Atlantic States Marine Fisheries Commission

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MEMORANDUM

January 30, 2014

TO: **South Atlantic Federal/State Management Board**

FROM: **Atlantic Croaker Technical Committee and Spot Plan Review Team**

RE: **Spot and Croaker Traffic Light Analysis & Management Considerations**

This memorandum offers a draft management framework and considerations regarding the use of the traffic light analysis model the South Atlantic State/Federal Management Board requested the Atlantic Croaker Technical Committee (TC) and Spot Plan Review Team (PRT) develop during the 2013 August Board meeting. The intent of this memorandum is to provide the Board with an updated report of the traffic light analysis model for the Spot and Atlantic croaker fisheries as well as draft management options given a variety of scenarios. The TC and PRT requests review and guidance from the Board on the feasibility of these management options for the 2014 fishing year and beyond, as well as the incorporation of the traffic light analysis model and draft management framework into to the Interstate Fishery Management Plans for Atlantic Croaker and Spot.

Executive Summary

Introduction

The current management scheme for Atlantic croaker compares annual changes in various trigger indices with the previous two year's average index value. If the index value drops below 70% of the previous two year average, at a minimum, examination of the data is required by the Atlantic croaker technical committee (TC). For spot, index values are compared to the 10^{th} percentile of the indices time series. If two of these indices (one of which must be an independent index) is below the 10^{th} percentile the Plan Review Team (PRT) is to recommend the South Atlantic Board consider management action. Both of these management trigger schemes do not illustrate long term declines or increases in stock since they don't make comparisons over longer time periods. Under the current annual trigger exercises, the high degree of variability in year to year index values results in rapid changes that make it difficult to respond to rapid decreases in the trigger indices beyond a general review by the TC or PRT because of the effort involved. In relatively short lived species like Atlantic croaker and spot it is not always necessary to respond to rapid annual changes in management index triggers but rather to persistent periodic declines that occur over several years. Declines that might occur over several years require close monitoring in order to anticipate when or if management action may be required. With this in mind, a management response scheme which uses techniques that illustrate multi-year changes and trends would be more useful than simply examining year to year changes against the previous year or sharp declines in a single year compared to the time series. Knowing the level at which to respond or initiate some type of management action should be based on long term knowledge of general stock levels as well as how that stock has changed over time. The traffic light model offers the ability to illustrate changing trends based on relevant stock parameters that can include historical abundance, life history parameters, and response to fishing pressure by using assessment based reference points.

To better manage the Atlantic croaker and spot fishery resources, this document proposes a potential management framework that incorporates information on trends in the fisheries using the Traffic Light Analysis Model.

Traffic Light Analysis

The Traffic Light method was originally developed (Caddy and Mahon, 1995; Caddy, 1998, 1999) as a precautionary management framework for data poor fisheries whereby reference points could be developed that would allow for a reasonable level of resource management. The name comes from assigning a color (red, yellow, or green) to categorize relative levels of different indicators of the state of either a fish population or a fishery. These indicators can be combined to form composite characteristics within similar categories and can include biological indicators such as growth and reproduction, population level indicators such as abundance and stock biomass estimates, or fishery indicators such as harvest/landings and fishing mortality. However, each indicator must be evaluated separately in order to determine its appropriateness for use in a management scheme. The complete report on the Traffic Light Analysis Model on the current trigger indices for Atlantic croaker and spot can be found in the second portion of this memo. This brief summary is designed to give an overview of the advantages of the Traffic Light Analysis Model over the current annual trigger exercises for both species.

Overall advantages of the Traffic Light Analysis Model

- This analysis model fits well with both limited and more extensive data sets for setting reference points.
- The basic color scheme is intuitive and easy to explain to both fisheries professionals and the non-scientific community.
- Boundary reference points for the color scheme can be set according to known assessment based time periods for any data series.
- Setting reference time frames over multiple generations can cover known periods of population fluctuations taking into account long term increases and decreases.
- Different indexes can be used to compare trends across production (harvest/landings), abundance (fishery independent surveys), and assessment based metrics (spawning stock biomass or estimated fishing mortality).

Summary of Atlantic croaker and Spot Annual Trigger Exercises compared to Traffic Light Analysis (TLA) Model

Atlantic Croaker

- The commercial and recreational harvest TLA show earlier indications of declining harvest rates versus the 70% trigger for Atlantic croaker (figures 1 and 2)
- The current 70% trigger for Atlantic croaker only tripped if there was a sharp year to year decline and the index only triggered three times over a 30 year period for both recreational and commercial harvest.
- The TLA began to show signs of decline in landings 3-4 years before the 70% trigger demonstrating greater sensitivity to harvest trends.
- The TLA using the fishery independent indices for both adults and juveniles were more variable than the harvest trends, but the overall patterns of declines (through increasing proportions of red/yellow) was still more sensitive than the 70% trigger for Atlantic croaker (figures 5 and 6)
- In Atlantic croaker there were some discrepancies between the harvest indices (commercial and recreational) and the abundance indices (fishery independent surveys) in the TLA (see full report). Most of those discrepancies were accounted for in different age structures of the different data sets. The commercial and recreational harvests were dominated by age 3+ fish while the fishery independent indices were driven largely by age 0-2 fish. When the age structure was taken into consideration in estimating a composite juvenile and adult TLA (ages 0-2 and ages 3+, respectively), the juvenile classes matched up more closely with the trends in the fishery independent indices.

Spot

- The commercial and recreational harvest TLA is much more indicative of change than the 10^{th} percentile trigger for spot. (figures 3 and 4)
- The TLA for spot fishery independent indices offers a much better tool for examining year to year changes in index values with more sensitive reference points that can be set using historic and known levels of abundance or harvest compared to the current 10^{th} percentile method.
- The current 10^{th} percentile trigger for spot was rarely tripped in most of the indexes and when it did, it occurred at some of the lowest values for each index. While this did provide a conservative

measure for management responses or action, the triggers should be more responsive at higher levels because this would allow a management response before stock levels got to such low values.

Management Considerations

The next step in this process is determining the level of management response that should be appropriate for the different color proportions that may occur if the Traffic Light Analysis Model is used in a management framework. In general practice with the Traffic Light Analysis Model, the green/yellow boundary is typically set at the long term mean of the data series reference period and the yellow/red boundary is set at 60% of the long term mean, which would indicate a 40% decline from the series mean. Index values that fall in the yellow zone will always have some proportion of either yellow/green or yellow/red depending on where it falls in the transition (yellow) zone. Since increasing proportions of red reflect decreases, the relative proportion of red in the index may offer one way of determining if any management response is necessary to a change in index values.

North Carolina Blue Crab Adaptive Management Framework

One current example of incorporating the Traffic Light Analysis Model was recently implemented for the North Carolina blue crab fishery (table 1). This framework applies the traffic light analysis to a production characteristic (spawning stock and general stock indicators from different fishery independent surveys), as well as an adult abundance characteristic (from different fishery independent surveys that catch adults). There are two management level responses that are tied to the relative proportion of red within each characteristic. A moderate management level response occurs when the proportion of red for the traffic light characteristic reaches 50% and can result in actions that limit harvest such as restricting trip level harvest for sponge crabs, institution of minimum and/or maximum size limits for female crabs, or seasonal closures in spawning areas. An elevated management level occurs when the traffic light characteristic reaches 75% and can result in more restrictive management actions such as prohibition of sponge crabs, no peeler harvest, or closure of the fishery through either season or gear (or both).

Application & Recommendations

In drawing from the North Carolina blue crab adaptive management framework, the application of tiered red proportion thresholds and management tools has much utility in addressing declining trends for both the Atlantic croaker and spot fisheries. Additionally, many of the management tools utilized in the blue crab adaptive management framework could be applied to the Atlantic croaker and spot fisheries, particularly size limits, possession limits, and seasonal closures.

The production characteristic which the North Carolina blue crab adaptive management framework utilizes- particularly the unique life history and spawning stock indicators- does not fit as well in application for Atlantic croaker or spot. Additionally, the blue crab adaptive management framework does not use commercial data to prevent any biases or influences not related to the stock condition. For Atlantic croaker and spot, a more appropriate production characteristic might be commercial and recreational data (as a 'harvest' characteristic), given their current use in assessing each species through the annual trigger exercises. Utilizing the traffic light anaylsis model, the composite commercial and recreational traffic light analysis for Atlantic croaker and spot (figures 7 and 9) could be most useful as the harvest characteristic, while the composite of fishery independent surveys and indices (Figures 8 and 10) could be applied as the adult abundance characteristic.

Proportion Thresholds

In considering appropriate thresholds for the proportion of red necessary to enact management measures, the Atlantic Croaker Technical Committee and Spot Plan Review Team determined that approx. 30% (moderate concern) and approx. 60% (elevated concern) currently serve as adequate proxies based on independent and dependent fishery data during the last 30 years. Thresholds significantly higher than these may not work effectively in addressing declining trends. Further analysis will be needed to establish precise thresholds for enacting management measures.

Management Measures

Atlantic croaker

In evaluating the Atlantic croaker fishery in relation to the NC blue crab adaptive management framework, the tiered approach based on the Traffic Light Analysis Model may allow for sufficiently conservative measures to be utilized and still provide flexibility for more or less restrictive measures depending on performance. Effort controls may not be a viable option as a management tool for Atlantic croaker recreational and commercial fisheries due to the inability to enact limited entry or monitor a quota system on a real-time basis. Possible management tools for consideration may be bag limits, size restrictions, time & area closures, and gear modifications. An example of each of these tools is provided in table 2. Closures (as listed in table 2) were determined based on coastwide recreational harvest estimates by wave over the last two years and assessed based on when harvest is highest. Similarly to the NC blue crab adaptive management framework, each level of management response could be enacted based on a 3 year time series and subsequently hold management measures in place for 3 year period so as to provide consistent measures coastwide and allow for sufficient time to evaluate impact of measures.

Spot

In evaluating the spot fishery relative to the NC blue crab adaptive management framework, there is less of 1:1 applicability in the approach, largely due to a lack of age data as well as the short life history of spot. While neither croaker nor spot have reference points to work from in assessing the status of the stock, the additional lack of minimum management measures for spot makes it difficult to determine what impact any proposed measures may have relative to the natural cycles of species abundance. In considering management tools, limited options are available in constraining effort. In trying to improve recruitment, the reduction of landings through season closures and timed gear restrictions may provide some benefits. An example of each of these tools is provided in table 3. Closures were determined based on coastwide recreational harvest estimates by wave over the last two years and assessed based on when harvest is highest. Similarly to the Atlantic croaker example & NC blue crab adaptive management framework, each level of management response could be enacted based on a 2 year time series and subsequently hold management measures in place for a 2 year period so as to provide consistent measures coastwide and allow for sufficient time to evaluate impact of measures. A 2 year period rather than 3 year period was considered more appropriate given the short life history of spot. In implementing these measures, while potentially improving abundance, may allow for an expansion of the age structure for Spot, as current data indicates that few if any are observed beyond age 3, when they may be able to live to age 4 and older.

For both species, the application of an overall harvest percentage reduction using a combination of management tools listed under each tier response could be an option for state-by-state management rather than the implementation of coastwide measures at each tiered level.

Conclusion

The proposed management framework for Atlantic Croaker and Spot is intended to act as interim management measures between stock assessments, and not to be implemented in substitution of a stock assessment. Rather, the measures proposed are aimed addressing mutli-year changes and trends, and the accuracy of their impacts can only be improved through better age data, further highlight the need for an updated stock assessment for both species.

Determining appropriate management responses, at what levels they should occur, and how they should be applied across the different Atlantic states is the next step in adopting the Traffic Light Analysis method for use with Atlantic croaker and spot. The TC and PRT request the Board's review of this draft management framework and Traffic Light Analysis for consideration in the interstate fisheries management of Atlantic croaker and spot.

Figures

Figure 1. Commercial Landings for Atlantic croaker Traffic Light Analysis

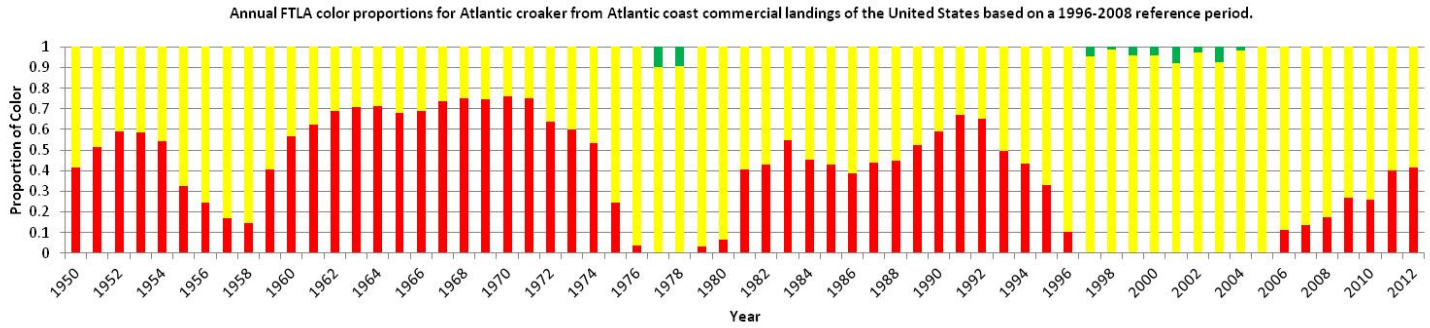


Figure 2. Recreational Harvest for Atlantic croaker Traffic Light Analysis

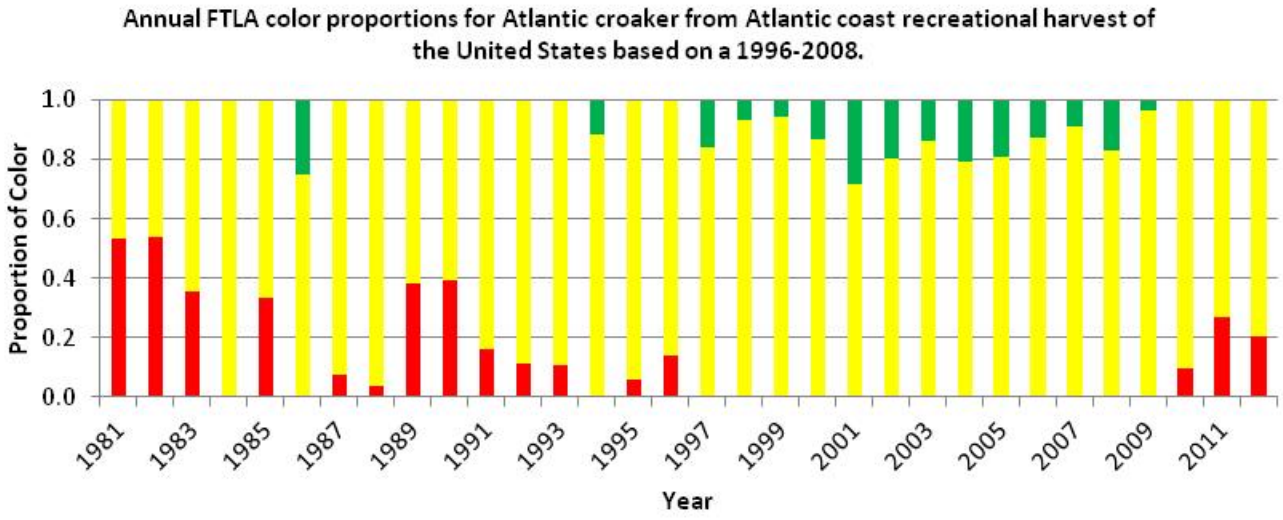


Figure 3. Commercial Landings for spot Traffic Light Analysis

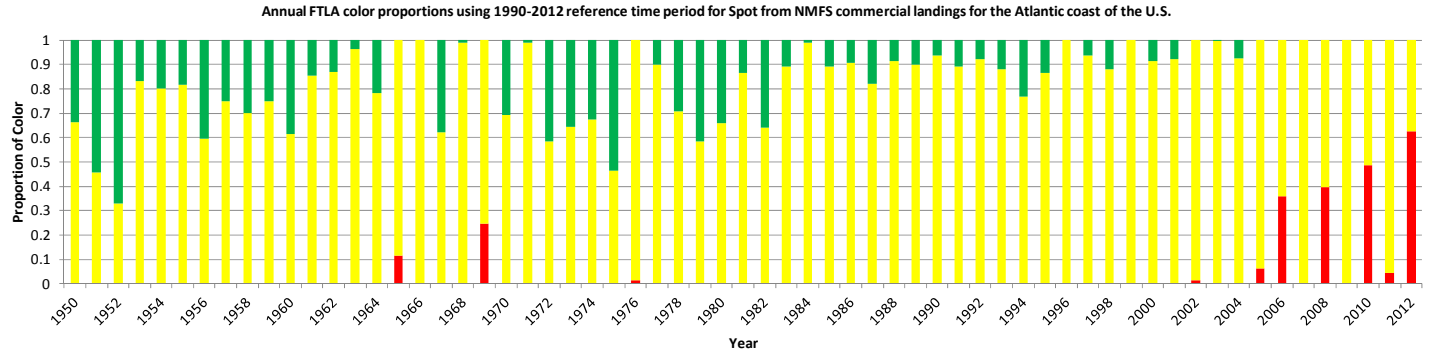


Figure 4. Recreational Harvest for spot Traffic Light Analysis

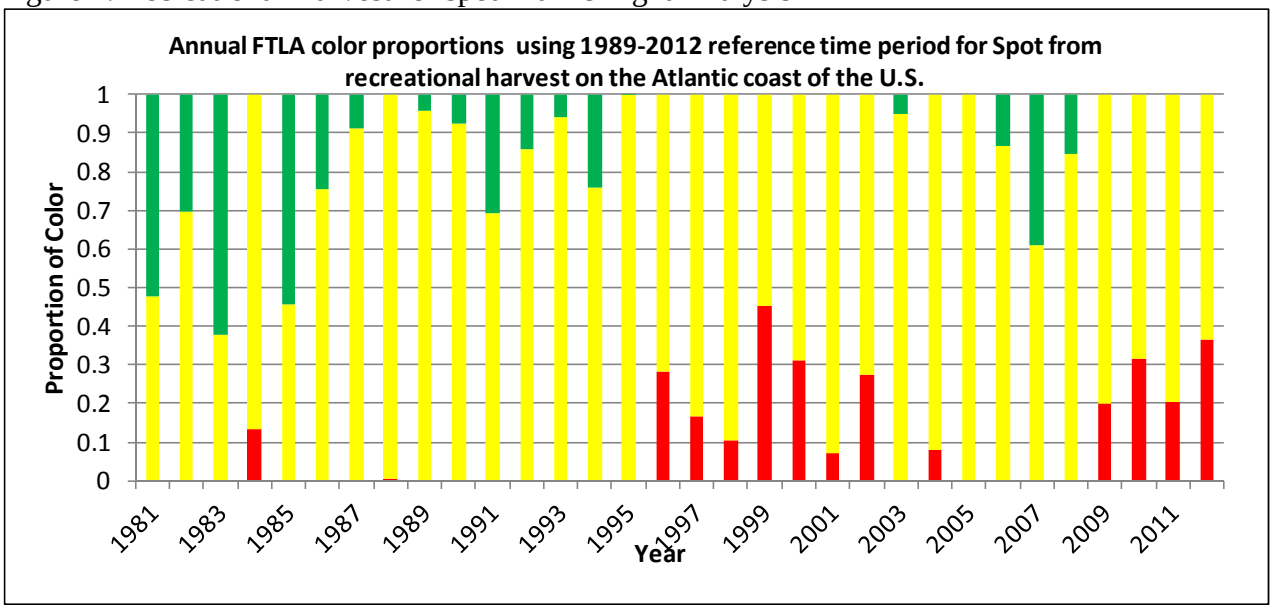


Figure 5. Adult Atlantic croaker Traffic Light Analysis for fishery independent indices

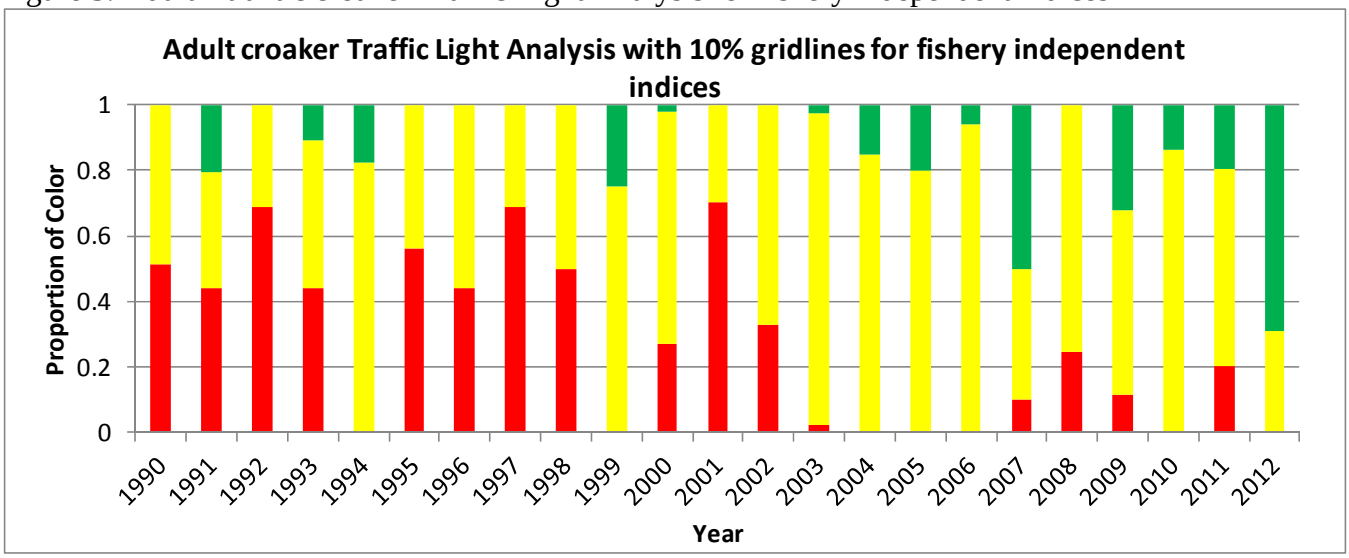


Figure 6. Juvenile Atlantic croaker FTLA for fishery independent trigger indices

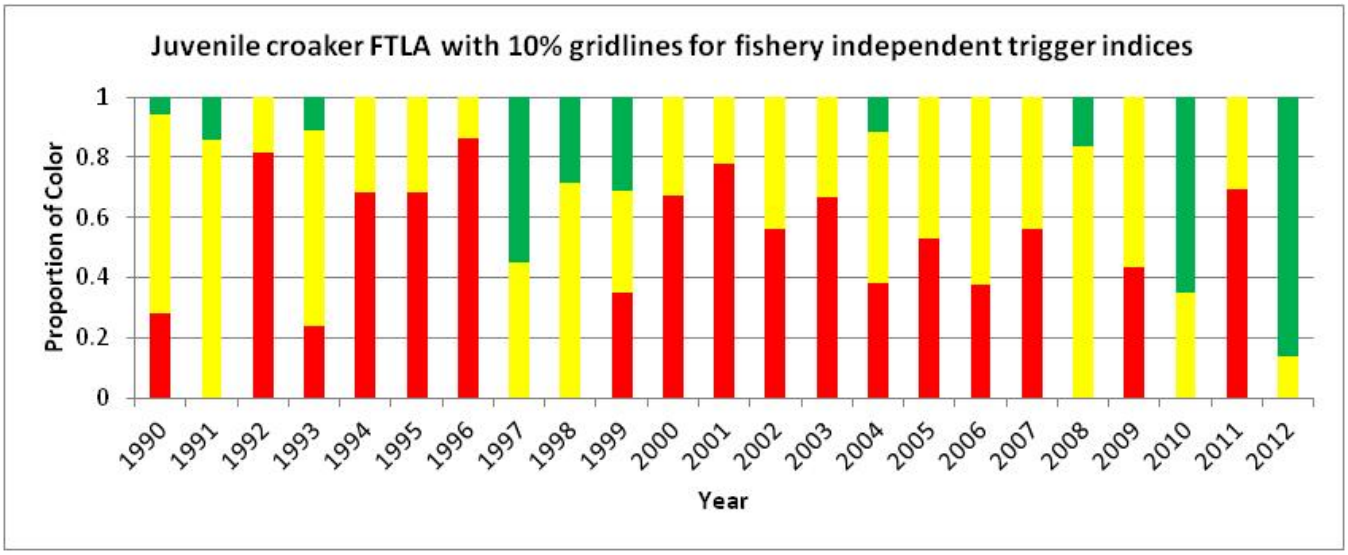


Figure 7. Composite Commercial and Recreational Landings Traffic Light Analysis for Atlantic Croaker

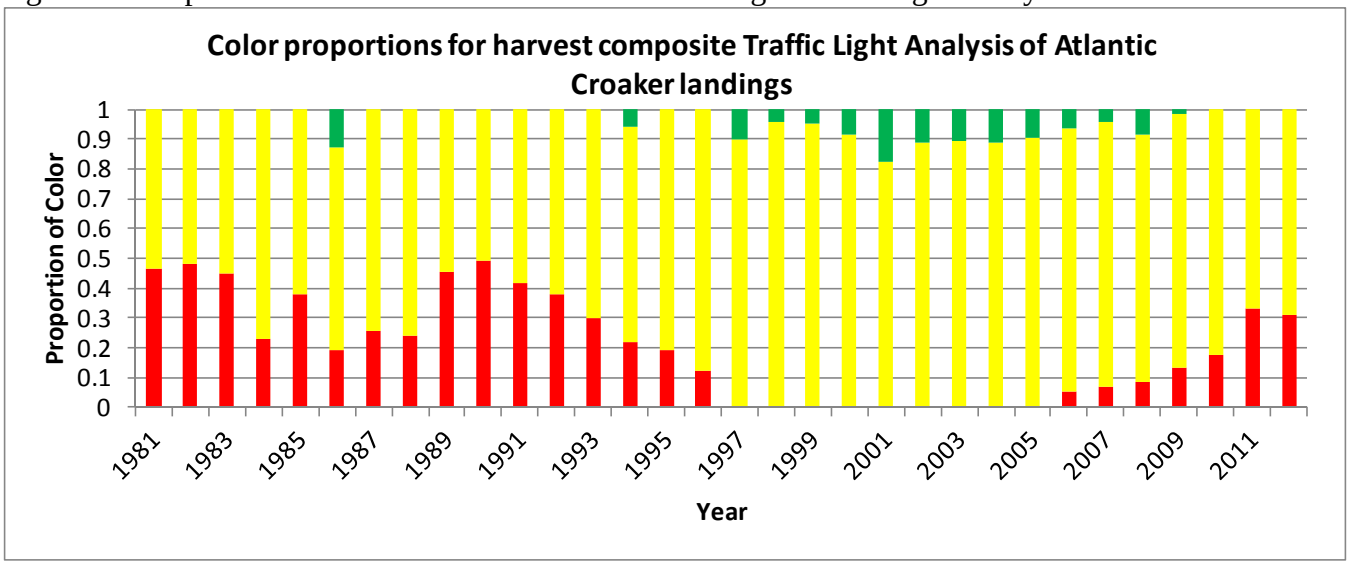


Figure 8. Composite Fishery Independent Surveys and Index Traffic Light Analysis for Atlantic Croaker

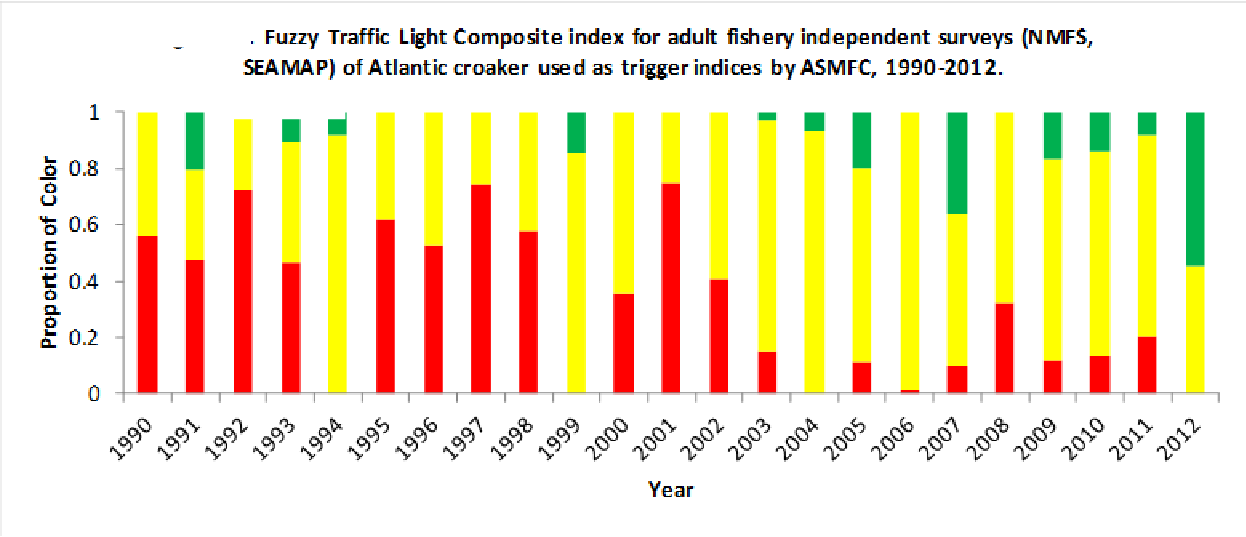


Figure 9. Composite Commercial and Recreational Landings Traffic Light Analysis for Spot

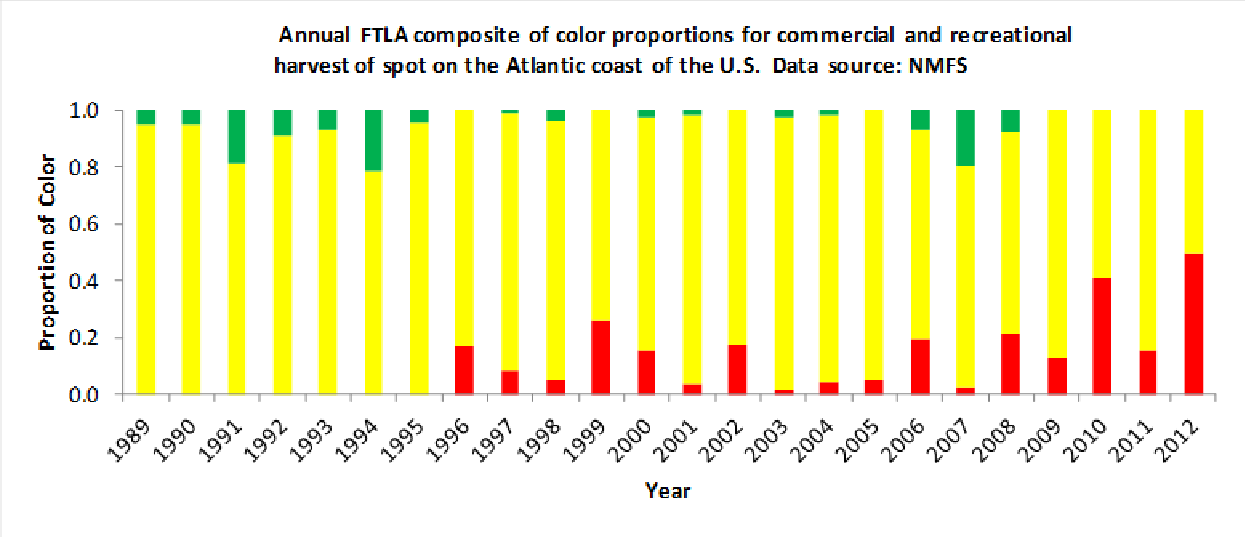
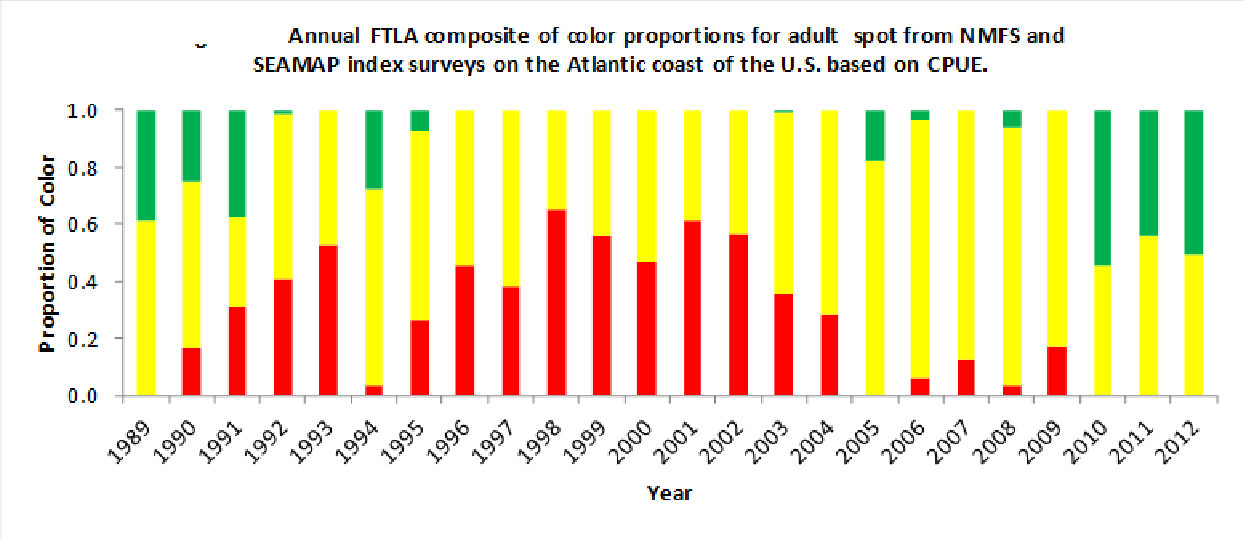


Figure 10. Composite Fishery Independent Surveys and Index Traffic Light Analysis for Spot



Tables

1. Fishery Management Measures for North Carolina Blue Crab Adaptive Management Framework

Characteristic	Moderate management level (50% red)	Elevated management level (75% red)
Adult abundance	A1. Increase in minimum size limit for male and immature female crabs A2. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 5%) and/or implement gear modifications to reduce sublegal catch A3. Eliminate harvest of v-apron immature hard crab females	A4. Closure of the fishery (season and/or gear) A5. Reduction in tolerance of sub-legal size blue crabs (to a minimum of 1%) and/or implement gear modifications to reduce sublegal catch A6. Time restrictions
Recruit abundance	R1. Establish a seasonal size limit on peeler crabs R2. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color) R3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	R4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots in specific areas R5. Expand existing and/or designate new crab spawning sanctuaries R6. Closure of the fishery (season and/or gear) R7. Gear modifications in the crab trawl fishery
Production	P1. Restrict trip level harvest of sponge crabs (tolerance, quantity, sponge color) P2. Minimum and/or maximum size limit for mature female crabs P3. Close the crab spawning sanctuaries from September 1 to February 28 and may impose further restrictions	P4. Prohibit harvest of sponge crabs (all) and/or require sponge crab excluders in pots for specific areas P5. Reduce peeler harvest (no white line peelers and/or peeler size limit) P6. Expand existing and/or designate new crab spawning sanctuaries P7. Closure of the fishery (season and/or gear)

2. Fishery Management Measures for Atlantic Croaker Management Framework

Characteristic	Moderate management level (30% red)		Elevated management level (60% red)	
	Recreational	**Commercial**	**Recreational**	**Commercial**
Adult abundance	Catch limit: X numbers/day limit (coastwide)	Catch limit: 8" minimum (coastwide); X pounds/day limit (coastwide)	Catch limit: 9" minimum (coastwide); X numbers/day limit (coastwide)	Catch limit: 9" minimum (coastwide); X pounds/day limit (coastwide)
	Closures: state specific areas closure for 20 days after May 1 & before Oct 1	Closures:	Closures: state specific areas closure from Aug 1-Sept 1	Closures: state specific areas from Sept 1-Nov 1
	Gear Modifications:	Gear Modifications:	Gear Modifications:	Gear Modifications: gillnets prohibited from August 1-30
Harvest	Catch limit: X numbers/day limit (coastwide)	Catch limit: 8" minimum (coastwide); X pounds/day limit (coastwide)	Catch limit: 9" minimum (coastwide); X numbers/day limit (coastwide)	Catch limit: 9" minimum (coastwide); X pounds/day limit (coastwide)
	Closures: state specific areas closure for 20 days after May 1 & before Oct 1	Closures:	Closures: state specific areas closure from Aug 1-Sept 1	Closures : state specific areas from Sept 1-Nov 1
	Gear Modifications:	Gear Modifications:	Gear Modifications:	Gear Modifications: gillnets prohibited from August 1-30

3. Fishery Management Measures for Spot Management Framework

Characteristic	Moderate management level (30% red)		Elevated management level (60% red)	
	Recreational	Commercial	Recreational	Commercial
Adult Abundance	Closures: May 1- June 15	Closures: NA	Closures: Sept 1- Oct 15	Closures: Sept 1- Oct 1
	Minimum Size Limit: X”	Gear Modifications:	Minimum Size Limit: X”	Gear Modifications: gillnets prohibited from Sept 1-30
Harvest	Closures: May 1- June 15	Closures: NA	Closures: Sept 1- Oct 15	Closures: Sept 1- Oct 1
	Minimum Size Limit: X”	Gear Modifications:	Minimum Size Limit: X”	Gear Modifications: gillnets prohibited from Sept 1-30