Index did not trigger)			

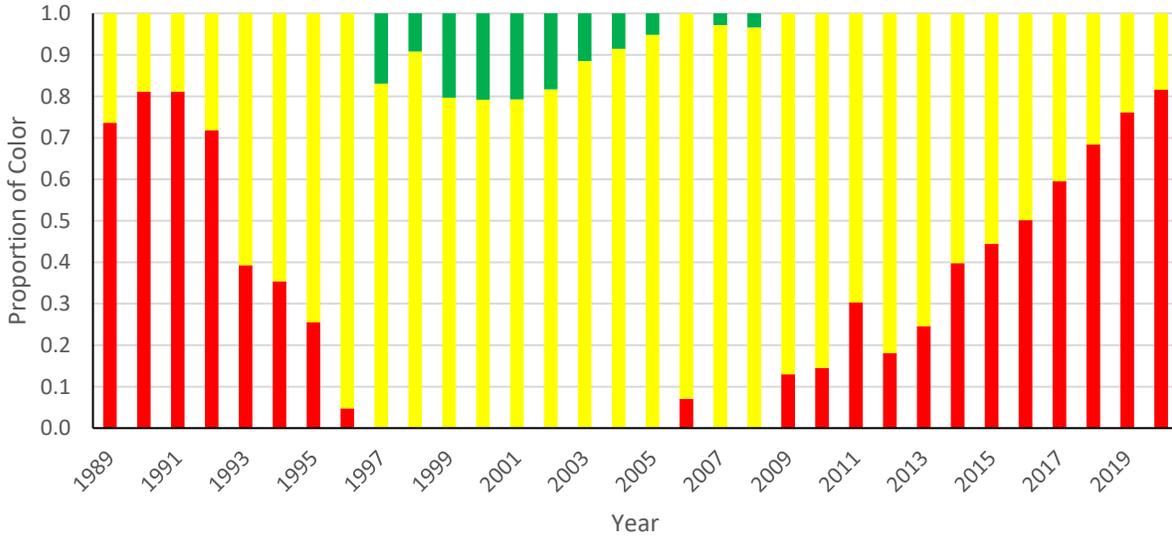
4 TRAFFIC LIGHT ANALYSIS (FISHERY DEPENDENT)

4.1 Commercial Landings

4.1.1 Mid-Atlantic

- Commercial landings in the Mid-Atlantic declined 83.1% in 2020 (65.2 metric tons) from 2019 (385.9 metric tons) and represented the 15th year of decline in commercial croaker landings (Figure 5).
- The TLA for commercial landings has been above the 30% threshold every year since 2011 (Figure 5) and 2020 was the 7th year in a row where landings were above the 30% threshold.
- More concerning is that the red proportion has been above the 60% red threshold for the last three years of the series (2018-2020) and was only just under 60% in 2017 (59.5%).
- The three year mean red proportion for croaker has exceeded 30% since 2010 and exceeded 60% in 2020. The continued steady decline in croaker landings in recent years represent some of the lowest landings levels in the time series.

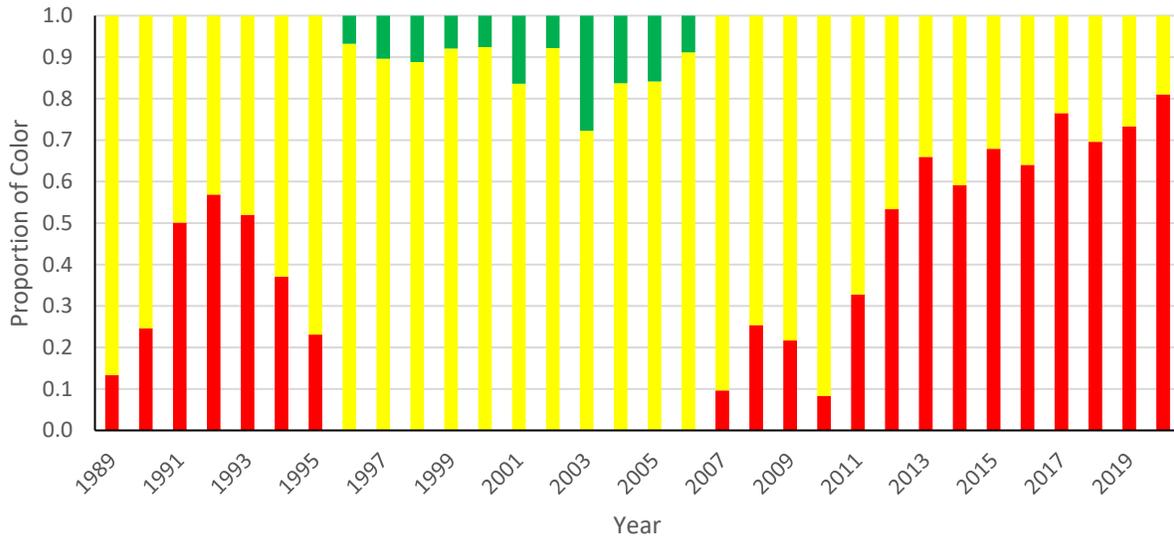
Figure 5. Annual TLA color proportions for Atlantic croaker commercial landings for the Mid-Atlantic (NJ-VA) coast of the US



4.1.2 South Atlantic

- Commercial landings in the South Atlantic declined 53.0% in 2020 (290.4 metric tons) from 2019 (618.1 metric tons) and represented the 13th year of decline in commercial croaker landings in the South Atlantic (Figure 6).
- The TLA for commercial landings in the South Atlantic has been above the 30% threshold every year since 2011 (Figure 6) and 2020 was the 10th year in a row where landings were above the 30% threshold.
- More concerning is that the red proportion has been above the 60% red threshold for seven of the past eight years of the series (2013-2020) and was only just under 60% in 2014 (59.1%).
- The three year mean red proportion for croaker has exceeded 30% since 2010 and exceeded 60% for the past six years. The continued steady decline in croaker landings in recent years represent some of the lowest landings levels in the time series.

Figure 6. Annual TLA color proportions for Atlantic croaker commercial landings for the South Atlantic (NC-FL) coast of the US



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 Coastal Trawl 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.
- 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 during the final three years of the time series were the highest since 1995.
- There were no SEAMAP Coastal Trawl 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

using both full observer coverage and SEAMAP tows, and this trend was likely influenced by the lack of SEAMAP tows and reduced observer coverage. Figure 8 shows how the trends in catch rates track in years prior to 2020. As in all years, the magnitude of the 2020 discard estimate is informed by the observer data (magnitude of catch rates) and shrimp trawl effort data (expansion factor to expand catch rates to total discards), so the magnitude of catch rates was likely also impacted by reduced observer coverage.

- 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.

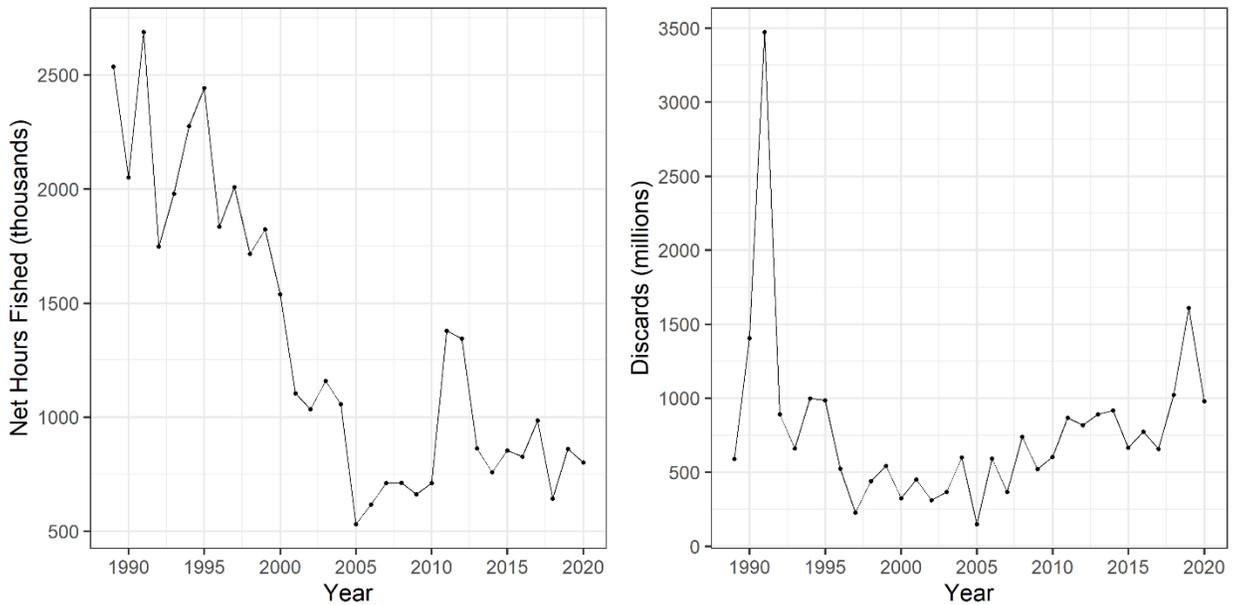
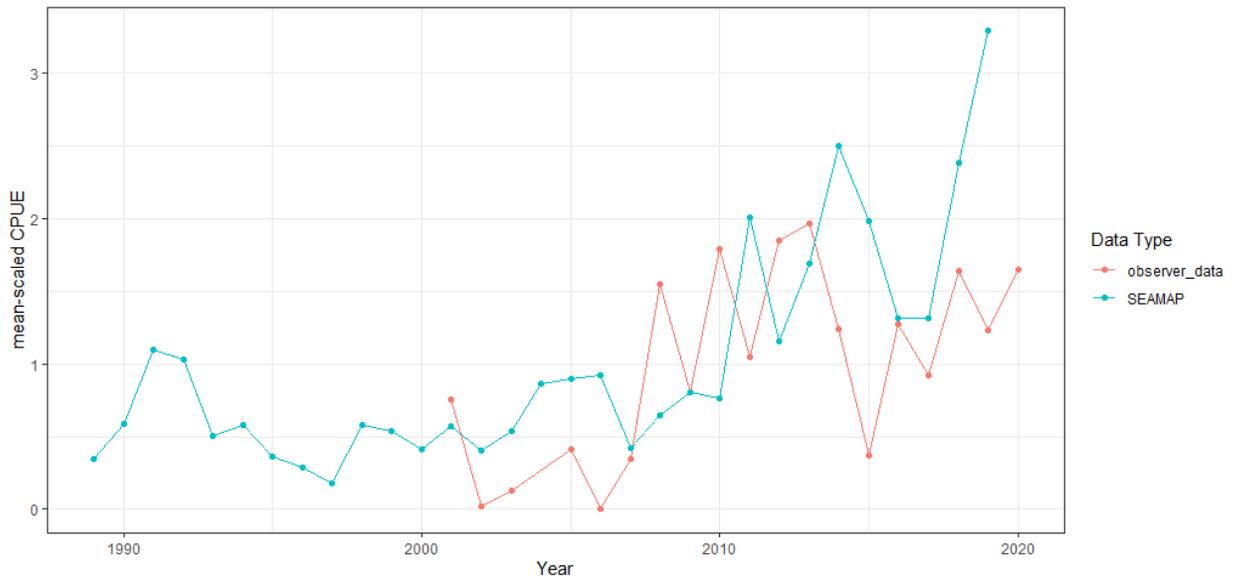


Figure 8. Comparison of Atlantic croaker mean-scaled catch-per-unit-effort from SEAMAP Coastal Trawl Survey data and South Atlantic Shrimp Trawl Fishery Observer data.



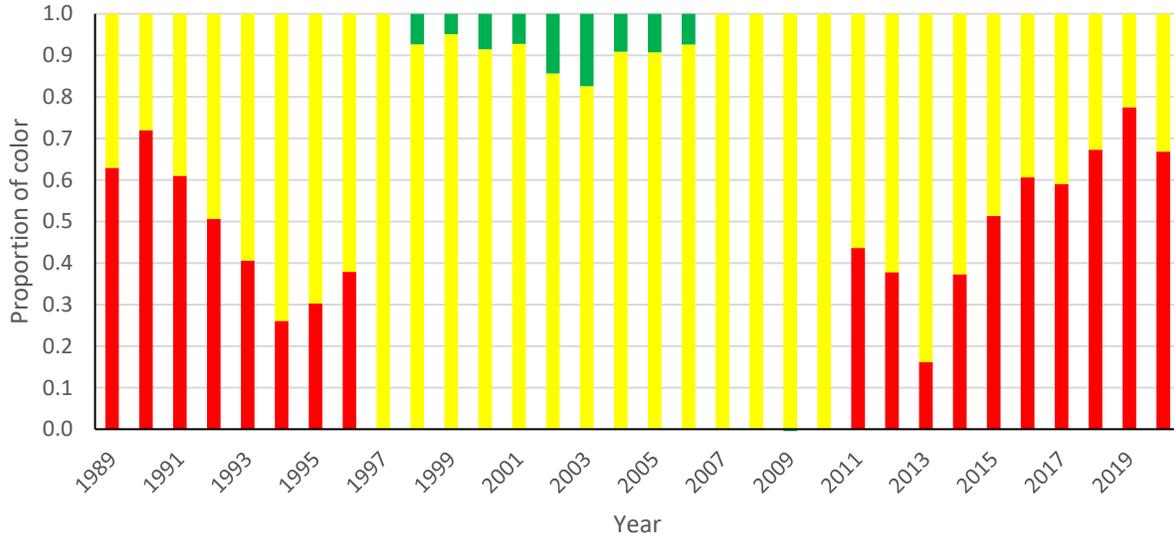
4.3 Recreational Harvest

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. See the Introduction section for a detailed discussion on impacts from COVID-19 on recreational harvest data.

4.3.1 Mid-Atlantic

- The recreational harvest increased in 2020, up 144% (1,142.7 metric tons) from 2019 (468.2 metric tons).
- While the increase in recreational harvest in 2020 was significant, the recreational harvest level in 2019 was the lowest annual harvest in the entire time series (1981-2020) for the Mid-Atlantic.
- The proportion of red in the TLA was 66.8% in 2020 decreasing from 77.5% in 2019 (Figure 9), indicating the recreational index has reached trigger levels at the 30% level since 2014 and has been above the 60% level for the last three years..
- As with commercial landings, the continued decline in harvest levels for Atlantic croaker in the recreational fishery are also cause for concern.

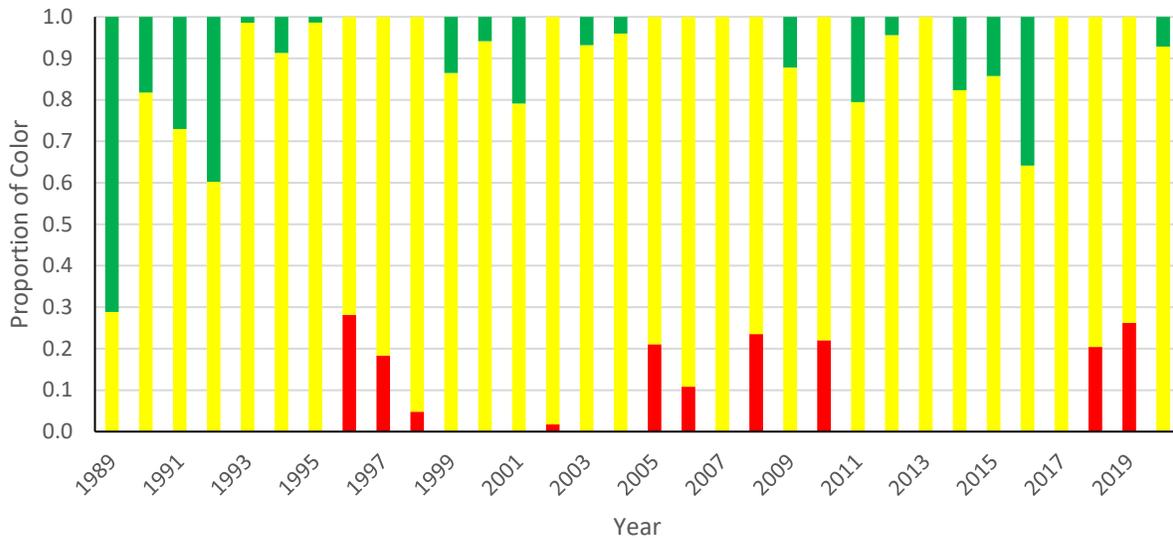
Figure 9. Annual TLA color proportions for Atlantic croaker from the Mid-Atlantic (NJ-VA) coast recreational harvest of the U.S. based on a 2002-2012 reference period



4.3.2 South Atlantic

- The recreational harvest index for the South Atlantic increased 76.5% in 2020 to 758.1 metric tons from 429.5 metric tons in 2019.
- This was the first increase in recreational landings in the South Atlantic in the past two years with no red proportion in 2020 (Figure 10).

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



5 TRAFFIC LIGHT ANALYSIS (FISHERY-INDEPENDENT SURVEYS)

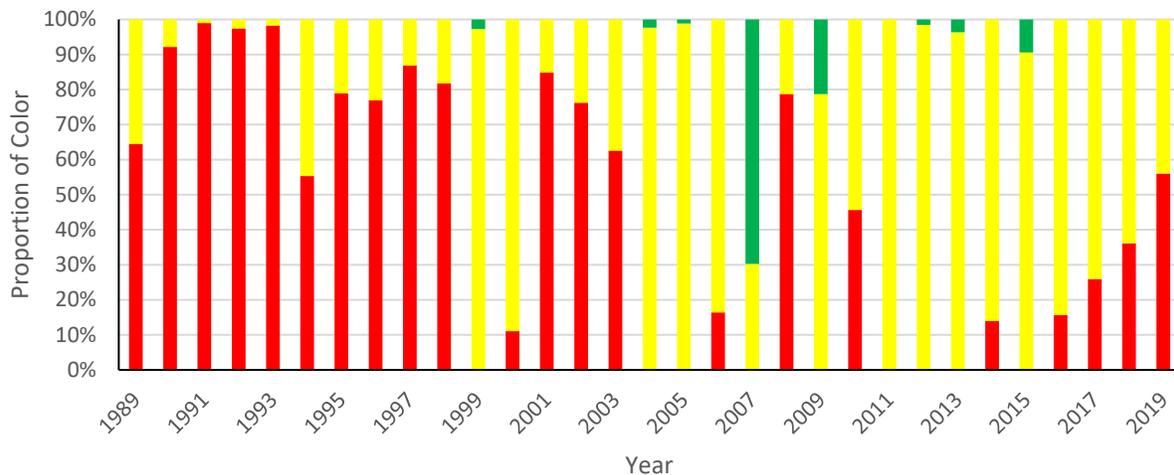
**Important note:

The ChesMMAP survey has not completed the calibrations necessary to convert the 2019 and 2020 index values that would allow full use of the entire time series after the vessel and gear changes that occurred in 2019 (see Section 3.2). ChesMMAP was able to sample in 2020, so once calibration exercises are complete the index data should be available in 2022. As discussed in the Introduction, the NEFSC fall groundfish survey and SEAMAP are only presented through 2019 due to impacts from the pandemic, and ChesMMAP only goes through 2018 in this report.

5.1 NEFSC Fall Groundfish Survey

- The index value for 2019 was 269.8 fish per tow and represented a 31.5% decrease from 2018 (394.0 fish per tow).
- 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 (Figure 11).
- The index has been below the long term mean (452.7 fish per tow) for the past four years.
- The general trend for the index has been declining since the series peak in 2007.
- The red proportion of the TLA has exceeded the 30% threshold for the last two years with the 3 year red proportion average being 39.4%.

Figure 11. Annual TLA color proportions for Atlantic croaker from NEFSC ground-fish trawl survey 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 were made 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 the end of 2021, 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. Since 2008 abundances for both age groups have remained relatively low.
- The TLA reflected these trends with high proportions of red since 2008 (Figure 12 and Figure 13).
- Proportionately, the decline was slightly greater for juveniles than for adults in recent years.

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

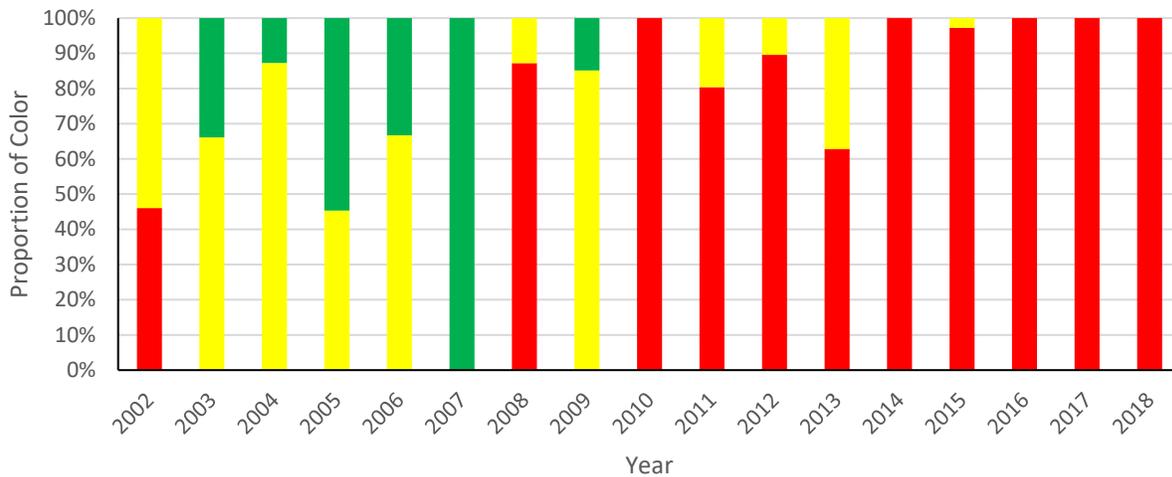
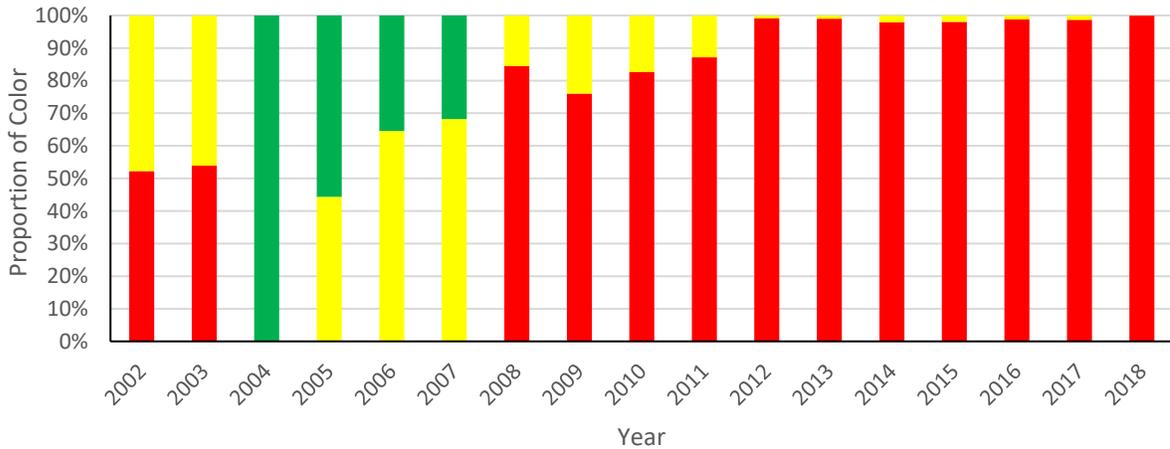


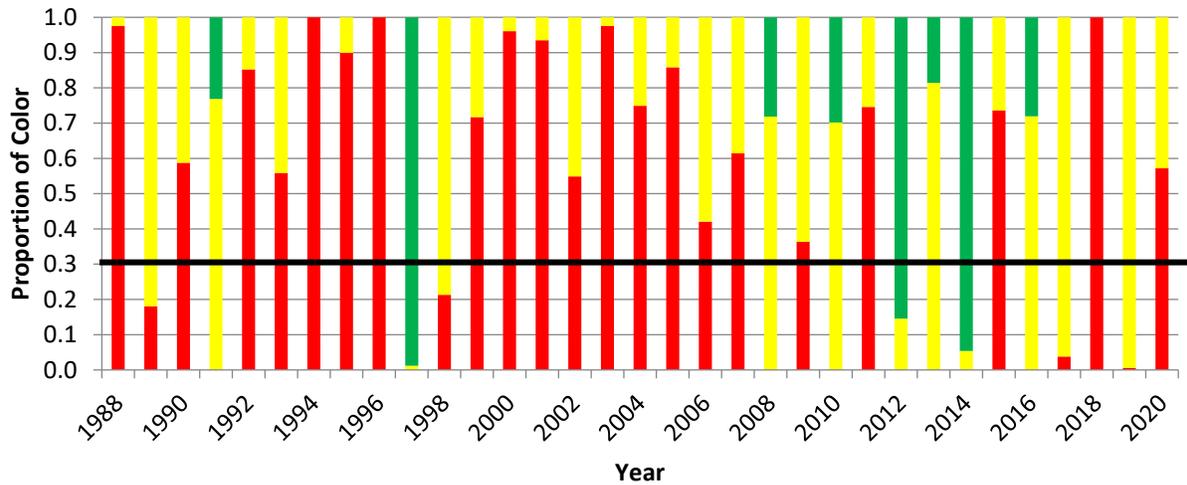
Figure 13. ChesMMAP survey annual TLA color proportions for Atlantic croaker ages 2+ using a 2002-2012 reference period



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 decrease (54.8%) in 2020 from 2019 going from 15.6 fish per tow in 2019 to 7.05 fish per tow in 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 the long term mean in 2020 with a red proportion of 57.2%. However, the index would not have tripped the TLA trigger in 2020 since the red proportion was not above the 30% threshold for 3 of the previous 4 years.

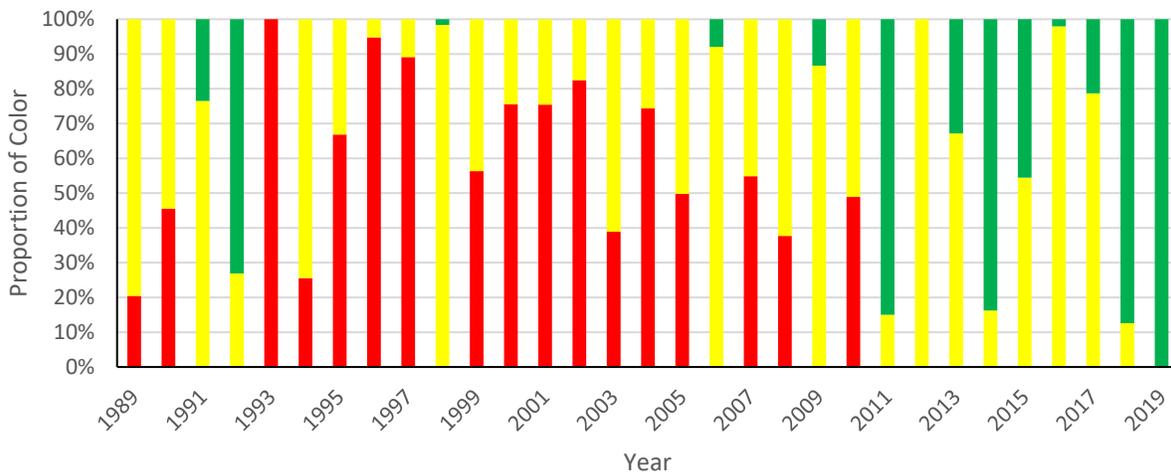
Figure 14. Annual TLA color proportions for age zero Atlantic croaker from VIMS spring trawl survey using 2002-2012 reference period



5.4 SEAMAP Survey

- The SEAMAP survey index used was for the spring season when adult Atlantic croaker (ages 2+) are captured.
- The SEAMAP index increased 12.7% in 2019 (34.7 kg/tow) from 2018 (30.7 kg/tow).
- Index values have remained above the long term mean since 2011 so there was no red in the TLA for recent years (Figure 15).
- The TLA trigger for the SEAMAP survey did not trip in 2019.

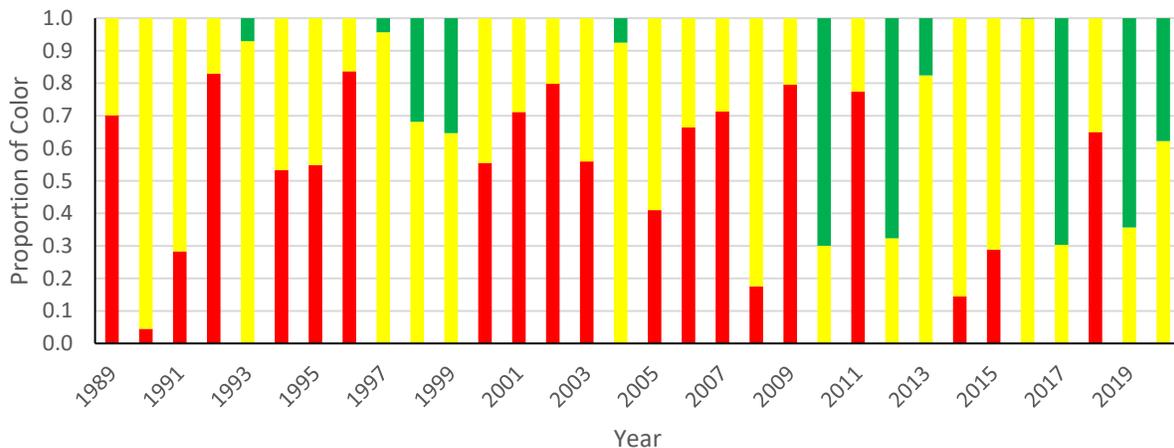
Figure 15. Traffic Light Analysis for SEAMAP catch data by weight in spring using a 2002-2012 reference period



5.5 North Carolina Program 195

- The North Carolina index declined in 2020 (27.6%) to 804.3 fish/tow (versus 1,110.8 fish/tow in 2019) and was still well above the long term mean (290.3 fish per tow) resulting in a green proportion of 37.8% in the TLA (Figure 16).
- While there was a decrease in CPUE, there was still a relatively high green proportion, likely indicating recruitment remained strong in 2020.
- Note sampling during June 2020 was limited to day trips and only the sites accessible from a nearby port were sampled which primarily included the river strata (Neuse River, Pamlico River, and Pungo River) and those sites close to the mouth of the rivers. A total of 28 stations were towed during the June 2020 (54 stations are sampled each June under normal conditions).

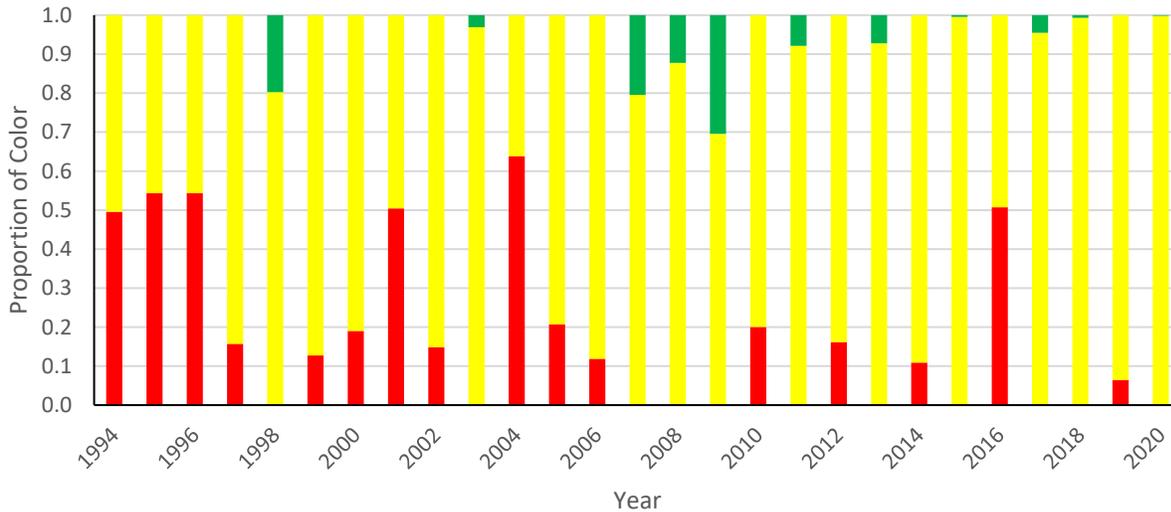
Figure 16. NCDMF Program 195 TLA color proportions for juvenile Atlantic croaker using 2002-2012 reference period



5.6 SCDNR Trammel Net Survey

- The SCDNR trammel index increased 12.9% in 2020 (1.52 fish per set) compared to 2019 (1.35 fish per set). Annual CPUE has been variably above and below the long term mean (1.34 fish per set) since 2009, indicated by annual alterations between red and green proportions in the TLA (Figure 17).
- The 2020 index value was only just above the long term mean.

Figure 17. SCDNR trammel net survey TLA color proportions for Atlantic croaker 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, the COVID-19 pandemic in 2020 made survey work impossible for the NEFSC survey 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 latest year available for ChesMMAAP. The VIMS survey was available through 2020 and is in the Fishery Independent survey section above (Section 5.3).
- The juvenile composite TLA characteristic (Figure 18) for the mid-Atlantic in 2018 was above the 60% red threshold using ChesMMAAP and VIMS and was the 9th year above the 30% threshold. The Mid-Atlantic juvenile composite index likely triggered in 2019 and 2020 regardless of whether index values had been available since it met the threshold of triggering in three of the previous four years.
- 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 NC Program 195 and it did not trigger in 2020 with three of the four terminal years showing green proportions in the index (Figure 19).

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

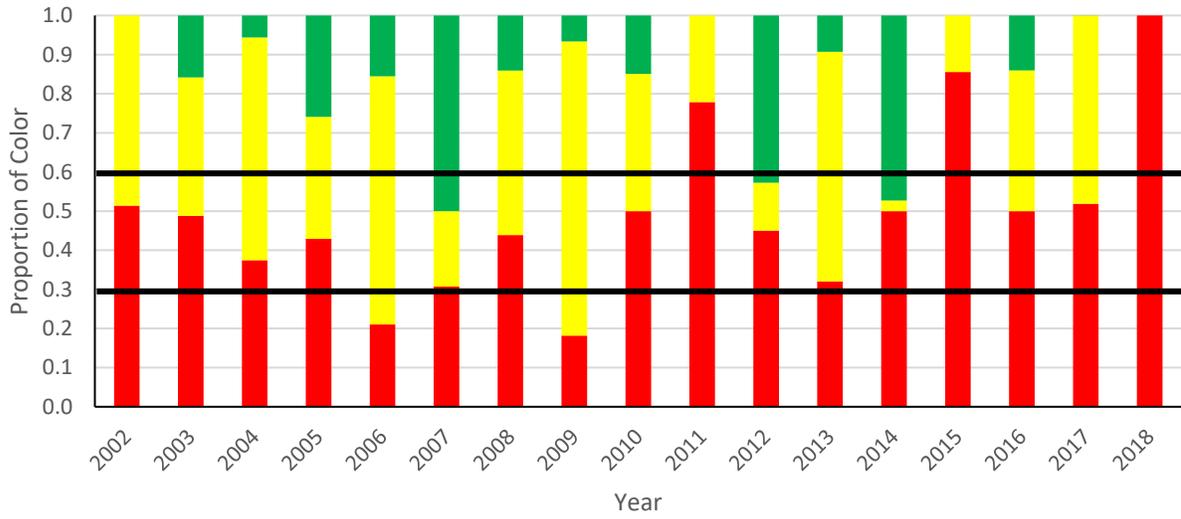
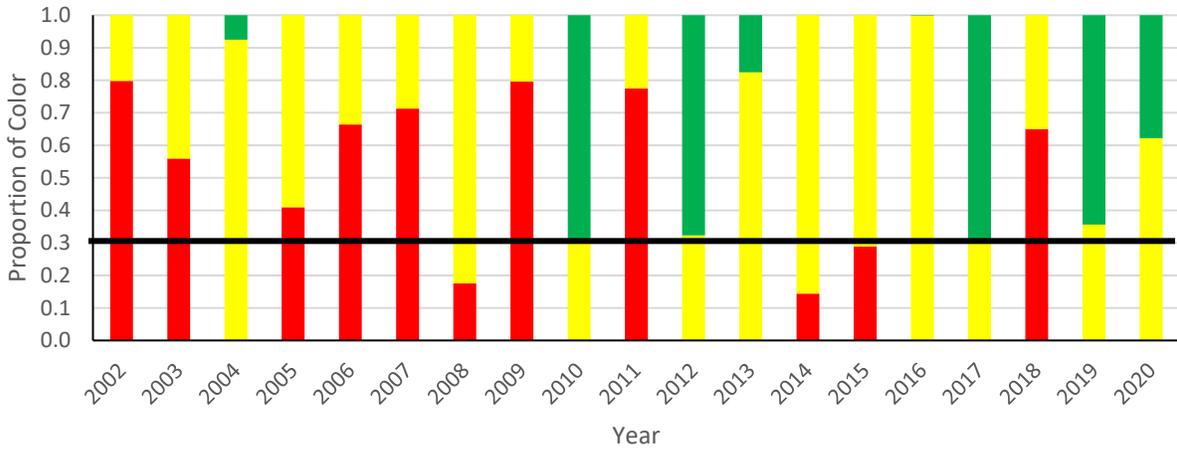


Figure 19. Juvenile (ages 0) Atlantic croaker index for the South Atlantic using NCDMF Program 195.



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 (2007-2020) 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 has been on a declining trend since 2012 as indicated by high red proportions above the 60% threshold for the last five years (Figure 20). This trend continued in 2020 with a red proportion of 69.5%.
- This corresponds well with the decline seen in the ChesMMAP survey for juveniles in recent years as well.
- The adult Atlantic croaker index for NEAMAP also showed a declining pattern in recent years (Figure 21), although not as much of decline as that seen in the juvenile fish.
- The NEAMAP survey TLA would have triggered in 2020 for adult fish with red proportions above the 30% threshold for three of the four previous years (Figure 21). Red proportions in 2019 and 2020 exceeded the 60% threshold as well.

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

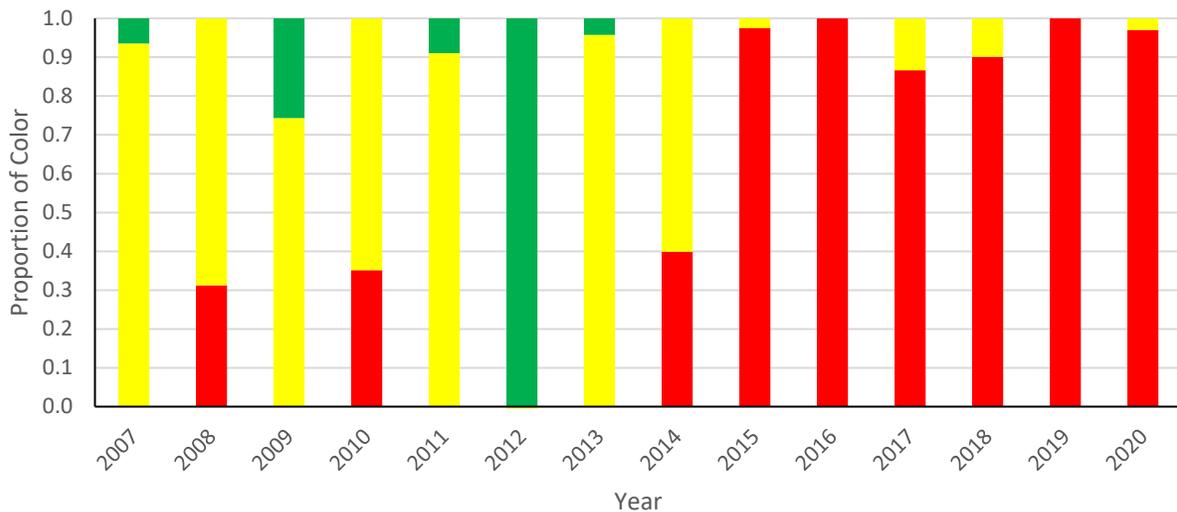
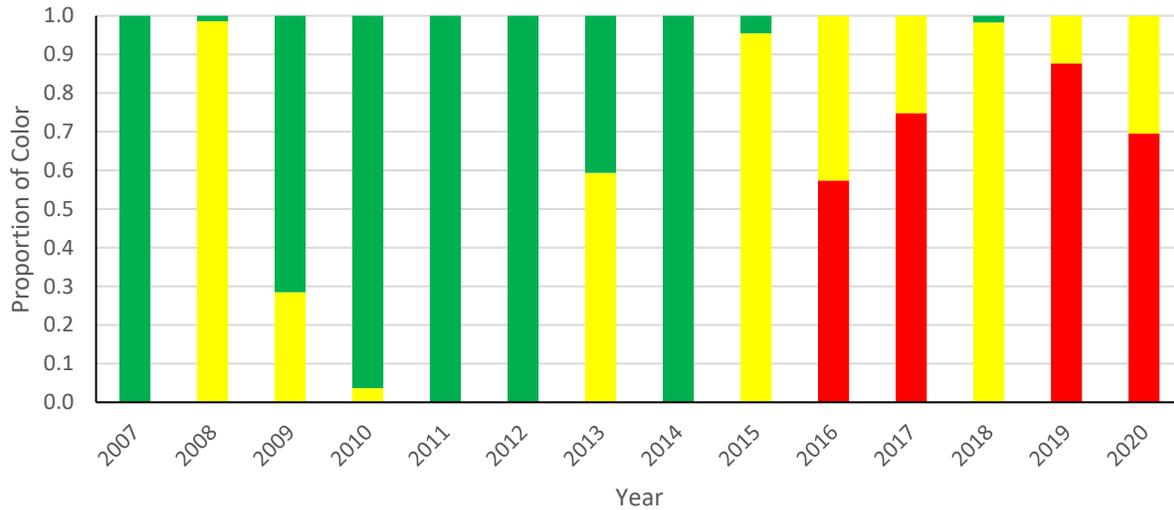


Figure 21. Adult (ages 2+) TLA color proportions for Atlantic croaker from the NEAMAP survey using a 2007-2019 reference period



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). While the composite only went through 2018 in order to correspond to data available from the ChesMMAP and VIMS surveys, red proportions were still above 60% for just the NEAMAP survey (Figure 22).
- The adult Atlantic croaker composite characteristic for the Mid-Atlantic with NEAMAP included also showed increasing proportions of red and would have triggered in 2019 at the 30% threshold (Figure 23).

6.3 Summary

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 a more limited 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 the use of the NEFSC survey 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 report year 2022.

Figure 22. Juvenile Atlantic croaker (ages 0-1) TLA composite characteristic index for the Mid-Atlantic through 2018 using NEAMAP and VIMS with a 2007-2019 reference period

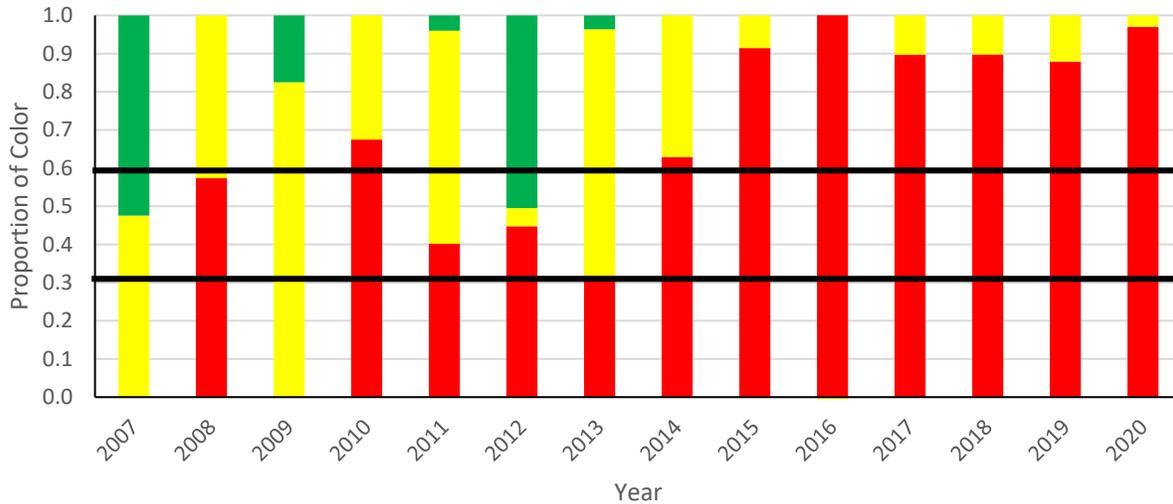


Figure 23. Adult Atlantic croaker (ages 2+) TLA composite characteristic index for the Mid-Atlantic (NJ-VA) through 2018 using NEFSC, NEAMAP and ChesMMAP (2007-2018), NEFSC and NEAMAP (2019) and NEAMAP only (2020) with a 2007-2019 reference period

