Adaptive index based approaches to develop a temporary ABC 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 23) indicated the SAFMC has taken sufficient steps to address overfishing of Red Snapper, and another (dated 02/15/2017, included in Attachment 23) 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) 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 23).

Different data-poor methods have been used to set ABCs in the past. The SAFMC 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. This tool couldbe used to develop an ABC for Red Snapper. A fishery-independent index, life history parameters, and natural mortality data are already available from SEDAR 41. However, there remains uncertainty in total removals, selectivity, steepness, and ratio of FMSY to natural mortality. The use of the DLMTool Kit would require input from the SSC to parameterize the model and a sub-group of the SSC might be needed to assist in the development of an ABC.

Another option would be to develop an ABC based on the indices of abundance used in SEDAR 41 and total removals or landings. This method would be simple and would not require as much data as the DLMTool Kit methods. An index-based approach to developing an ABC would need to include two components: an index and an ABC scalar to determine sustainable removals. In SEDAR 41, five indices of abundance were considered 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 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. There were two fishery-independent indices analyzed for SEDAR 41: SERFS chevron trap survey and SERFS video index. There is a lack of independence with the two surveys since the video cameras are attached to the chevron traps. Therefore, the SERFS chevron trap and video indices were combined into one index in the final stock assessment. The headboat-observer index and 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).

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. 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, and 2016. MRIP transitioned to Access Point Angler Intercept Survey (APAIS) in 2014 and recreational discards make up a significant amount of the removals for Red Snapper.

Options for the index to determine overfishing:

- 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 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
- Develop an index for red snapper less than 20 inches (TL) from headboat observer data from 2005 to most recent year (outside of mini-seasons) to develop the standard deviation and use last 3 years to determine trend
- Develop an index for red snapper less than 20 inches (TL) from headboat observer data from 2005 to the most recent year (outside of mini-seasons) to develop the standard deviation and use last 5 years to determine trend

Other options or items to consider?

Examples of the headboat-observer program used to develop standard deviation and trend.

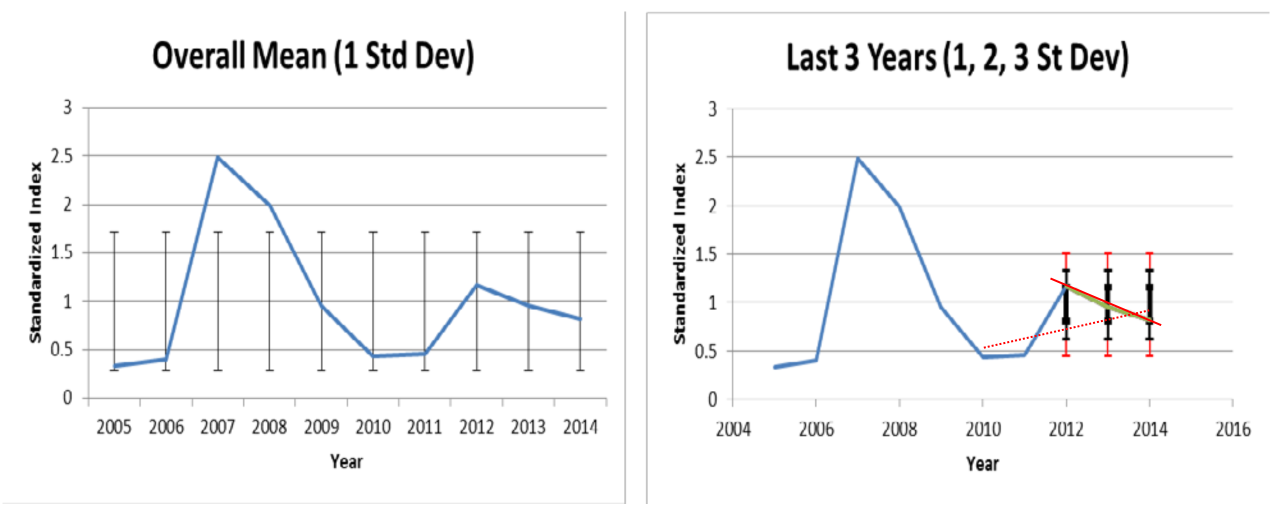

Figure 1. The standardized index from the at-sea headboat observer program with data from 2005 to 2014 used in SEDAR 41. The left graph includes the overall mean and 1 standard deviation from the mean. The right graph includes trends for the last 3 (solid red line sloping downward) years and last 5

(dash red line sloping upward) years as well as estimates of 1 (thick black mark), 2 (black line with cap), and 3 (red line with cap) standard deviations.

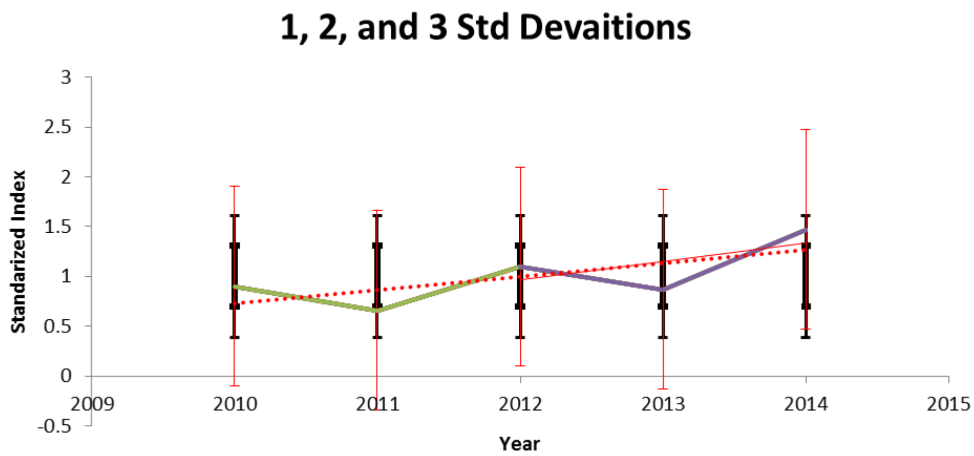

Figure 2. Standardized index from the combined chevron trap and video indices from 2010 to 2014. The graph includes trends for the last 3 (solid red line) years and last 5 (dash red line) years as well as estimates of 1 (thick black mark), 2 (black line with cap), and 3 (red line with cap) standard deviations.

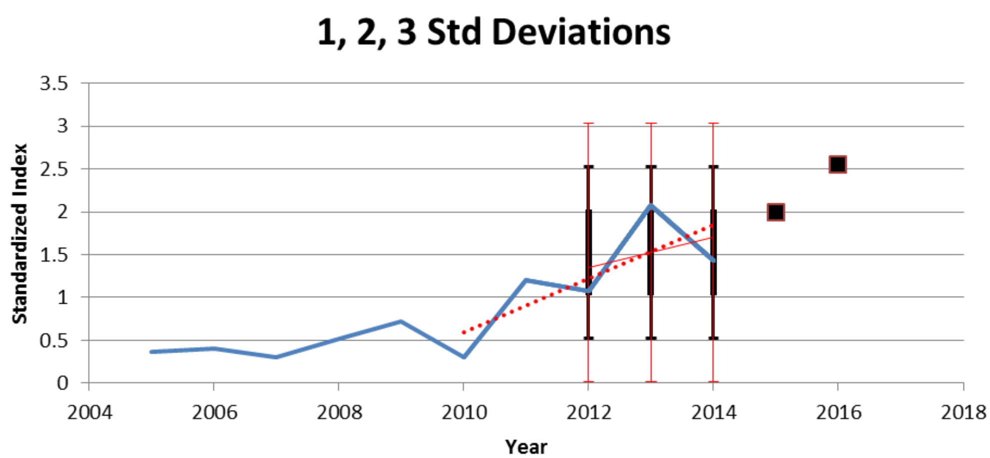

Figure 3. Standardized index from the SERFS chevron trap index from 2005 to 2016. The graph includes trends for the last 3 (solid red line) years and last 5 (dash red line) years as well as estimates of 1 (thick black mark), 2 (black line with cap), and 3 (red line with cap) standard deviations. The 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 ABC scalar:

- Use a 3-year running average of total removals from 2014 to 2016 to develop ABC scalar

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

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 ABC if another method is not developed.

Trend direction and Confidence Interval. Must meet both conditions.

- Negative trend and outside 99.7% CI of index, decrease the ABC from the average catch by 10%
- Negative trend and outside 95% CI of index, decrease the ABC from the average catch by 25%
- Negative trend and outside 68% CI of index, decrease the ABC from the average catch by 50%
- Positive trend and outside 99.7% CI of index, increase the ABC from the average catch by 10%
- Positive trend and outside 95% CI of index, increase the ABC from the average catch by 20%
- Positive trend and outside 68% CI of index, increase the ABC from the average catch by 30%

Example based on the at-sea headboat observer index

The ABC scalar for this example will be a running average from 2012 to 2014. Assume the at-sea headboat index was either 1.5 or 0.9. If the index value was 1.5 with a five year trend, the ABC for 2015 would increase from 119,752 removals to 143,702 removals. If it was 1.5 with a three year trend, the ABC would not change and remain at 119,752 removals. If the index value was 0.6 with a five year trend, the ABC for 2015 would remain at 119,752 removals. If the index value was 0.6 with a three year trend, the ABC would decrease by 25% to 89,819 removals.

(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?)

Another approach could use the trend direction and slope of the index

- Negative trend with slope greater than xx decrease from the previous ABC by xx%
- Negative trend with slope greater than xx decrease from the previous ABC by xx%
- Positive trend with slope greater than xx increase from the previous ABC by xx%
- Positive trend with slope greater than xx increase from the previous ABC by xx%