Adaptive index-based approaches to develop a temporary experimental quota for Red Snapper

The South Atlantic Fishery Management Council (SAFMC) recently received two letters from the National Marine Fisheries Service (NFMS) on the topic of Red Snapper management in the South Atlantic region: one letter (dated 03/03/2017, included in Attachment 21 to the April 2017 SSC Meeting) indicated the SAFMC has taken sufficient steps to address overfishing of Red Snapper, and another (dated 02/15/2017, included in Attachment 21 to the April 2017 SSC Meeting) indicated that discard-only projections were not possible due to the length of time since the terminal year of data for the stock assessment (SEDAR 41 2016) and uncertainty in the recreational landings due to revisions to the Marine Recreational Information Program (MRIP). In light of this, the SAFMC has requested that NMFS determine whether new Acceptable Biological Catch (ABCs) projections beyond 2017 will need to be developed for Red Snapper if those from SEDAR 41 are ultimately determined to not be usable for management (dated 04/03/2017, included in Attachment 21 to the April 2017 SSC Meeting).

Different data-poor methods have been used to set ABCs in the past. The SAFMC's Scientific and Statistical Committee (SSC) explored using Depletion Corrected Average Catch (MacCall 2009) and Depletion Based Stock Reduction Analysis (Dick and MacCall 2011) for Wreckfish and other data-poor species. Depletion Corrected Average Catch and Depletion Based Stock Reduction Analysis are included in the DLMTool Kit (Carruthers et al. 2015), which was developed to explore a variety of data-limited methods depending on available data. The DLMTool Kit was used by the Mid-Atlantic Fishery Management Council to develop ABCs for Black Sea Bass, Blueline Tilefish, and Mackerel. A fishery-independent index, life history parameters, and natural mortality data are already available for Red Snapper from SEDAR 41. However, there remains uncertainty in total removals, selectivity, steepness, and ratio of F_{MSY} to natural mortality. One of the biggest issues with any ABC that is developed is that the current MRIP system is not sufficient for management based on communications from NMFS to the Council mentioned above (letters dated 03/03/2017 and 02/15/2017).

Another option would be to develop a temporary, experimental quota based on the indices of abundance used in SEDAR 41, which would be used to track Red Snapper abundance annually. Ideally, this method would be simple and use information that can be compiled by June of the following year. Other methods are being developed to improve MRIP and potentially track Red Snapper rebuilding progress. While these methods are being developed, the simple approach described next could be used to develop a Red Snapper temporary quota to allow limited harvest. The experimental quota would enable the collection of data on age of Red Snapper from recreational and commercial fisheries, provide samples to inform selectivity of fisheries, and potentially reduce the economic impact of keeping the fishery closed.

An index-based approach to developing a quota would need to include two components: an index and a scalar to determine sustainable removals. SEDAR 41 considered five indices of abundance for the stock assessment. The commercial logbook and headboat fishery-dependent indices included data through 2009 and were not recommended to be extended past 2009 due to management actions that closed the fishery. The headboat at-sea observer index was based on data collected by on-boat observers from 2005 to current and included counts of Red Snapper less than 20 inches that would have been discarded throughout the time series. This index could be extended; however, comments during public scoping suggest that the headboat fishery may have altered its behavior to avoid areas where Red Snapper are abundant.

There were two fishery-independent indices analyzed for SEDAR 41: Southeast Reef Fish Survey (SERFS) chevron trap survey and SERFS video index. There is a lack of independence with these two surveys, however, since the video cameras are attached to the chevron traps. Therefore, the SERFS chevron trap and video indices were combined into one index in SEDAR 41. A fishery-independent index can be developed based on methods from the latest stock assessment (Note: these have not been developed yet and data included in the paper used slightly different methods). Unfortunately, a video index could not be completed until August 2017, at the earliest, and be presented to the Council in September. A trap index is provided based on the methods used in the Southeast Reef Fish Survey Report to the Council.

Important changes in Red Snapper sampling or management:

- 2004 – Change from MRFSS to MRIP
- 2010 – Red Snapper harvest closed in federal waters.
- 2010 – Councils required to manage with OFL, ABC, and ACLs.
- 2012 – 6-day recreational season with 1 fish per person and commercial season with 25-pound trip limit.
- 2013 – MRIP transitioned to Access Point Angler Intercept Survey
- 2013 – 9-day recreational season with 1 fish per person and commercial season remained open until ACL met with 75-pound trip limit.
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2010 was included because this was the first year of the Red Snapper closure and fishermen likely changed how they typically fished. Mini-seasons were open from 2012 to 2014. A season was not opened in 2010, 2011, 2015, or 2016. MRIP transitioned to Access Point Angler Intercept Survey (APAIS) in 2013 and recreational discards make up a significant amount of the removals for Red Snapper.

In the following options, the indices used could start at different time periods. 2005 was included since this was the first year of the observer data and a year after the transition from MRFSS to MRIP.

Options for the index to track population trends:

- Develop SERFS chevron trap index starting in 2005 to develop the standard deviation and use the last 3 years to determine trend
- Develop SERFS chevron trap index starting in 2005 to develop the standard deviation and use last 5 years to determine trend
- Develop SERFS chevron trap index starting in 2012 to develop the standard deviation and use last 3 years to determine trend
- Develop SERFS chevron trap index starting in 2012 to develop the standard deviation and use last 5 years to determine trend
- Develop SERFS chevron trap and video index starting in 2010 to develop the standard deviation and use last 3 years to determine trend
- Develop SERFS chevron trap and video index staring in 2010 to develop the standard deviation and use last 5 years to determine trend

Other options or items to consider?

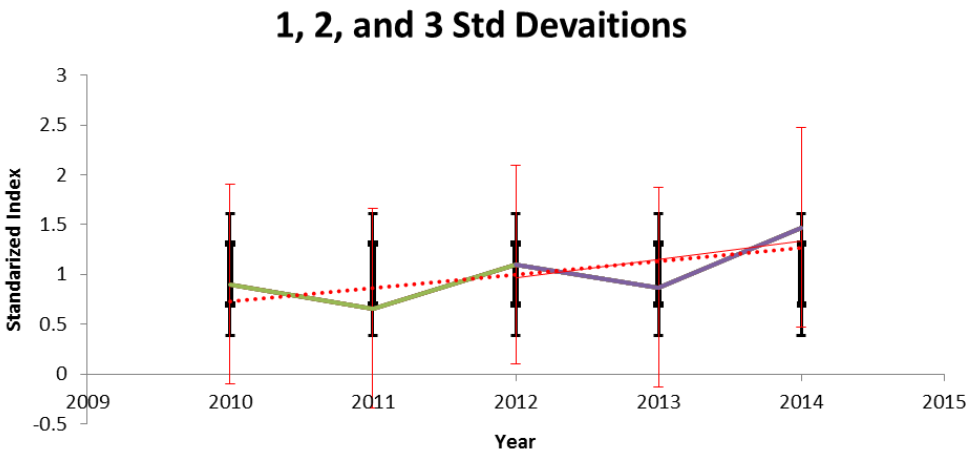

Figure 1. Standardized index from the combined chevron trap and video indices of abundance for Red Snapper from 2010 to 2014. The graph includes trends for the last 3 (solid red line) years and last 5 (dash red line) years as well as estimates of 1 (thick black mark), 2 (black line with cap), and 3 (red line with cap) standard deviations.

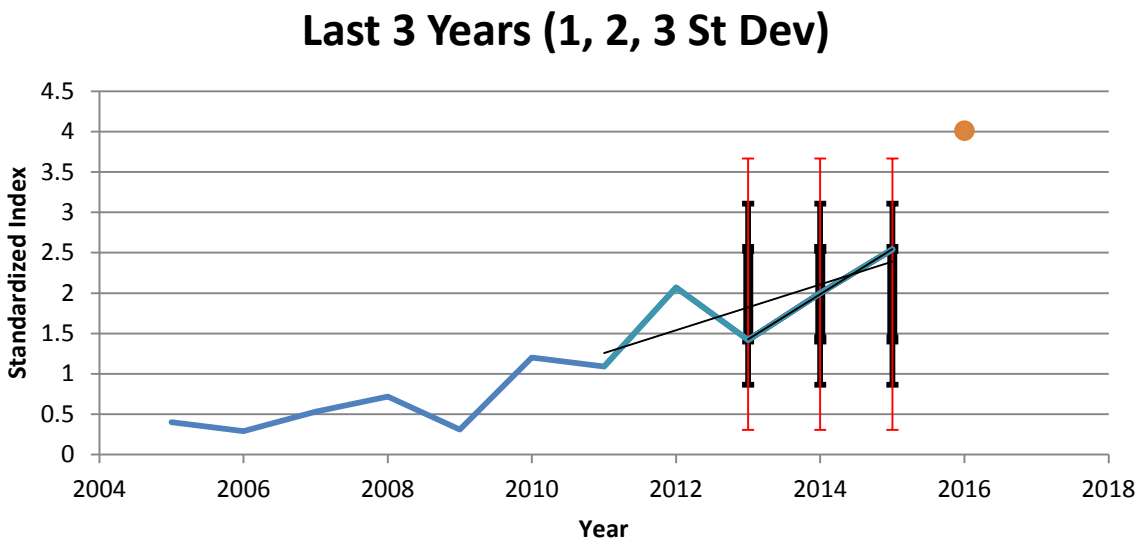

Figure 2. Standardized index from the SERFS chevron trap index of abundance for Red Snapper from 2005 to 2016. The graph includes trends for the last 3 (solid red line) years and last 5 (dash red line) years as well as estimates of 1 (thick black mark), 2 (black line with cap), and 3 (red line with cap) standard deviations and a point estimate for the 2016 index value. The index of abundance is developed using a delta-glm and standardized to a mean of 1 for the entire time series. This method is used in the annual SERFS Trends Report developed by SC DNR.

Options for quota scalar based on Red Snapper landings or total removals:

- Use a 3-year running average of Red Snapper total removals from 2014 to 2016 to develop quota scalar
- Use a 2-year average of Red Snapper total removals from 2014 to 2015 to develop quota scalar and 3-year running average afterward.
- Use a 3-year running average of Red Snapper landings from 2014 to 2016 to determine quota scalar. If season was not open, that year is not included in the average.
- Use latest 3-years with a season and average Red Snapper landings (2012 to 2014) to determine quota scalar.

All of the scalars above use landings or landings plus dead discards (total removals) to develop a scalar. Commercial and headboat landings are tracked through a logbook program with all vessels in the South Atlantic Region selected to report. MRIP is used to collect data from private recreational and charter trips. NMFS has indicated that MRIP catch estimates are unreliable due to uncertainty in the removal estimate for Red Snapper and MRIP is modifying the effort survey with a completion date in late 2018. Therefore a quota for the recreational Red Snapper fishery cannot be based on landings at this time. Instead an effort based quota could be considered.

Red Snapper are a highly sought after recreational species. When the mini-seasons were open in 2012, 2013, and 2014, most Florida private recreational vessels (53 to 89% depending on year and inlet) fishing in the ocean were targeting Red Snapper (Sauls et al. 2017). The percentage of private recreational vessels targeting Red Snapper in other states has not been developed due to limited data. The effort during future mini-seasons is likely to be similar to effort in past mini-seasons. Therefore, the allowable effort in 2014 (8-day season) could be used as a proxy for recreational landings. To be conservative, additional catch controls (e.g. size limit and vessel limit) and best fishing practices (e.g. requirement for descending device or venting tool) could be established for the recreational fisheries to reduce number of fish harvested and improve survivorship of released fish.

Even though headboat captains report landings and discards for every trip, the recreational ACL is not separated into different components to allocate a portion of the Red Snapper landings to the headboat fishery. A specific landings based quota for headboats has not been developed.

Since the commercial sector has a separate Red Snapper ACL than the recreational sector, a Red Snapper landings based quota could be established based on a previous year's ACL. Once the quota is reached for the commercial sector, the commercial fishery would be closed. In 2012, there was a 25-lb trip limit for Red Snapper. In 2013 and 2014, the trip limit was increased to 75-lb.

Table 1. ABC recommendations and ACL based on actions in Amendment 28, landings from 2012 through 2015, and landings plus dead discards from 2012 through 2015.

Year	Landings ABC (Numbers of Fish)	Dead Discards ABC (Numbers of Fish)	Total ABC (Numbers of Fish)	ACL for Landings only (Numbers of Fish)	Landings (Numbers of Fish)	Landings + Dead Discards* (Numbers of Fish)
2012	45,000	41,000	86,000	13,067	16,591	80,516
2013	52,000	44,000	96,000	13,325	11,767	72,881 or 97,563**
2014	59,000	47,000	106,000	31,387	42,510	**205,859**
2015	64,000	50,000	114,000	0	2,850	**276,729**
2016	69,000	52,000	121,000	0		

*Source: NMFS Red Snapper 2016 Season Presentation to SAFMC June 2016,
**One landings estimate through Marine Recreational Fisheries Statistics Survey (MRFSS) and one with landings was estimated from a study conducted by Florida Fish and Wildlife Research Institute (FWRI). The 72,881 from FWRI was accepted as the estimate of landings.

Methods to determine the following year experimental quota if another method is not developed.

The directionality of the trend from the fishery independent survey (chevron trap) and the confidence interval (variation) can be used to adjust the experimental quota for the following. For Red Snapper, the chevron trap index of abundance can be developed prior to the June Council meeting as this index is provided to the Council each year in June. A regression line can be applied to the recent trend (last 3 to 5 years) to determine the directionality of the index. If the population continues to increase, additional harvest may not significantly impact the stock. However, if a negative trend is observed, then harvest should be restricted to prevent overfishing. Because there is variation in the sampling program, slight changes in the index overtime might be indicative of normal sampling error. To prevent changes in the management of red snapper due to sampling error, the confidence interval (based on the 1, 2, or 3 standard deviation the annual index value) can be used to determine how the scale of the change. The greater the standard deviation, the more likely the observed change in the index of abundance is due to variation in the population size. A change to the previous year's quota could be based on meeting both the trend directionality and confidence interval as listed in potential options below.

- Negative trend and outside 99.7% CI of index, decrease the quota from the previous year by 10%
- Negative trend and outside 95% CI of index, decrease the quota from the previous year by 25%
- Negative trend and outside 68% CI of index, decrease the quota from the previous year by 50%
- Positive trend and outside 99.7% CI of index, increase the quota from the previous ? year by 10%
- Positive trend and outside 95% CI of index, increase the quota from the previous? year by 20%
- Positive trend and outside 68% CI of index, increase the quota from the previous? year by 30%

Example based on MARMAP Index for last 3 years

The index for this example uses a running average from 2013 to 2015. Assume the MARMAP index was either 2.75 or 1.25. If the index value was 2.75 with a three year trend, the quota for 2016 would increase by 10%. The increase can be achieved by altering a size limit, increasing fishing days, or increasing catch quota in commercial fishery. If the index value was 1.25 with a three year positive trend, the quota for 2016 would remain at the previous year's quota. However if the trend in the index becomes negative and the index value is 1.25, then the quota would need to be reduced to decrease the probability of overfishing. The quota could be reduced by increasing the size limit, reducing the number of days for the season, or reducing the trip/bag limit.

(Note: When the new index value is included, this could change the direction of the trend line. Should the new value be incorporated into the trend?)