Standing, Reef Fish, Ecosystem, and Socioeconomic SSC
Review of SEDAR 72: Gulf of Mexico Gag Operational Assessment
September 27 – 30, 2021

The hybrid meeting of the Gulf of Mexico (Gulf) Fishery Management Council's (Council) Standing, Reef Fish, Ecosystem, and Socioeconomic Scientific and Statistical Committees (SSC) was convened at 8:30 AM EDT on September 27, 2021.

Review of SEDAR 72: Gulf of Mexico Gag Stock Assessment Report

Dr. Lisa Ailloud (SEFSC) presented the data inputs, model, results, and projections from the SEDAR 72 operational assessment of Gulf gag grouper. Gag, a protogynous hermaphroditic species, was last assessed in the Gulf in SEDAR 33 Update (2016; SEDAR 33U[1]) using female-only spawning stock biomass, and was determined to be sustainably managed at that time.

Several data inputs used in SEDAR 33U were modified in SEDAR 72. Most notably was the change in the recreational catch and effort data to the Marine Recreational Information Program's Fishing Effort Survey (MRIP-FES) from the previous MRIP Coastal Household Telephone Survey (CHTS). Gag is vulnerable to episodic red tide events, and SEDAR 72 accounted for observations of these disturbances directly within the model. Lastly, improvements were made to improve retention and the recreational fleets' selectivities, and better quantify commercial discards by differentiating between black grouper and gag. Updated information on the maturity schedule, sex transition timing and these influences on the observed sex ratio were informed by recent research. The base model for SEDAR 72 found gag to be overfished and undergoing overfishing for both females-only and sexes-combined estimates of spawning stock biomass (SSB).

The model time series ranged from 1963 through 2019. Removal data were collected from the commercial vertical and longline fleets, and the recreational for-hire, private, and headboat fleets. Fishery-independent data came from the Reef Fish Observer Program, the Headboat Observer Program, the Panama City and Pascagoula Laboratories video surveys, and the Age-0 survey were collected from three databases across the Gulf. Maximum age for gag was increased from 31 to 33 years, with the target M calculated using Then *et al*. (2015[2]). Recent examination of sex transition timing indicated the transition of females to males occurs later than previously thought (revised to age 4) with a 50% probability of transition by age 11.6 years. The female-only iteration of SSB was used in the base model, with a sensitivity run completed using sexes-combined.

Recreational catch and effort data were updated to the MRIP-FES data currency, with a coefficient of variance (CV) of 0.2. Historical for-hire catch ratios (charter and headboat) prior to 1981 were recalculated to resolve overestimation issues. For private recreational landings, a marked overestimation was observed in 1983 and was recalculated as the geometric mean of the fishing years 1981, 1982, 1984, and 1985. The migration to MRIP-FES demonstrates considerable

[1] https://sedarweb.org/docs/suar/GagUpdateAssessReport_Final_0.pdf
[2] https://academic.oup.com/icesjms/article/72/1/82/2804320

increases in the magnitude of private recreational catch and effort (approximately 100%), with substantially smaller differences observed in the for-hire fleets for the years 1985 forward. Recreational discards (in thousands of fish) are dominated by the private vessel fleet, which is estimated to be discarding an order of magnitude more gag grouper than the for-hire fleets. Private vessel discards are estimated to be higher in SEDAR 72 than SEDAR 33U due to the changeover to MRIP-FES and the discard mortality estimate of 12% was retained.

Commercial landings data were largely unchanged from SEDAR 33U, with the exception of some species misidentification corrections updated to resolve differences between black and gag reported landings. The coefficients of variation (CVs) for the commercial landings were set at 0.05 for data from before 2010 (pre-individual fishing quota [IFQ] program implementation), and to 0.01 after 2010. Commercial discards (thousands of fish) have decreased precipitously since 2005 for the vertical line fleet and increased since 2010 for the longline fleet; however, commercial discards remain a small fraction of the total discards for all fleets. The commercial discard mortality of 25% was retained.

Length composition data suggest that the commercial fleets land relatively larger gag grouper than the recreational fleet, while the majority of recreational discards are near or below the minimum size limit of 24 inches total length (TL). Commercial discards occur across a wider length distribution, which is likely due to regulatory effects from the Individual Fishing Quota (IFQ) program. Age composition data from the commercial and recreational fleets show patterns of strong age classes moving into and through the fishery beginning in 1992, 1996, 2000, and 2009.

SEAMAP Pascagoula Lab video survey data (n = 148 measured) observed fish between 25 cm (10 inches) and approximately 130 cm (51 inches) TL but are limited by small annual sample sizes. The Panama City Lab video survey data captures smaller fish (n = 122 measured), between 20 cm (8 inches) and 100 cm (39 inches) TL. A red tide episodic mortality index was updated to include all ages (0+), with mortality estimated by age for red tide years between the 2002 and 2018 fishing years; with the greatest mortality observed in 2005.

Dr. Ailloud reviewed the stepwise progression from SEDAR33U to SEDAR 72, including the updated data inclusions, adjustments to selectivities, red tide analyses, and model variability. This stepwise approach was critical to ascertain and compare the influence of model parameters on resulting outputs.

Model fits to recreational landings data oscillate around the observed values, largely due to the setting of a more liberal CV of 0.2 than applied in SEDAR 33U. Model fits to the commercial data are more precise as well (CV = 0.05 pre-2010, 0.01 for 2010+). Landings from both fishing sectors have decreased since the 2000s. Model fits to recreational discard data are improved, though values are approximately twice that observed for SEDAR 33U. Commercial vertical line discards are slightly overestimated, and longline discards underestimated; however, commercial discards are a small fraction of the total discards, which come predominantly from the private recreational fleet.

Fleet-specific selectivities were modified from SEDAR 33U, allowing the model to freely estimate these selectivities by fleet. The for-hire fleets were found to be selecting for somewhat smaller

fish than observed in SEDAR 33U. Gag is initially selected by the commercial vertical line fleet at a smaller size than the longline with both following a logistic pattern. The charter and headboat fleet selectivities are dome-shaped, suggesting that deep offshore habitats may serve as refugia from these fleets. Private recreational selectivity was constrained to be dome-shaped, decreasing to zero at the largest and oldest length bins to reflect the lack of samples from that fleet in those length and age ranges. However, the assumption of zero selectivity at the largest sizes is likely incorrect as recreational anglers with capable large offshore vessels likely launch from private docks which are not sampled by the MRIP Access Point Angler Intercept Survey.

Length fits were improved for the Pascagoula Lab video survey. Generally, fits to length and age composition data can be poor when sample sizes are very low. Fits to age composition data were similar between SEDAR 72 and SEDAR 33U. Annual exploitation peaks in 2005, 2014, and 2018 with red tide events contributing to those removals as a "bycatch" fleet. Total exploitation is predominantly from the private recreational fleet, with annual peaks of red tide mortality of 13.67 million fish in 2010, 3.34 million fish in 2014, and 1.3 million fish in 2018.

Estimates of total biomass and female-only SSB were both observed to be depleted to previously unseen levels in the model terminal year of 2019. Recruitment has remained depressed for gag since the mid- to late-2000s with steepness fixed at 0.855. Further, the male proportion of the gag stock is estimated to comprise just 1.4% of the total population; whereas, the virgin condition of the stock is estimated to have been comprised of approximately 32% males.

An SSC member questioned the benefit of going further back in time beyond 1986 to generate historical estimates of catch and effort which is considered to be a period of less precise and accurate data. Dr. Ailloud replied that modification to the time series was beyond the scope of an operational assessment. She acknowledged that the recreational data prior to the MRIP period (pre-1981) were not thought to be accurate; however, commercial data from that early period are thought to be known with acceptable precision. Lastly, beginning the time series in 1986 would result in the modeling of a stock subjected to decades of fishing and certain assumptions previously made may be invalidated.

Dr. Ailloud continued with the model diagnostics. The jitter (10%) analysis produced robust results. The retrospective pattern analysis showed similar trends in SSB trajectory as the terminal year of data was walked back from 2019 through 2014. An analysis of Mohn's ρ generated a value of -0.002, which is within the range of values considered appropriate for gag grouper.

Sensitivity analyses were reviewed, with a run using the SEDAR 33U vector for M generating similar model results to those from the base model. Several sensitivity analyses were conducted to explore any improvement in model by combing the various fishery-independent video surveys; however, no improvement was realized and the indices were considered separately. A sensitivity run examining red tide selectivity-at-age yielded exploitation rates that were difficult to interpret; another attempt was made using time blocks on M to better capture red tide mortality. As a result, fits to the age-0 index were improved most, with discernible improvements to fits to the other indices also. However, estimated landings and discards for 2013 generated by the model were inexplicably high; thus, this sensitivity run was not included in the model.

An SSC member asked if the spikes in recruitment following red tide were appropriate. Dr. Ailloud replied that a density-dependent release was plausible and were supported by the red tide modeling in Ecopath/Ecosim. Another SSC member postulated sperm limitation becoming a more prevalent issue in the gag grouper stock, since recruitment does not appear to have rebounded to a level commensurate with that observed before the mid-2000s.

A sensitivity run was conducted to examine the recreational catch and effort data generated by the FWC Gulf Reef Fish Survey (now the State Reef Fish Survey). Hindcasting for the data were available back to 1981. Prior to 1981, mean catch per unit effort (CPUE) for 1981 – 1985 was used to estimate the historical CPUE. Trends in model outputs are commensurate using Gulf Reef Fish Survey (GRFS) data (which is now called the State Reef Fish Survey [SRFS]); however, the lower level of landings reported through SRFS compared to MRIP-FES does result in a lower estimate of SSB, exploitation rate, and age-0 recruits.

Dr. Ailloud referenced literature stating that female-only SSB provides the best estimates of biological reference points if the potential for decreased fertilization is weak; whereas, a sexes-combined SSB is best when the potential for decreased fertility is moderate or unknown (Brooks et al. 2008). Increasingly skewed sex ratios may result in reduced fertilization rates and, as a consequence, reduced population growth (e.g., sperm limitation, reduced genetic diversity or resilience). Recent research estimates that males account for ~1% in the fished stock and ~5% in the Madison Swanson Marine Protected Area (Barbieri et al. 2021). The last strong year class was in 2006/2007, and the relationship between sex ratio and fertilization success is poorly understood.

Relative F is set at the average of the 2017 – 2019 fishing years. Selectivity and retention are set at the 2019 values, and recruitment follows the Beverton-Holt stock-recruit relationship from the model. Landings data for 2020 are input as is, and data for 2021 and 2022 use the three-year average of landings from 2018 – 2020. The sector allocation ratio used represents the current allocation ratio of 39% commercial, 61% recreational. An SSC member asked about the difference between the F_{MSY} proxy, $F_{MAX,}$ and a proxy value using a spawning potential ratio. Another SSC member recounted, that in the review of SEDAR 33 (2014), the SSC thought that the estimates of virgin biomass using an F_{MSY} proxy of $F_{SPR30\%}$ were unreasonably high. Further, at that time, the sexes-combined estimated SSB seemed to be outside of what was plausible for the stock. An SSC member suggested using 2018 and 2019, instead of only 2019, for informing retention and selectivity in the projections to account for management changes related to the change in the minimum size limit. Another SSC member added that red tide mortality should not be included in any calculation of F since these events directly affect natural mortality estimates of M. Dr. Ailloud stated that incorporating deaths due to red tides events as a "bycatch" fleet in the base model only contributed to total removals; however, the projection analyses would specify removal from red tide events as contributing to estimation of M.

Dr. Ailloud stated that, under the females-only and sexes-combined scenarios for SSB, gag grouper has been overfished since 2006, with overfishing occurring since 2001. An SSC member proposed using the sexes-combined estimate for SSB, considerate of the reality of the currently skewed sex ratio and the potential problems with fertilization and recruitment since 2006/2007. Further, he thought that consideration should be given in the future to exploring an alternate proxy for F_{MSY} in $F_{SPR30\%}$, since F_{MAX} may not be appropriate moving forward. Council staff noted that,

ultimately, the decision to modify the F_{MSY} proxy would be under the Council's purview at this time. Council staff further recommended providing rationale to any revised recommendation for an F_{MSY} proxy.

The SSC discussed the merits and feasibility of using SRFS for monitoring recreational catch and effort for gag grouper in the future. The SSC heard from a Council member that the estimates of precision for the SRFS were better than those generated by MRIP-FES. Another SSC member contended that data estimated prior to the MRIP time period (pre-1981), which include data beyond to which the SRFS data used in the sensitivity are calibrated, should be excluded due to their lack of precision and plausibility. The SEFSC replied that removing the pre-1981 recreational catch and effort data does not have a substantial effect on the stock status, but does help with tuning the model to the initial estimates of exploitation rate. The SEFSC added that removing those recreational data is not easily accomplished within the bounds of the current assessment and that the commercial data for that time series are thought to be plausible. An SSC member asked about the virgin condition of the stock, which Dr. Ailloud acknowledged was not actually in 1963 (the start date for the model). Rather, the model internally estimates an offset for each directed fleet to estimate what the virgin condition of the stock.

> **Motion: The SSC determined that the SEDAR 72 operational assessment of Gulf of Mexico Gag (based on the combined sexes SSB) represents the best scientific information available.**
>
> ***Motion carried with one opposed and one absent.***

The SSC discussed the projection settings for gag grouper. The projection setting offered in the current draft of the SEDAR 72 stock assessment report constitute a starting point; however, the SSC may choose to modify the definitions used for the parameters in the projections. The SEFSC contended that exploring the GRFS data further for gag was most appropriately done in a research track assessment. The SSC decided the selectivity and retention will both represent values from 2019. Steepness is externally informed and fixed at 0.855 with the sigma-r set at 0.6. Recruitment will be derived from the model estimated Beverton-Holt stock-recruit relationship. Landings for 2020 will be input as-is, and landings from 2021 and 2022 will use the average landings from 2018 – 2020. The sector allocation will be fixed at the status quo value of 39% commercial, and 61% recreational.

The SSC discussed the potential F_{MSY} proxy to use for gag grouper, given that steepness is fixed in the model, and asked to see the corresponding SPR proxy for that steepness value of 0.855. In the past when a stock recruitment relationship is unknown, steepness if fixed at or near 1 and a proxy for MSY is used. An SSC member thought the SSC may not be able to make an informed decision on OFL and ABC without seeing the results based on different F_{MSY} proxies based on fixed steepness values. An SSC member expressed concern about using an uncertain stock-recruit relationship in projections. Another SSC member agreed, and asked whether it was reasonable to fix steepness while allowing the recruitment deviations to vary naturally around the mean, without fixing sigma_R. Dr. Ailloud replied that doing so would require re-running the model and all diagnostics. Ultimately, the SSC specified that steepness be fixed at 0.855, and F_{MAX} be used as a

proxy for F_{MSY}. The merits of also considering $F_{SPR40\%}$ were also discussed but ultimately the SSC requested additional runs using an F_{MSY} proxy of $F_{SPR30\%}$.

With respect to red tide mortality, the SEFSC recommended a correction for the observed 2021. The red tide Ecospace model used to generate that mortality index for SEDAR 72 could be used to develop an estimate of mortality for 2021 since the model could account for event severity by age and year. The SSC asked to see a range of red tide severity, along with an estimate from the Ecospace model, for consideration for the 2021 projection year.

The SSC further reviewed the projections for gag grouper on Thursday, September 30. An SSC member began discussions around the increased precision and reporting frequency of the more specialized GRFS (now, SRFS) survey. He thought SRFS to be more appropriate for monitoring private angler landings for gag grouper, especially given that the stock is a Florida-centric stock, and almost all harvest of gag grouper would be recorded by SRFS. He recommended that the sensitivity run for SRFS be run through the full suite of model performance and diagnostics, just as had been performed for the base model run for SEDAR 72. The SEFSC replied that it hasn't yet discussed how to treat the SRFS data as a component of a base run. A scalar may be possible to apply to the current base model; however, that method may present its own challenges. The SSC discussed the possibility of using that scalar approach to convert the recreational portion of the recommended catch limits into SRFS currency. The SEFSC expressed concern, stating that the evolution of such a modeling effort would need to occur within the SEDAR process. The SSC requested that the scalar approach be described by the SEFSC for its review by the SSC.

Dr. Ailloud reviewed the previously parameterized projections using the sexes-combined estimate of SSB. Three red tide scenarios were developed: 10% of the intensity of the 2005 red tide (low), 30% (medium), and 72% (high), expecting that the 2021 red tide would dissipate in mid-November 2021, based on historical patterns and Ecospace modeling. All scenarios predict that gag grouper is still overfished and undergoing overfishing; however, at $F_{SPR30\%}$, the degree to which the stock is overfished is much greater than at F_{MAX}. Under $F_{SPR30\%}$, gag grouper is thought to have been overfished since the 1970s.

The SSC discussed the severity of the 2021 red tide event with respect to the next most recent red tide event in 2018, with the general sentiment being that the 2021 red tide has not been as expansive or severe as the 2018 red tide event. The SEFSC added that hypoxic events are not being detected in 2021 in offshore sampling as were detected during 2018.

Dr. Ailloud added that there is not guidance with respect to the F_{MSY} proxy when using sexes-combined SSB for a hermaphroditic species. The SSC replied that it has normally made recommendations to the Council with respect to F_{MSY} proxies when appropriate. The SEFSC added that it supports the use of $F_{SPR30\%}$ as a proxy for gag grouper.

Dr. Ailloud reviewed the guidelines for rebuilding under the MSA. For the $F_{SPR30\%}$, the low red tide scenario shows the stock rebuilding within 10 years; however, fishing mortality would need to be reduced to zero to achieve the rebuilding date of 2033. Because the minimum time to rebuild for $F_{SPR30\%}$ is within 10 years, the only rebuilding scenario under $F_{SPR30\%}$ would be to set F equal to zero. For the F_{MAX} scenario, the stock would rebuild by 2029 in the absence of fishing mortality,

with some yield allowed annually under an $F_{Rebuild}$ target of 2033. The SEFSC replied that rebuilding yields account for discards, and as such, the retained yields would be a portion of the total listed yields by year.

The SSC recognized that a complete closing of the fishery would result in the loss of critical fishery-dependent and biological information needed to monitor stock rebuilding. The SSC acknowledged that the current F_{MSY} proxy is F_{MAX}, and that changing that proxy would require a plan amendment. The SSC discussed further its consideration for using $F_{SPR30\%}$, and was supportive of using the medium severity red tide scenario based on the Ecospace model. The medium value of red tide severity (30%) was viewed as more precautionary than the low severity value (10%), the latter which the Ecospace model demonstrated as a lower bound of severity for the 2021 red tide event. The SSC thought that the medium red tide intensity demonstrated an adequate perception of the 2021 red tide. Further, the SSC noted that the base M estimate in the base model likely is underestimating natural mortality by not accounting for red tides.

Given the lack of time remaining in the meeting, the SSC decided to revisit the gag grouper projections at its next meeting.

Standing, Reef Fish, Ecosystem, and Socioeconomic SSC Hybrid Meeting Summary November 18, 2021

The hybrid meeting of the Gulf of Mexico (Gulf) Fishery Management Council's (Council) Standing, Reef Fish, Ecosystem, and Socioeconomic Scientific and Statistical Committees (SSC) was convened at 8:30 AM EDT on November 18, 2021.

Evaluation of SEDAR 72 Projections for Gulf Gag Grouper

Dr. Lisa Ailloud (SEFSC) provided context for the use of the maximum fishing mortality (F_{MAX}) proxy for the fishing mortality rate at maximum sustainable yield (F_{MSY}) for Gulf gag grouper. The F_{MAX} proxy originated in the 2001 Reef Fish Stock Assessment Panel assessment of gag grouper. The stock was originally assessed considering only female SSB. At that time, F_{MAX} was providing an SPR proxy equivalent of approximately 43 – 65% SPR, which was greater than $F_{30\%SPR}$. When looking at female-only SSB for a protogynous hermaphrodite like gag grouper, there was less concern for the proportion of males in the population; it is in this scenario that F_{MAX} was determined to be appropriate. However, males generally represent the oldest and largest individuals in the population, so the inclusion of males now seems more appropriate to better conserve and rebuild the gag grouper stock structure and status.

Dr. Ailloud reviewed the projections settings for Gulf gag as determined by the SSC during its September 2021 review of the SEDAR 72 stock assessment. The Ecospace model, which is used

to inform episodic mortality from red tide, was updated since the September 2021 SSC meeting to include data through mid-October 2021; the new proportional severity estimates for the low, medium, and high severity designations are 6% of the strength of the 2005 red tide, 24%, and 68%, respectively. Dr. Ailloud reviewed the corresponding projections under both $F_{30\%SPR}$ and F_{MAX} for the low, medium, and high red tide severity designations. Under F_{MAX}, the Gulf gag grouper stock rebuilds in just under 10 years with no fishing mortality; whereas, under $F_{30\%SPR}$, rebuilding takes 10 – 12 years, depending on the red tide severity assumed. Rebuilding under F_{MAX} would rebuild the Gulf gag grouper stock to a lower level of SSB than under $F_{30\%SPR}$.

Under the Magnuson-Stevens Fishery Conservation and Management Act, if a stock can be rebuilt in 10 years or less (T_{min}), then the Council is required to select that rebuilding scenario. However, if the stock cannot be rebuilt in 10 years, then there are three options to consider for a rebuilding timeline: 20 years ($T_{min} * 2$), T_{min} + one generation period (8 years for Gulf gag grouper), or the time needed to rebuild the stock at 75% of the maximum fishing mortality threshold. The SSC discussed these options, including recommending a change in the F_{MSY} proxy for gag grouper from F_{MAX} to $F_{30\%SPR}$. Council staff clarified that changing the F_{MSY} proxy is a Council prerogative and requires a plan amendment to modify. The SSC was advised to provide recommendations under both the F_{MAX} and $F_{SPR30\%}$ scenarios. Since F_{MAX} is projected to rebuild Gulf gag grouper to an SPR equivalent of only 13%, compared to 30% for rebuilding under $F_{30\%SPR}$, the SSC thought F_{MAX} was representative of a harvest strategy that was too aggressive to support optimum yield. Further, given the low proportion of males in the Gulf gag grouper population (less than 2%), the SSC reaffirmed the value in considering the males in the rebuilding strategy. The SSC also reaffirmed its estimation of a medium severity index of red tide, as estimated by the Ecospace model. It was also noted that the age-specific estimates of episodic mortality from red tide are higher for younger ages; however, in the SEDAR 72 model, this mortality is averaged across all ages. A more explicit application of the Ecospace model should be considered in the next Gulf gag grouper research track assessment.

Ms. Emily Muehlstein reviewed the findings of the Council's Something's Fishy tool for Gulf gag grouper. A total of 423 responses on the condition of the stock were collected directly from fishermen, with 418 responses directly analyzed. The majority of respondents were from the private angling fleet, with smaller portions comprised of the remaining fleets. Generally, respondents were more likely to report that the Gulf gag grouper stock was in good condition, followed by neutral or poor condition responses. The commercial and for-hire fleets were more likely to report a negative stock condition, while the private angling fleet was more likely to report a positive stock condition. The vast majority of responses were from western central Florida. Common themes indicated a large number of juveniles, and larger fish being found nearshore in the Big Bend off Florida. Respondents also noted increased depredation by dolphins and sharks, that some fish were "more skinny" than in the past, and that Gulf gag grouper were being outcompeted by red snapper. Ms. Muehlstein clarified that Something's Fishy does not represent an independent scientific survey, or a representative sample of anglers targeting gag; the tool is not expected to have a quantitative effect on the stock assessments, but rather to help inform patterns and trends that may go otherwise unexplained. The SSC noted the higher proportion of positive responses in the Big Bend region of west Florida, which is also where the larger proportion of the Gulf gag grouper biomass is thought to occur. Presently, the Gulf gag grouper SSB is estimated to be 16% of the SSB at the minimum stock size threshold (MSST), and 8% of the SSB at MSY.

Motion: The SSC finds that the SEDAR 72 based GoM gag projections are the best scientific information available, and are suitable for use in management.

Motion carried without opposition.

The SSC noted the continued importance of maintaining fishery-dependent data collection which would be disrupted if the fishery experienced a closure.

Motion: The SSC finds, based on the new scientific information that F_{MAX} for Gulf of Mexico gag is no longer appropriate for use as a proxy for MSY, and the SSC recommends that $F_{30\%SPR}$ be the MSY proxy and the basis for status determination criteria. The SSC recommends that projections based on $F_{30\%SPR}$, and the "medium" red tide scenario, be used to establish OFL, ABC, and rebuilding schedules. Projections based on F_{MAX} are scientifically valid and suitable for analytical purposes, excluding the setting of catch levels for rebuilding purposes.

Motion carried without opposition.

Standing, Reef Fish, Socioeconomic, and Ecosystem SSC Meeting Summary September 21 – 23, 2022

Review: Alternative Model Run for SEDAR 72 Base Model using Florida's State Reef Fish Survey

Dr. Katie Siegfried (Southeast Fisheries Science Center [SEFSC]) presented a resolved issue with the landings data from the headboat directed landings and discards. When these data were pulled for the assessment, Area 23, which covers northwest Florida and Alabama, was accidentally omitted. The inclusion of these data in both the original SEDAR 72 base model using Marine Recreational Information Program (MRIP) data, and Florida's State Reef Fish Survey (SRFS) data, resulted in minimal differences in the estimated landings by year. This error was also corrected for the SEDAR 68 operational assessment for scamp, which is not being discussed at this SSC meeting. Although these differences for gag grouper were small, both the MRIP- and SRFS-informed models were re-run to ascertain any effects to management benchmarks and rebuilding timelines. This resulted in no substantial change to the rebuilding timeline for the SRFS model; however, the MRIP model now projects that the stock rebuilds in 10 years (T_{Min}, F=0) at a fishing mortality rate at maximum sustainable yield (F_{MSY}) proxy using a 30% spawning potential ratio ($F_{30\%SPR}$), and a medium severity estimate for red tide mortality in 2021. Dr. Siegfried commented that automated data processing methods being developed by the SEFSC are being built to include error checking and safeguards.

Dr. Lisa Ailloud (SEFSC) presented the revised results of the SEDAR 72 Gulf of Mexico gag grouper operational assessment using the SRFS private angling landings in place of those from the MRIP's Fishing Effort Survey (FES), and the original SEDAR 72 base model. The Council requested the SRFS-informed model run in October 2021, with diagnostics, to see how the SRFS private angling landings data performed for gag grouper. A review of the SRFS was coordinated and completed by NMFS Office of Science and Technology (OST) in May 2022. The findings of the review were subsequently evaluated by NMFS OST and SEFSC staff, and no major concerns were identified in the review that would preclude the use of the calibrations for their intended purpose. Generally, the SRFS model estimates similar trends in landings as the MRIP model, albeit with lower estimates of removal and stock size. Approximately 95% of private angling landings of gag grouper are captured within the SRFS sampling frame, which encompasses the eastern Gulf of Mexico from the Florida/Alabama state line east and south through Monroe County. Like the MRIP-informed model, the SRFS model shows a decline in gag grouper landings in recent years.

Dr. Ailloud presented updated model results and diagnostics, including comparisons with the SEDAR 33U assessment as well as the previously approved SEDAR 72 base model (SEDAR 2021), and revised management benchmarks, stock status estimates and projections for Gulf gag grouper. Fits to age and length composition data were similar between model runs, with some bounding issues with selectivity of directed fleets resolved by fixing those values to improve model stability. Fits to indices, trends in recruitment, exploitation rate (F), and spawning stock biomass (SSB) were also similar between models. The aforementioned headboat correction, which had a minimal effect on the overall results from the models, will be included in a revised report for the SRFS run. The SRFS run does estimate a lower virgin biomass, a lower rate of depletion, and less recruitment, all to pair to the lower estimated historical removals under SRFS compared to MRIP. The 2014 red tide episodic mortality event is more pronounced in the SRFS run than in the MRIP run; Dr. Ailloud noted that the time blocks in the model for defining fishing season duration for the recreational fleets led to differences in retention estimates between the models. However, these retention estimates are generally estimated with considerable uncertainty. Diagnostics demonstrated stable models using either SRFS or MRIP, and minimal retrospective patterns in the SSB, recruitment, and F as years of data are peeled away. Generally, the SRFS run scales down the stock's population size by about 50%, but does not change the stock's trajectory or the ratio of SSB to virgin SSB in the terminal year. Both models perform similarly.

An SSC member noted that the last stock assessment, the SEDAR 33 Update (2016) showed a healthy stock when using female-only biomass and F_{MAX} as the proxy for F_{MSY} (the SSC determined this proxy to be inappropriate in November 2021). However, since the 2014 terminal year of that assessment, there have been three red tide episodic mortality events (2014, 2018, and 2021), and recruitment and landings have declined therein. The SSC member also postulated whether the *Deepwater Horizon* oil spill may have had an effect on recruitment of gag grouper on the west Florida shelf, and noted that the issue of sex ratio has been an ongoing concern.

Dr. Ailloud continued with the projections from the models, which were informed by a medium severity estimate of red tide mortality in 2021 compared to the 2005 red tide, and proxies for F_{MSY} of $F_{30\%SPR}$ and $F_{40\%SPR}$. F_{MAX} was not included here due to previously being deemed inappropriate

by the SSC. Choosing a proxy for F_{MSY} affects estimates of a recruit's future reproductive output. With protogynous hermaphrodites, if only measuring female biomass, long-term F may result in relatively low biomass levels of males, which in turn affects long-term yield. Given the uncertainty surrounding the relative contribution of males to the reproductive output of the stock, using sexes-combined SSB (males and females) provides a buffer to avoid depleting the males. Following a similar logic and adding in the complexity of uncertainty surrounding steepness, Harford et al. 2018[3] provides guidance on the level of SPR that would be highest probability of achieving long-term MSY in hermaphroditic stocks. Steepness was fixed in both models.

For the projections, selectivity and retention are fixed at their 2019 values, with recruitment following the Beverton-holt stock-recruitment relationship. Actual landings are used for the interim years of 2019 – 2021, and the average of those three years for 2022. The sector allocation ratio from Reef Fish Amendment 30B is retained (61% recreational, 39% commercial), and the red tide influence in the interim years is included as a fixed F. Ultimately, the sector allocation scenario may necessitate differing sets of projections; if SRFS data are used to inform the sector allocation based on the years used in Reef Fish Amendment 30B (1986 – 2005), the sector allocation (based on the same formula as the present sector allocation) changes to 65% recreational, 35% commercial. Under either the SRFS or MRIP models, gag grouper is overfished and undergoing overfishing. Using an F_{MSY} proxy of $F_{30\%SPR}$, the stock rebuilds to a smaller SSB than at $F_{40\%SPR}$, with ultimately smaller yields over time. The SSC noted that fixing steepness and setting a proxy for F_{MSY} in effect fixes stock productivity.

The SSC discussed the SRFS run compared to the MRIP run, considerate of how the fishery is expected to be monitored in the future. An SSC member noted that the State of Florida and the Council have expressed a desire to use the same data collection program to both monitor and assess the stock, which would indicate using SRFS. The SEFSC was commended on its work to perform these additional analyses. Another SSC member added that migrating from a generalized survey like MRIP to a region-specific survey like SRFS may be more appropriate for stocks that are effectively sampled by the latter (95% of private angling landings for gag grouper are captured by SRFS), with the added benefit of improved precision in the SRFS survey. An SSC member asked whether switching from recommending the MRIP model at its November 2021 meeting as consistent with the best scientific information available (BSIA) to the SRFS model was in effect stating that one survey was better than the other. Council staff recalled that the SSC has always made recommendations on BSIA on a case-by-case basis, and has never given a blanket recommendation to any fishery-independent or -dependent survey. SSC members noted that any recommendation of BSIA was not specific to a survey, but rather to the completed stock assessment product as being *consistent* with BSIA. An SSC member thought it appropriate for the SRFS survey to be considered whenever it encompasses the overwhelming majority of the private angling landings for a stock (>90%). The SSC also noted the differentiation in circumstances with species like gag compared to, say, red snapper, when considering the spatial distribution and magnitude of landings compared to the surveys examining those stocks. An SSC member expressed some reservation about making determinations of BSIA between the surveys.

The SSC noted the need to determine whish proxy to use for F_{MSY}. As noted, the SSC no longer supports the use of F_{MAX} for gag grouper. An SSC member noted differences in when the stock

[3] https://gulfcouncil.org/wp-content/uploads/05f.-Harford-et-al.-2019-Fish-and-Fisheries.pdf

was estimated to be overfished, based on the way in which SSB is calculated (female-only versus sexes-combined SSB), and based on the F_{MSY} proxy (F_{MAX} versus $F_{30\%SPR}$). These model specifications have changed from assessment to assessment as the data have evolved with time. An SSC member thought that an F_{MSY} proxy of $F_{30\%SPR}$ was likely a lower bound for gag grouper, and $F_{50\%SPR}$ or $F_{60\%SPR}$ was a higher bound, with $F_{40\%SPR}$ being closer to the middle. Another SSC member agreed, adding that given the low sex ratio, rate of reproduction, and red tide susceptibility, there appeared to be ample evidence in support of a higher F_{MSY} proxy than $F_{30\%SPR}$, and certainly higher than F_{MAX}.

Motion: The SSC recommends $F_{40\%SPR}$ as the appropriate F_{MSY} proxy and the basis for stock status determination criteria for Gulf of Mexico gag grouper.

Motion carried with one opposed and 5 absent.

The SSC discussed selecting the exact model that was consistent with BSIA, considerate of discussions about the data inputs and the trends observed in the stock. An SSC member asked whether the SSC was differentiating between the MRIP and SRFS surveys, and determining one to be more consistent with BSIA than the other. Another SSC member noted the certification of the SRFS program and its calibration to historical data, and its increased precision over MRIP due to it being explicitly designed for waters adjacent to Florida. Further, they noted that the decision isn't about which survey is "better"; however, the surveys are linked in that intercept data collected by SRFS are ultimately used to inform MRIP's catch estimation in the Access Point Angler Intercept Survey. Where the surveys differ is in the estimation of fishing effort. Another SSC member added that monitoring and assessing the stock using the same survey(s) was likely to the benefit of understanding the performance of the stock over time. An SSC member stated that deciding which survey to use for the private angling landings made implicit assumptions about accuracy. Another SSC member replied that studies were planned or ongoing to better determine relative estimates of accuracy for various surveys; at present, the MRIP Transition Team, which has been working on the calibration ratios for the several state surveys for various species, has stated that it is not yet possible to determine which survey(s) is more accurate. An SSC member thought that determining that the SRFS run was consistent with BSIA was not out of order, especially given the comparatively similar performance of the two models.

Motion: The SSC determines that the SEDAR 72 Gulf of Mexico Gag Operational Assessment State Reef Fish Survey Run, based on the combined-sexes SSB, the corrected SRHS data, an MSY proxy of F40%SPR, and the "medium" red tide scenario is consistent with the best scientific information available and should be used as the basis for stock status determination and management advice. Based on this assessment model, the stock is determined to be overfished and undergoing overfishing.

Motion carried 15-4 with 5 absent.

Dr. Ailloud reviewed the rebuilding timelines for the projections assuming no fishing pressure (F = 0), to determine the minimum time to rebuild the stock (T_{Min}). Both the MRIP and SRFS models, assuming an $F_{30\%SPR}$ reference point, rebuild in 10 years with F = 0. This similarity is not

surprising given the similar performance of both models, with the primary difference being a scaling of the magnitude of recreational harvest. Assuming an $F_{40\%SPR}$ reference point, the MRIP model rebuilds in 13 years at F = 0, and 12 years for the SRFS run. Dr. Ailloud also provided the rebuilding timeline for T_{Min} * 2, which was preferred by the Council in its recommendations to NMFS for the proposed gag grouper interim rule. Under T_{Min} * 2, the MRIP model projects the rebuilding of the stock by 2049, compared to 2047 under SRFS, under an FMSY proxy of $F_{40\%SPR}$. An SSC member was concerned with the assumption of F = 0, since that assumes no additional red tide mortality or any changes in the magnitude of discards, which they thought seemed unreasonable. Dr. Ailloud agreed, replying that it isn't possible to predict exactly when, for how long, or how severe the next red tide event, or successive events, will be. Generally, the SEFSC acknowledged the presence of episodic mortality and discard mortality, and the incompatibility of that knowledge with the assumption of no fishing mortality. The SEFSC encouraged the use of interim analyses to examine the performance of the stock in the interim years between stock assessments. The SSC member then stated that they thought the argument that rebuilding the stock in 10 years was possible under F = 0 was not defensible. The SSC thought the mortality from discards would remain unchanged, and then determining the acceptable F from directed effort could be determined from there. The SSC acknowledged the sound analysis for calculating the rebuilding timelines based on the options available under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), deferring to the Council to determine which rebuilding timeline it thought most appropriate given physical, biological, social, and economic considerations. An SSC member asked about further consideration of discards out of season. The SEFSC noted the ability to consider discards in this way for red snapper, and that doing so for other stocks would constitute a substantial model change, but should be done.

> **Motion: The SSC determines that the yields corresponding to the rebuilding schedules based on T_{Min}, T_{Min} plus one generation time (8 years for gag grouper), and T_{Min} * 2, are appropriately calculated and suitable for informing catch advice.**
>
> *Motion carried with no opposition and 5 absent.*

The SSC noted that the overfishing limit (OFL) projections (i.e., fishing at MFMT) and those for $F_{Rebuild}$, which are equivalent to the acceptable biological catch (ABC), were contained in the tables in the presentation provided in millions of pounds gutted weight. The SEFSC compiled these data into a single table for the different rebuilding timelines. The SSC noted that yields should be described annually, and not averaged into constant catch scenarios, given the overfished condition of the stock. Dr. Tom Frazer (Council Representative) added that it was likely that the Council would request annual interim analyses until the next stock assessment of gag grouper. These interim analyses may be used as "health checks" unless they result in revised catch advice from the SSC. An SSC member recalled similarities between the current estimated condition of gag grouper compared to historic red snapper and red drum assessments, when those stocks were thought to be most depleted. The SSC member thought it important to illustrate how much of a recovery would be needed to rebuild gag grouper from its current condition.

Table 1. OFL and ABC yields for gag grouper based on the model selected by the SSC (SRFS run, using $F_{40\%SPR}$, and medium red tide severity) for the three rebuilding timelines permitted under the Magnuson-Stevens Act.

SRFS RUN		mp gw		million pounds gutted weight		
F40%SPR		mt gw		metric ton gutted weight		
				FRebuild	0.091	
F= F40%SPR	0.098			**Year Rebuilt**	2047	
OFL	mt gw	**mp gw**		**TMin (12 yrs) * 2**	mt gw	**mp gw**
2023	189.915	**0.41869**		2023	175.909	**0.387812**
2024	284.417	**0.627031**		2024	264.72	**0.583607**
2025	382.781	**0.843887**		2025	357.698	**0.788588**
2026	467.534	**1.030735**		2026	438.582	**0.966907**
2027	566.314	**1.248507**		2027	533.216	**1.175539**
				FRebuild	0.081	
				Year rebuilt	2043	
				TMin (12 yrs) + 1 Generation (8 yrs)	mt gw	**mp gw**
				2023	157.508	**0.347245**
				2024	238.533	**0.525875**
				2025	324.008	**0.714315**
				2026	399.289	**0.880281**
				2027	487.816	**1.075449**
				FRebuild	0.074	
				Year rebuilt	2042	
				F=75% * F40%SPR	mt gw	**mp gw**
				2023	142.614	**0.31441**
				2024	217.079	**0.478577**
				2025	296.117	**0.652825**
				2026	366.418	**0.807812**
				2027	449.428	**0.990818**

Dr. Siegfried described the differences between the OFL and ABC scenarios in Table 1 for gag grouper, compared to the wide buffers observed in other rebuilding plan demonstrations (e.g., greater amberjack, gray triggerfish). For gag grouper, the stock-recruit curve was used for both management benchmarks and recruitment, and the time to rebuild for gag grouper is much longer (at least 12 years, and as many as 24 years) than for greater amberjack (6 years) or gray triggerfish (7 years). Generally, the shorter the rebuilding timeline, the lower the F must be to rebuild the stock in time, and thus, the larger the buffer will be between the OFL (at equilibrium F) and ABC. An SSC member noted that the assumptions about the spawner-recruit relationship is heavily informing future catch limits in the projections, which is in effect relying on gag grouper that have not yet been born to carry the rebuilding of the stock. Further, they thought that the approach

being taken with respect to discards may be underestimating the true number of discarded fish, and as such the subsequent discard mortality. The SEFSC thought regular interim analyses, perhaps using the combined video survey index of relative abundance, may be informative in keeping the SSC and Council apprised of the rebuilding progress of gag grouper in the interim years between stock assessments. Evaluating the recruitment of juvenile females into the fishery will need to be monitored with time to shed light on the annual success of recruitment of the stock. Although not contained in the SSC's previous motion about the catch limits associated with the different rebuilding timelines, the SSC stated that it thought the catch limits associated with the rebuilding timeline using 75% of $F_{40\%SPR}$, which is one of the options when T_{Min} is greater than 10 years under the Magnuson-Stevens Act, was a valid option for consideration by the Council. Further, the SSC decided to only recommend catch limits for the five year period of 2023 – 2027.

> **Motion: The SSC determines that the yields corresponding to the rebuilding schedules based on T_{Min} (12 years @ F = 0), T_{Min} plus one generation time (8 years for gag grouper; 20 years total), T_{Min} * 2 (24 years total), and 75% of $F_{SPR40\%}$ (19 years total) are appropriately calculated, and the 5-year OFL and ABC yield streams associated with those rebuilding timelines are suitable for informing catch advice.**

Motion carried with no opposition and 5 absent.