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May 23, 2016

Mr. Gregg Waugh
Executive Director
South Atlantic Fishery Management Council
4055 Faber Place Drive, Suite 201
North Charleston, SC 29405

Dear Mr. Waugh,

This letter pertains to your May 11, 2016 e-mail requesting additional information on various items pertaining to SEDAR 41 discussed during the SSC meeting. The following are our response to your queries:

Question 1: "During the SSC review of the SEDAR 41 red snapper assessment, it was noted that estimated MSY levels have declined with each subsequent assessment, from 2.3 million pounds with SEDAR 15, 1.8 million pounds with SEDAR 24, and to 763 thousand pounds with SEDAR 41. The SSC was given a supplemental presentation highlighting some potential reasons, such as changes in recreational landings, selectivity, and natural mortality, and informed that further details could be provided for the Council meeting. The MSY changes have considerable implications for the red snapper rebuilding schedule. Therefore, because this information is not documented in the SEDAR assessment, we wish to follow up on the offer to provide further details, and **request that the Center provide a written report addressing the MSY changes and probable causes as presented to the SSC, including the further details referenced such as changes in predicted abundance at age at MSY.**"

Response: When conducting a benchmark assessment, the previous benchmark is one of many considerations for making decisions. In a benchmark, everything is on the table for revision, and it is therefore possible for management quantities to change from one benchmark to another. Many of the changes made in SEDAR41 were attempts to address uncertainties from SEDAR24 or were based on new scientific information.

The rebuilding of Red Snapper is based on the fishing and spawning stock biomass benchmarks. Management quantities on the relative scale (e.g. F_{30}) have changed little between assessments, however quantities on the absolute scale (e.g. MSY or its proxy) have changed because of modifications to input data, selectivity patterns resulting from changes in regulations, and new

scientific information on life-history characteristics such as natural mortality and reproductive capacity.

For removals in the general recreational fleet, SEDAR41 used MRIP/APAIS estimates of recreational catch and discards, rather than those from MRFSS. A new method for calculating historical catch was also used at the recommendation of the Data Workshop Panel (FHWAR census method) that provided much lower estimates of historical catch. The resulting time series of recreational catch and the time series used in SEDAR 24 are shown in Figure 1. The lower historical landings provide a different picture of stock productivity.

A moratorium was put in place in 2010, followed by short mini-seasons in 2012, 2013, and 2014. The resulting change in selectivity can be seen in Figure 2 (top two panels). The weighted selectivities use the most recent time period, and demonstrate the increase in selectivity of the older age classes in both the landings and discards due to the new regulation. All fish are discarded during the moratorium, and there is an incentive to retain the largest fish in the mini-season due to the bag limit. The selectivity changes from SEDAR 24 to SEDAR 41 illustrate that the chosen management regulations will affect the selectivity of the fishery and consequently affect the benchmark calculations and dependent projections. The management decision of whether to allow harvest has a large effect on selectivity, and care should be used when examining projection results to ensure that they include the proper selectivity assumption to match the management regulation.

Figure 2 (bottom left panel) also illustrated the difference between the values used for natural mortality for Red Snapper. A new function published in 2014 (see question 3) was used to estimate the vector of natural mortality at age, and the result is an almost doubling at age 1 and a ~50% increase for other ages.

MSY is calculated using the most recent selectivities, which in this case select older fish for both the fishery landings and discards. The equilibrium recruitment estimated is about 23% less than what was estimated for SEDAR 24 and then the natural mortality is double for age-1 fish. Those two factors combined with the differences in selectivity and a sharp decrease in the historical removals explain the difference in the MSY proxy estimated by the model.

Changes in the scientific knowledge about reproduction seemed to have little effect on the relative inputs to the model (Figure 2, bottom right panel). The figure shows each measure of reproduction (eggs for SEDAR 41 and mature female gonad weight for SEDAR 24) scaled to their maximum value. SEDAR 41 used age-specific number of batches rather than a constant number of batches, age-specific batch fecundity, and an updated maturity curve. Though each of the updates differed from what was used in SEDAR 24, the relative reproductive output is very similar in both assessments

Question 2: "There was considerable discussion at the SSC and Review Workshop regarding catch estimates and age samples collected by FWRI during the brief open seasons during 2012-2014 (i.e., mini-season), and Council members are interested in clearly understanding how such information was used in the assessment. **Please provide a description of where and how the "mini-season" and FWRI age samples were used in the assessment.**"

Response: The Red Snapper assessment benefited greatly from the FWRI studies and sampling effort. Here is an outline of the FWRI studies and monitoring programs as well as when and how catch estimates and age samples were used in the assessment:

1. The fishery-dependent monitoring during the mini-seasons (2012-2014):
   These data were used to inform landings, discards, and size and age compositions of the recreational fleets. MRIP sampling is not designed to capture small pulses of fishing as is the case during a mini-season, and the FWRI sampling served as a supplement during the waves in which mini-seasons occurred. The size and age compositions of the fleet were particularly important. To avoid bias, only samples that came from trips that were randomly sampled were included in the length or age compositions. Composition data are used in the model at the trip level, rather than as individual fish sampled.
2. The fishery-dependent tagging effort from 2011 to 2013:
   These data were used to inform the population growth curve, but were not used to inform compositions of the recreational fleets. The tagging was done opportunistically, and therefore would not be indicative of the distribution of sizes of fish taken by the fleet.
3. The fishery-independent hook and line study:
   These data were used to inform decisions about selectivity (e.g. what sizes and ages of fish were caught in which gear and at what depth). The compositions were not used, as no index was developed. Rather, this was a pilot study used to determine whether a hook and line index would be useful for indexing snapper. If the survey were instituted in the future, and an index developed, the composition data would be used to characterize the survey.
4. The fishery-independent tagging effort from 2012 and 2013.
   The FWRI fishery-independent sampling program was designed to aid fishery managers in better understanding patterns of distribution, seasonal and spatial dynamics of movement patterns, ontogenetic changes in habitat choice, and site fidelity of Red Snapper based on recapture rates throughout the study area. Again, these data were used to inform the population growth curve. However, this was an independent tagging effort, so any length or age samples gathered did not reflect the compositions of a fleet or survey. These data were also used to inform the decisions about discard mortality.

Question 3: "One of the major changes in the SEDAR 41 red snapper assessment is the estimation of natural mortality, related to a newly published approach by Then et al. **We would like to know if this method been used to estimate natural mortality in other SEFSC assessments?**"

Response: In benchmark stock assessments, all new data and scientific information is brought forth and evaluated. In SEDAR 41 this included a new study on natural mortality by Then et al. (2014). SEDAR 41 is the first assessment from the SEFSC to use the Then et al. function for calculating natural mortality. During the course of SEDAR 24, there were many requests to re-evaluate the value of natural mortality used in the assessment. The literature review and resultant equation in the Then et al. paper was deemed the best available science for calculating natural mortality by the assessment and review panels.

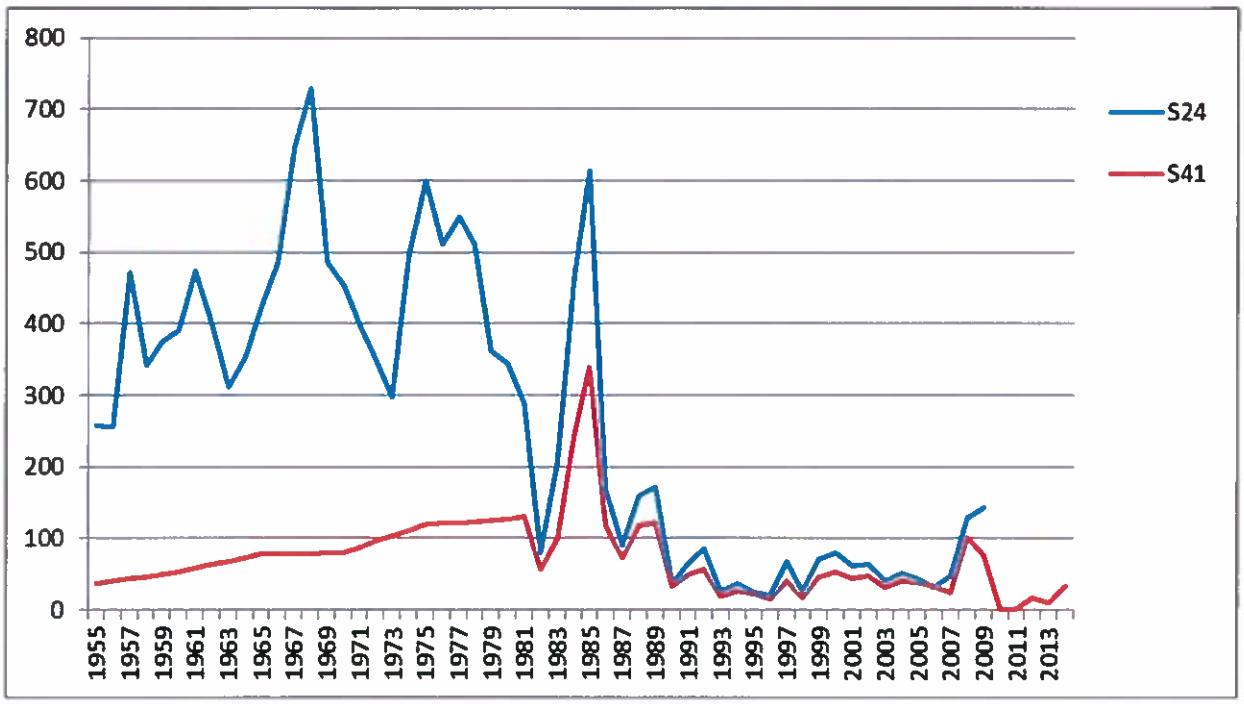

Figure 1. General recreational catch in 1000s of fish by year used for the SEDAR 24 and SEDAR 41 benchmark assessments.

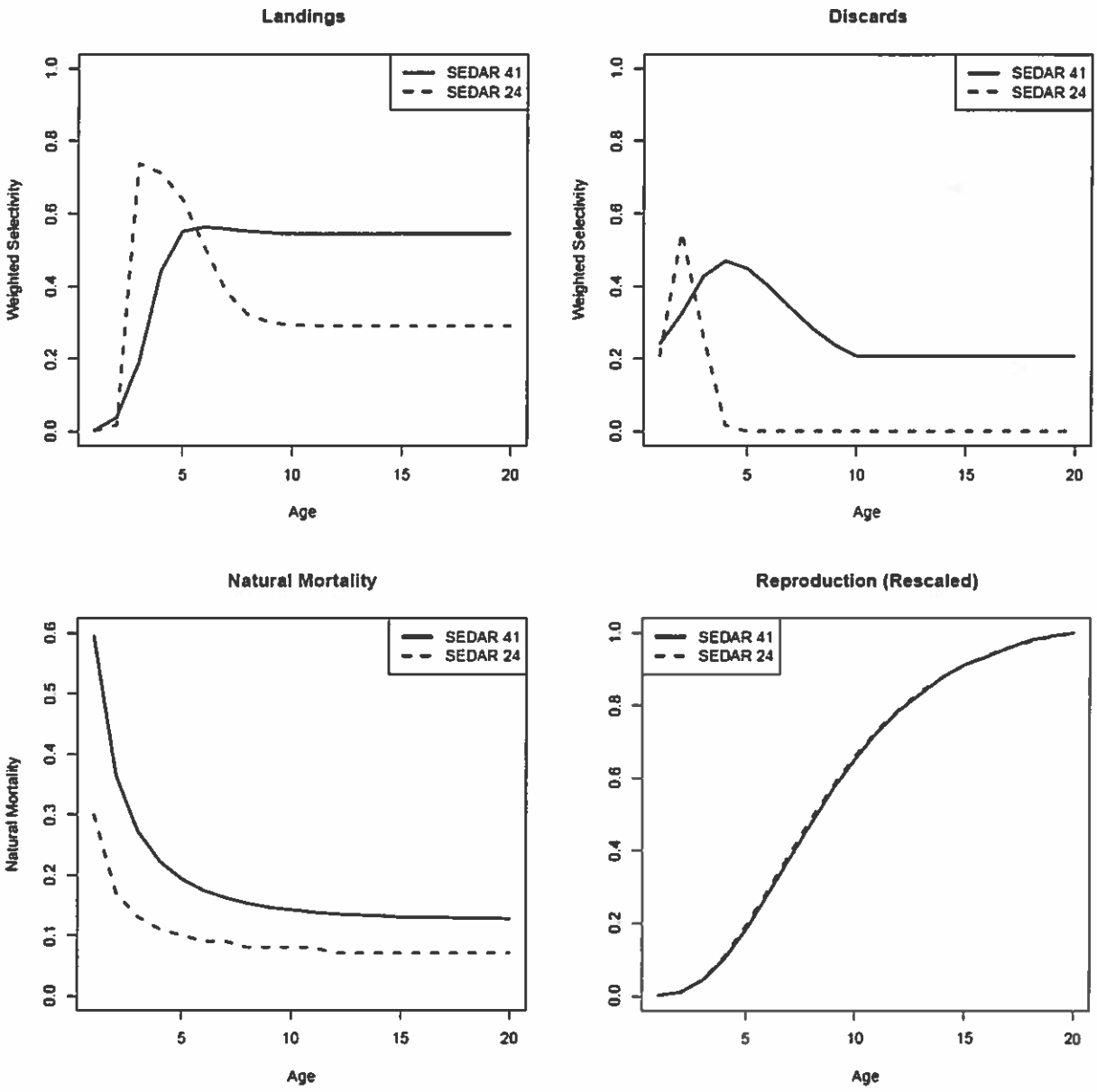

Figure 2. The top left panel shows the difference in the weighted selectivity of the landings; the top right panel shows the weighted selectivity of the discards; the bottom left panel shows the natural mortality; and the bottom right shows the rescaled reproduction used in SEDAR 41 and SEDAR 24.

Please contact Dr. Erik Williams at erik.williams@noaa.gov if you have any questions.

Sincerely,

Bonnie Ponwith, Ph.D.
Science Director

cc:

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