Gulf Fishery Management Council
Standing Scientific and Statistical Committees

Stock Assessment Review: SEDAR 88
Gulf Red Grouper
February 26 – 27, 2025
Council Office
Tampa, Florida

Review of SEDAR 88 Stock Assessment of Gulf Red Grouper

Fishermen Feedback

Council staff presented the results of the Fishermen Feedback tool for red grouper which was made available from April 24-May 24, 2024, and received 344 unique responses. Overall, comments were neutral in nature; however, there were several positive comments reported from peninsular Florida and south Texas. Regarding stock condition, a majority of positive responses indicated that fishermen were seeing high abundances of red grouper along their areas of distribution. For general themes, respondents were pleased to see high numbers of fish but indicated those fish were usually undersized, and similar to other iterations of the tool, indicated that sharks were a frequently encountered problem when fishing.

An SSC member asked if social media comments were going to be used in the future to inform the tool. Council staff replied that those commenting on social media likely do not expect their comments to be used for any type of analysis, and that the tool provides guidance so that users are fully aware of the use of their comments. Another SSC member noted that most of the negative or neutral comments were from areas where red grouper do not typically occur. An SSC member asked if comments are representative of homeport or area fished. Council staff responded that the tool requests fishermen indicate the areas they are fishing.

Dr. Francesca Forrestal (Southeast Fisheries Science Center [SEFSC]) presented SEDAR 88, which is a stock assessment of Gulf red grouper. This stock assessment uses Florida's State Reef Fish Survey (SRFS) in place of the Marine Recreational Information Program Fishing Effort Survey (MRIP-FES) data for recreational private vessel landings. SRFS was considered appropriate for inclusion in this assessment since the vast majority (>95%) of red grouper are landed off Florida, and while estimating a lower level of landings, SRFS demonstrates improved precision compared to MRIP-FES for red grouper. The SSC provided feedback to the SEFSC regarding SEDAR 88 at its December 4, 2024, webinar meeting.

Updates on Data Inputs

Several data updates from SEDAR 61 were performed in constructing the SEDAR 88 model. Current best modeling practices, incorporation of the SEDAR 88 Terms of Reference, and inclusion of red tide as a bycatch fleet were some of the updates reported. Specifically, updates to SEDAR 88 included "other landings" for the commercial handline fleet, the use of SRFS for recreational landings and discards (there is no shore mode for red grouper), the use of age-based data to inform landings with length-based estimates for discards, updating appropriate indices from

SEDAR 61 (commercial landings and Southeast Region Headboat Survey [SRHS] remained truncated), and the use of the combined video survey (G-FISHER). For life history data inputs, several notable metrics were changed from SEDAR 61. Fecundity was estimated as spawning stock biomass (SSB) in relative number of eggs such that per capita fecundity was calculated as the product of the proportion of females, the proportion of mature fish, and batch fecundity-at-age.

Updates to Model Specifications

The estimate for natural mortality (M) was updated using Hamel and Cope 2022[1] and increased (from 0.14 to 0.186) based on the maximum age of 29 years. The modification of M to the model used in SEDAR 88 resulted in an overall increase in spawning output, fraction of the unfished population estimate, and age-0 recruits relative to SEDAR 61. An SSC member asked if the change in M represented a substantial change from the previous model and SEFSC staff indicated that was a correct interpretation. Virgin recruitment (R_0), recruitment variability, and steepness were estimated within the model. As a result, the steepness used in SEDAR 88 was calculated as 0.66 whereas a fixed value of 0.99 was used in SEDAR 61.

The model was updated to use age-based selectivity rather than a length-based. Additionally, the NMFS bottom longline survey selectivity was modeled as a logistic function rather than a dome-shaped relationship, indicating full selectivity of older fish. This selectivity has been updated for other grouper species in recent assessments including, gag, yellowmouth grouper, and scamp. Red tide was included in the model as a bycatch fleet. Based on recommendations from the red tide topical working group, an empirical selectivity-at-age method was used. This allowed for spatially explicit and age-specific application of removals from the stock depending on the area and severity of observed red tide events. Broadly, the model was able to account for the spatial extent of red tide and overlay that with the documented distribution of red grouper, which exhibits ontogenetic shifts in habitat, to create an age-based selectivity measure.

Results

A bridging analysis was done to systematically incorporate the data changes in the model. The new model had improved predictive results for landings by the directed fleets. Fits to discard data were appropriate except for two years in the commercial trap fleet, and length-based fits in the longline fleet for younger fish. Model performance was improved by using the mean weight-at-age approach and modeled outputs were within confidence intervals for fishery-dependent and fishery-independent indices. Length composition fits were improved in SEDAR 88; however, the model appeared to underestimate the influence of strong cohorts moving through time. Recruitment, virgin recruitment (R_0), steepness, and recruitment variability were estimated well. Red tide was modeled for each year of observation (2005, 2014, 2018, 2021) and the model had high uncertainty in considering the influence of red tide on the stock in 2018 and 2021 as the time series approached the terminal year of 2022.

Diagnostics

A jitter analysis did not result in a lower negative log-likelihood (LL) than the base model. Recruitment diagnostics did result in a lower LL, which indicated a possible range of 0.55-0.80 for steepness. Contour likelihood analyses indicated that the point estimates from the model were

[1] https://www.sciencedirect.com/science/article/abs/pii/S0165783622002545

appropriate for steepness and recruitment variability and estimated max length (L_{inf}) and growth rate. Retrospective analyses resulted in acceptable ranges for SSB but not for recruitment and fishing mortality. The SEFSC hypothesized this was due to the inclusion of the red tide bycatch fleet in discrete years such that the model had difficulty adjusting when a red tide year was removed from the analysis.

Sensitivity Runs

Sensitivity runs looking at fixing steepness at 0.99 resulted in a higher fraction of the proportion of the stock unfished outside of the base model confidence intervals. Sensitivity runs indicated that increasing the maximum age to 29 in SEDAR 88 had an effect on the model outputs such as spawning output and fraction of the unfished stock, relative to SEDAR 61. Jack-knife analysis determined that G-FISHER was the most influential index and exhibited a strong effect on timeseries trends. Since G-FISHER has expanded its survey area in recent years, an SSC member asked if effort had been made to adjust the selectivity of the survey to capture that change, as has been done for other species like mutton snapper. SEFSC staff replied they had not received any indication from the data providers that an adjustment was need for red grouper.

Review of SEDAR 88 Stock Assessment of Gulf Red Grouper – Projections

Projection analyses used an average value from 2020-2022 to estimate selectivity and retention, and recruitment used the model estimated Beverton-Holt stock-recruitment relationship which was held constant in the projections. The sector allocation ratio was set to the current allocation (59.3% commercial and 40.7% recreational). SEFSC staff provided three benchmarks for SSC consideration: Overfishing Limit (OFL) as the yield at $F_{30\%SPR}$, $F_{40\%SPR}$, or estimated fishing mortality at maximum sustainable yield (F_{MSY}, estimated at $F_{46.6\%SPR}$) and Acceptable Biological Catch (ABC) values that would be set at 75% of the presented possible OFL scenarios. Each projection configuration resulted in a determination that the stock was not overfished nor experiencing overfishing. However, historical stock status determination varied with each presented scenario. For example, Kobe plot results indicated that the stock only experienced overfishing in one year under the $F_{30\%SPR}$ and fluctuated more in the other two scenarios.

Council staff asked about any effect from modifying sector allocations in the projections. It is likely, given the data input change from MRIP-FES to SRFS, that the Council will be interested in exploring changes in allocation when setting the new catch levels. SEFSC staff replied, that while stock status would not be expected to change, OFL and ABC values would be marginally different. Council staff cautioned against using a projection methodology that would require SEFSC staff to run several iterations of the projections to inform all the possible allocation scenarios the Council may possibly explore. Dr. Tom Frazer (Council representative) encouraged the SEFSC to communicate the workload required to make minor adjustments to the projection analyses and Council staff stated they would work with SEFSC to avoid this issue.

Several SSC members acknowledged that the stock appeared to be resilient to discrete high mortality as a result of red tide and inquired if that observation was supported empirically. SEFSC staff replied that recruitment pulses are routinely observed following red tide for red grouper. Council staff added that fishermen observations corroborate estimated recruitment pulses following red tide years, as do the age and length compositions in which the cohorts can be

observed moving through the population with time. An SSC member asked if the change in the natural mortality estimate was primarily responsible for the pronounced shift in the status determination criteria. SEFSC staff stated that attributing the overall stock status to one singular model input would be inappropriate. In addition to the modification of M, the relationship of the selectivity function in the handline fleet was updated, and the inclusion of red tide effects are also influencing the model.

For stock projections, future red tide events can be simulated using mean mortality levels observed from past observations. SEFSC staff presented how red tide events with varying severity would affect yield projections. An SSC member noted that the yields projected under $F_{30\%SPR}$ have not been observed, even under more liberal retention limits. The SEFSC agreed and noted that as the impetus for exploring other MSY values.

> **Motion: The SSC finds the SEDAR 88 stock assessment for Gulf red grouper to be consistent with the best scientific information available, and appropriate for management advice.**
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> *Motion carried without opposition*.

The SSC discussed catch advice recommendations and focused on whether the proposed increases in certain scenarios would be sustainable long-term, with focus on the life history characterization of red grouper. Several SSC members expressed concern that the model may be overcompensating for some model adjustment or combination of inputs while others considered that output as a realized reflection of stock resilience to episodic mortality. Another SSC member recalled the SSC's past history of using $F_{40\%SPR}$ for hermaphroditic groupers, like gag, scamp and yellowmouth grouper, and yellowedge grouper. Given that history of decision-making, the SSC member thought using $F_{40\%SPR}$ as the proxy for F_{MSY} was appropriate.

Dr. Frazer recalled the landings history and the Council's goal of ensuring stability in the fishery to the extent to which that was possible. An SSC member thought that adding precaution at the OFL, equivalent to the F_{MSY} proxy, was inappropriate, since the OFL is supposed to be risk neutral. Further, they added that the SSC can reduce the ABC by the amount necessary to account for scientific uncertainty. The SSC acknowledged that red grouper exhibits a variety of biological considerations that need to be accounted for when recommending catch advice. For example, it undergoes ontogenetic spatial shifts from nearshore shallow habitats to offshore deep-water habitats; large females transition to male based on environmental and social cues that are not completely understood; and its propensity to create unique habitats in the benthic substrate and territorial behavior may generate a carrying capacity issue that limits available space for other red grouper. It is also unclear if this density-dependent compensatory recruitment response is released during red tide events, which may explain the stock's overall resilience to these episodic mortality events. Ultimately, the SSC determined that accounting for the complex life history of red grouper was most imperative when recommending the OFL.

> **Motion: The SSC sets the OFL at $F_{40\%SPR}$ for Gulf red grouper based on the SEDAR 88 base model projections and a constant catch scenario for the fishing years 2027 – 2029 at 11.28 million pounds gutted weight (mp gw).**

Motion carried with one opposed and one abstention.

The SSC discussed the proposed catch limits in SRFS units in the context of their values in MRIP-FES, had that data unit been used. Council staff replied that the current catch limits would be expected to be considerably higher were they in MRIP-FES units.

Motion: The SSC sets the ABC at 75% of $F_{40\%SPR}$ for Gulf red grouper based on the SEDAR 88 base model projections and a constant catch scenario for the fishing years 2027 – 2029 at 8.78 mp gw.

Motion carried with two opposed.

SSC members discussed reviewing a representative index of abundance periodically for red grouper to check on the stock's health. SEFSC staff added that they would be keeping an eye on red grouper given the breadth of their investigations under SEDAR 88. The SSC lauded the SEFSC's work on the SEDAR 88 stock assessment.

Meeting Participants

Standing SSC
Jason Adriance
Mike Allen (*Chair*)
Luiz Barbieri
Harry Blanchet
Dave Chagaris
David Griffith
Tiffany Hopper
Jack Isaacs
John Mareska
Paul Mickle
Trevor Moncrief
Ralph Townsend
James Nance (*Vice Chair*)
William Patterson
Dan Petrolia
Sean Powers
Andrew Ropicki
Steve Saul

Council Representative
Tom Frazer