

Gulf of Mexico Fishery Management Council
Scientific and Statistical Committee
Review of SEDAR 61: Gulf Red Grouper
September 17-18, 2019
Tampa, Florida

Dr. Skyler Sagarese provided an overview presentation of the Gulf of Mexico Red Grouper Stock Assessment SEDAR 61 including data, continuity model, base model, diagnostics, and sensitivity runs.

Data Review

For SEDAR 61, many data inputs were similar to those used in SEDAR 42. However, the previous red grouper stock assessment (SEDAR 42) model for red grouper had difficulty fitting the magnitude and length composition of commercial discards. One resolution was to change the start date of the model from 1986 to 1993, when the data were more robust and the discard data were more consistent. After the SEDAR 42 review, the 1993 start date was considered inappropriate, since it did not provide a suitable amount of contrast between past and present data. Bootstrapping indicated that substantial uncertainty existed around initial estimates of stock size, productivity, and recruitment. Age and growth data were updated to produce a new growth curve. Fecundity was measured as batch fecundity in SEDAR 42 (proportion female * proportion sexually mature * batch fecundity per individual), while fecundity in SEDAR 61 was estimated as female spawning stock biomass measured as a relative number of eggs. Batch fecundity was input as a function of length-at-age using the updated growth curve. Commercial landings data were similar to those used in SEDAR 42, with data from 2010 – 2017 taken from the red grouper individual fishing quota (IFQ) database as opposed to the Accumulated Landings System. Commercial discards have been modified to use the “number of sets” for the commercial longline fleet, and “fishing days” for the commercial vertical line fleet. Estimated landings from the catch-per-unit-effort catch expansion closely follow logbook-reported landings, and are much lower than those reported and used in SEDAR 42. Recreational landings in SEDAR 61 used the fully-calibrated MRIP time series incorporating the Access Point Angler Intercept Survey (APAIS) and Fishing Effort Survey (FES) adjustments, with the recreational fleets again being combined as a single index. Private vessel landings were most influenced by the changes in MRIP (much larger compared to SEDAR 42), followed by the charter fleet. Recreational discards are self-reported, with charter and private vessel discards estimated to be higher in the new MRIP calibrated data than those data used in SEDAR 42.

Indices of abundance show declines in more recent years, which corresponds with observations from landings data for the same years. The fishery-independent regional video surveys were combined and modified to gain a better understanding of the stock over a greater spatial domain. Age composition data were available for each fleet, with strong year-classes observable in the data at corresponding fleet selectivities. These age data were used as a complete dataset with sample weighting conducted to reweight the age composition data. Length composition data for commercial discards correspond to the minimum size limits, with the regulatory change in 2010 to

18 inches from 20 inches total length. A new fishery-independent index from the Florida Fish and Wildlife Research Institute (FWRI) called the Repetitive Time Drop Survey (a vertical line survey) was also incorporated into the model.

Red tide is modeled within SEDAR 61, and can account for a substantial amount of episodic mortality in a given year. Combined video survey data show a decrease in abundance in 2014, with a progressive recovery evident by 2017. An ecosystem analysis of red tide mortality showed the total mortality from the perspective of both total biomass and age stanza. The 2005 red tide was predicted to be a much greater source of episodic mortality for both total biomass and age stanza (age-0, age-1 to age-3, and age 4+) than the 2014 red tide. Red tide associated mortality was inversely related to age.

The outlier observed in the 1990 recreational landings data was noted to not be due to the institution of the minimum size limit. Outliers in general are being considered in greater detail by the MRIP calibration team. For commercial discards, data post-IFQ have been difficult to use to create catch-per-unit-effort (CPUE) indices for the commercial fleets. Currently, commercial observer program data are used to estimate discards; further, indices of abundance may be able to be generated from those same data.

SEDAR 61 Continuity Model (SEDAR 61C)

This continuity model mimics the model developed for SEDAR 42. Some methodological improvements have been made for several datasets, making some previously used approaches statistically unsupported. The differences between the SEDAR 42 and SEDAR 61 are largely explained by the newly calibrated MRIP data (with APAIS and FES adjustments). Changing the start date from 1986 to 1993 in the SEDAR 42 model resulted in an increase in the projected OFL.

SEDAR 61 Base Model (SEDAR 61B)

The SEDAR 61B base model time series began in 1986 with 2017 as the terminal year. The square root of the sample size for composition data was used to iteratively reweight effective sample sizes for those composition datasets. Steepness was fixed at 0.99 and red tide was modeled only in years when red tide was reported (i.e., 2005 and 2014). Length-based selectivity was modeled by fishing fleets and fishery-independent surveys. Age composition data go back to 1991.

The SEDAR 61B model fits the landings data similarly, if not better in some cases, than the SEADR 42 model. Fits to the commercial discard data are much improved. Fits to the recreational discards are also better; however, with the use of the new MRIP data, the magnitude of the recreational discards has increased considerably. Declines are seen in the recreational indices in recent years, with similar fits for overlapping years between SEDAR 61B and SEDAR 42. Fits to fishery-independent indices also show low abundance in recent years, with similar fits for overlapping years between the models. Fits to length composition data are much improved in SEDAR 61B than SEDAR 42. Fits to age composition data are fairly similar in SEDAR 61B compared to SEDAR 42, indicating that the gains in the fits to the length composition data did not result in a substantial tradeoff in model fit between composition data types.

SEDAR 61B is estimating a lower total biomass and a lower estimate of spawning stock biomass than SEDAR 42. Declines in 2005 and 2014 are attributed to red tide episodic mortality. Strong recruitment events were observed in 1995, 1998, 2001, 2005, and 2013. Recruitment remains highly variable for red grouper. Coefficients of variance (CVs) for the recent recruitment data are more uncertain in SEDAR 61B compared to SEDAR 42. A function of using Stock Synthesis requires that recruitment deviations sum to zero, meaning that the CVs for the years of recruitment data must balance out to zero. Total fishing mortality follows a generally similar trend, with spikes in 2005 and 2014 resulting from for red tide which is treated as “fishing” fleet in the model. Except for red tide years, the commercial bottom longline fleet remains the dominant source of fleet-specific fishing mortality; however, the recalibrated MRIP data (APAIS/FES) show the recreational fleets removing a comparable amount of biomass comprised mostly of younger individuals.

Model Diagnostics and Sensitivities

Model diagnostics tested model performance against variations in data and parameterization. The jitter analysis varies model parameters by 10% above and below each parameter estimate, and yielded consistent results which indicated a stable model. Bootstrapping runs showed consistency in most respects, except for recruitment in the terminal year (2017) which is expected. Also, initial estimates of fishing mortality showed variability outside the upper and lower quartiles, which may be an artifact of a 1986 start date, as opposed to some point further in the past (pre-1986). Retrospective analyses did not reveal any systematic retrospective patterns by removing consecutive years of data from the terminal year back. Model sensitivity was checked by removing a single index at a time. The model showed stability regardless of the index removed. Likelihood profiling indicated an ability of the model to estimate some parameters. Data weighting may be informing the model to more strongly consider the recreational data than in SEDAR 42; however, the CVs around the index weighting are larger for the commercial data, which is contrary to the assumption that commercial landings data known with a greater degree of precision than the recreational data.

Many sensitivity runs were done for both satisfying the terms of reference and potential review questions. Red tide analyses showed that 2015 was not distinguishable from 2014 as a separate episodic mortality event. A “leave one out” sensitivity analysis, and the total removal of fishery-dependent indices, indicated little permutation in model output suggesting model resiliency. Sensitivity runs estimated steepness at approximately 0.73; however, steepness was fixed at 0.99 indicating, there was not a strong stock-recruitment relationship.

Stock Status and Projections

Based on SEDAR 61B, as of the end of 2017, Gulf red grouper is not overfished ($SSB_{2017}/MSST$ [minimum stock size threshold] = 1.64; $MSST = 0.5 * B_{MSY}$) and is not undergoing overfishing ($F_{Current (2015-2017)}/MFMT$ [maximum fishing mortality threshold] = 0.784; $MFMT = F_{30\%SPR}$). However, this determination does not account for the 2018 red tide episodic mortality event, which was known to be a significant mortality event in the eastern Gulf.

A time period of 2010 – 2017 was used for mean recruitment, selectivity, retention, and discard mortality when creating yield projections. Catch allocations are set at 76% commercial and 24% recreational. Final landings estimates from 2018, and the revised annual catch limit (ACL) for 2019, are included and assumed to be harvested. Projections use the FES-adjusted MRIP recreational calibrated landings data.

Without including a red tide event in 2018, and assuming a start year of 2020, fishing at $F_{30\%SPR}$ would result in an initial increase (spike) in allowable catch above 8 million pounds (mp) gutted weight (gw). This spike in 2020 is being informed by low estimates of apical fishing mortality, meaning the model is assuming too few red grouper are being removed compared to the predicted available biomass. This is due to the 2005 and 2013 cohorts moving through the fisheries as age-7 and age-15 fish. Caution was expressed for not considering the 2018 red tide event, given the recent trends in catch for the recreational and commercial fleets, and the observations of abundance from fishery-independent indices in recent years following the 2014 red tide event. If an event in 2018 was similar in magnitude to the red tide events in 2014, or 2005, then some substantial decrease in biomass should be expected. Further caution was expressed about relying on the SEAMAP seasonal groundfish surveys as the only index of recruitment without a corroborating index.

The Council's "Something's Fishy" data collection tool identified general trends in abundance and stock health as reported by recreational and commercial anglers. These anglers generally noted decreases in the number of larger red grouper, but also reported a large preponderance of smaller fish appearing in recent catches. Further, a separate study in southwestern Florida queried anglers about the severity of the 2018 red tide event compared to the 2005 and 2014 events. Generally, these anglers determined that the 2018 red tide event was "devastating", too many samples coming from the same portion of the area surveyed (reporting bias). However, this perception could be a function of recall bias as an ecosystem analysis estimated that red grouper mortality was higher during the 2014 event.

Catch Recommendations

The SSC noted that under the old definition of $MSST (1-M * B_{MSY})$, red grouper would be considered overfished as of 2017 ($SSB_{2017}/MSST_{OLD} = 0.96$). However, the stock has decreased to almost 50% of B_{MSY} in the past; therefore, the new definition of $MSST (0.5 * B_{MSY})$ may be appropriate for this stock. The SSC acknowledged that there appear to be unknown factors which could be driving stock biomass down beyond just red tide. Future assessments should consider spawning stock biomass using both sexes combined, further evaluation of red tide episodic mortality, and other improvements and considerations already noted by the analytical team.

Motion: The SSC agrees with the SEDAR 61 assessment that overfishing is not occurring for Gulf red grouper as of 2017.

Motion carried without opposition.

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Motion carried without opposition.

The SSC recommended that the decision table from the assessment presentation (Table 1) be conveyed to the Council to illustrate the probabilistic risk of a given catch level, given an assumption about the severity of the 2018 red tide.

Table 1. Catch limits and their corresponding probabilities of resulting in overfishing, given certain assumptions about the severity of the 2018 red tide event relative to past red tide events, and using a P* of 0.427 from the ABC Control Rule. Catch is in gutted weight. These data incorporate Fishing Effort Survey-adjusted recreational MRIP data.

Scenario	2020-2024 Mean Catch (Pounds)	No 2018 Red Tide	Half 2014	2014	2005	Double 2005
Equilibrium yield at F_{MSY} proxy ($F_{SPR30\%}$)	7,643,329	0.50	0.82	0.98	1.00	1.00
F at Optimum Yield ($F_{OY} = 75\% F_{SPR30\%}$)	6,423,319	0.15	0.40	0.74	0.90	1.00
Landings fixed at 2017 target	4,305,711	0.00	0.01	0.05	0.11	0.83

Data from FWRI’s red tide monitoring program indicated that the spatial extent, intensity, and duration of the 2018 red tide was similar in scale to the 2005 red tide event. The SSC agreed that due consideration of the effects of the 2018 red tide event was necessary. One proposal was to consider the slope of a line from the assumed 2019 landings to a point when the equilibrium yield is achieved. The SSC could then select a certain number of years of catch projections to recommend to the Council. The SSC also agreed that annual interim analyses would be necessary to monitor the stock.

The SEFSC produced additional analyses reflecting an assumption of the 2018 red tide event being equivalent to the 2005 event, based on the information from FWRI’s red tide monitoring unit. These analyses are shown in Table 2, and are based on the current sector allocations of 76% commercial and 24% recreational.

Table 2. Update to the projections decision table for SEDAR 61 using the proposed OFL and ABC for the 2005 red tide scenario. Catch is in gutted weight. These data incorporate Fishing Effort Survey-adjusted recreational MRIP data.

Catch (Lbs)	No 2018 Red Tide	Half 2014	2014	2005	Double 2005
5,348,324	0.025	0.100	0.299	0.500	0.997
5,190,960	0.018	0.075	0.242	0.427	0.993
5,130,000	0.016	0.067	0.222	0.399	0.990
4,900,000	0.009	0.043	0.155	0.300	0.975

Modifying the treatment of recruitment deviations in the projections was also offered as a way to smooth the characteristic spike in the projected yields. Doing so assumes no recruitment deviations from the mean, and yields less pronounced increases from 2019 to 2020 and beyond. The revised yields still increase over time to the equilibrium yield.

The SSC discussed the difference between using the lowest yield for a five-year projection period (2020 – 2024) versus the mean of the annual yields for the same period. The SSC thought that using the average of the annual yields would better encompass uncertainty in the projections, and provide more stability for the proffered time period, than using the lowest annual yield. The SSC noted that their OFL and ABC advice is based on the data and projections from the SEDAR 61 stock assessment; however, the Council should consider input from the fishermen and trends in landings when determining at what level to set the ACL. The SSC added that red grouper is not considered overfished under the new definition of MSST; under the old definition, red grouper would be considered overfished as of 2017. Given these factors, the SSC determined that red grouper constituted a special circumstance, since the SEDAR 61 assessment did not appear to be capturing the decline in abundance observed by the fisheries.

Motion: The SSC moves that for Gulf of Mexico Red Grouper, the OFL is 5.35 million pounds gutted weight. The OFL is based on the average yield from projections in SEDAR 61 using the current sector allocations (76% Comm / 24% Rec) and assuming the impact of the 2018 red tide is approximately the same as the 2005 red tide on the red grouper stock.

Motion carried 15-6.

The SSC asked if it was possible to back-calculate from FES-adjusted MRIP catch recommendations to APAIS-only adjusted MRIP catch recommendations. The SEFSC indicated it was possible; however, a method for doing so has not yet been developed and vetted. In making a recommendation for ABC, the SSC indicated an inclination to decrease the P* value to 0.3 to account for the decline in landings and abundance in the stock. Using the status quo P* value of 0.427 may actually be a higher risk than calculated by the current ABC Control Rule, as there is no metric to incorporate known unknowns.

Motion: The SSC moves for Gulf of Mexico Red Grouper to have an ABC of 4.9 million pounds gutted weight.

Motion carried 15-5 with 1 absent and 1 abstention.