Gulf of Mexico Fishery Management Council
Standing, Reef Fish, Socioeconomic, and Ecosystem SSC

Review of:
SEDAR 75 Operational Assessment
Gulf of Mexico Gray Snapper

January 10, 2022

Review of SEDAR 75: Gulf of Mexico Gray Snapper

Dr. Francesca Forrestal (Southeast Fisheries Science Center [SEFSC]) presented the SEDAR 75 Operational Assessment of Gulf of Mexico Gray Snapper[1]. SEDAR 75 resolved several concerns from the previous model (SEDAR 51 2018[2]), and incorporated updated recreational landings data calibrated to the Marine Recreational Information Program's Fishing Effort Survey (MRIP-FES). Dr. Forrestal reviewed the model's construction and development, included indices of relative abundance, base model estimations and results, diagnostics, and yield projections based on the Council's currently defined status determination criteria. SEDAR 75 uses data through 2020.

Model Construction and Development

Dr. Forrestal reviewed the data used in the model, which include catch and effort from the directed fleets (commercial longline, commercial vertical line, commercial nets and traps, recreational shore, recreational private vessel, and charter for-hire and headboats combined), with all of Monroe County in Florida included in the Gulf. The estimates of natural mortality, maximum age (28), and sex ratio (50:50) were unchanged from SEDAR 51. The ratio of fecundity to length was updated with additional samples, with functional maturity estimated at 2.5 years and 269.8 mm fork length (FL); 90% of individuals are estimated to be sexually mature by 5 years and 358.8 mm FL. These estimates are slightly greater than the physiological maturity, but better represent what is thought to be effectual maturity for this species within the stock. Shore mode landings were examined in a topical working group (TWG) to address concerns about the magnitude of estimated landings and discards in 1984, and other issues. Eliminating 1984 was considered but avoided; instead, the year was smoothed using the 1986 stratum since a geometric mean approach was not possible due to a lack of data in that stratum from the preceding years.

SEDAR 75 no longer uses the regional fleet stratification used in SEDAR 51, but keeps all fleets separate except for the for-hire fleets. For abundance indices, the commercial vertical line fleet for the pre-individual fishing quota period (pre-2010) was excluded, and the updated combined video survey was added. All other indices were updated through 2020. Length composition of retained catch was updated, and age compositions were included along with length compositions from fishery-independent surveys. Meristic relationships between age, length, and weight were all updated with new model estimates. The treatment of the commercial fleet structure in SEDAR 51

[1] https://sedarweb.org/documents/sedar-75-gulf-of-mexico-gray-snapper-final-stock-assessment-report/
[2] https://sedarweb.org/documents/sedar-51-gulf-of-mexico-gray-snapper-final-stock-assessment-report/

led to an error in the total landings, which was corrected in SEDAR 75. Recreational landings still make up the majority of total landings (greater than 90% in recent years), with most of those recreational landings coming from the recreational private vessel mode. Calibrating the recreational data to MRIP-FES resulted in approximately a 2.3x increase in landings from the former MRIP Coastal Household Telephone Survey (CHTS), and also an increase in the estimate of recreational shore landings in recent years. An SSC member noted that the high point estimate of over 22 million recreational discards appeared to be driven by wave 1 (January and February) estimated from Florida in 2020 (about 6 million fish), which appeared larger than any other estimate from wave 1 in the time series. Dr. Forrestal noted that she would look into those data.

Commercial discards are estimated to be quite low, due in part to commercial fishing behavior and no commercial trip limits. Recreational discards are estimated to comprise a large proportion of recreational catch (approximately 80% for private vessels, 90% for shore, and 60% for for-hire vessels in 2020). Commercial discard mortality was estimated at 6.9%, and recreational discard mortality at 14%. An SSC member asked whether the estimate of a 90% discard fraction for the shore mode was reasonable. Others replied that there is considerable fishing effort on bridges, jetties, rivers, freshwater springs, and piers which all hold a large number of gray snapper that are at or near the Florida state waters minimum size limit (10 inches total length). Combined with a state-waters 5-fish recreational bag limit, this may be driving this point estimate for high discards. An SSC member asked about the discard mortality rates, and why they were seemingly lower than for other species. Council staff replied that much of the fishing activity for gray snapper occurs in waters less than 20 meters in depth; combined with generous minimum size limits and recreational bag limits, and no commercial trip limits, and the requirement to use circle hooks which decreases terminal hooking injuries, and the resultant discard mortality rates for this species should be comparatively lower. Another SSC member added that the shore mode did not account for private access point discards, which may be lower. Dr. Katie Siegfried (SEFSC) asked whether the estimate then represented a floor for the shore mode landings. Dr. Siegfried added that there was also an issue about repeated discarding, especially in the shore mode, which may affect the point estimate for those discards and possibly the corresponding discard mortality rate. The SSC noted that data to better inform the shore mode landings with respect to differences in catch per unit effort between public and private access points were not available.

Dr. Forrestal reviewed the indices of relative abundance. Fishery-dependent indices include the directed fleets with the exception of the commercial vertical line as previously noted, with Stephens and MacCall associated catch estimation used to identify gray snapper target trips. Fishery-independent indices include the Fish and Wildlife Research Institute's (FWRI) age-0 and age-1 surveys in four regions along west Florida, which were used as a recruitment index, and indicate an increase in recruitment in recent years. An SSC member asked whether there could be a climate change effect involved in those indices; Dr. Forrestal said such an effect was not investigated but could be a research recommendation. Another SSC member noted the sawtooth pattern in the age-0 index, which could represent a density dependent effect; however, an SSC member added that other density independent environmental effects could also be at play, given gray snapper's propensity for inhabiting euryhaline environments at juvenile stages. The SEAMAP trawl survey was used for 2010 – 2020, included length composition data, and showed a consistent trend over that period with a sharp increase in 2020. The combined video index

captured larger fish than the SEAMAP survey, and is increasing over time. The Reef Fish Visual Census has several data gaps since 2013, and captures fish similar in size to the SEAMAP trawl.

Dr. Forrestal reviewed the progression of the model's development from the SEDAR 51 base model, to the base model presented for SEDAR 75. All ages above 21 were combined into a plus group (21+). Main recruitment deviations were estimated from 1981 – 2020, with time-varying retention to account for changes in size limit regulations. Dirichlet multinomial likelihood was used for analyzing composition data. Dome-shaped selectivity is modeled for all directed fleets and fishery-independent surveys, except for the combined video index, which used a logistic function. Age selectivities were estimated with loose symmetric beta priors. A continuous F method was used since catch is not precisely known. Fishery-dependent indices used a coefficient of variance (CV) of 0.2; commercial indices, 0.05; and recreational indices, 0.1. Time-varying retention was modeled to account for changes in management regulations over time, with all fish caught before size limits assumed to be retained. Full retention above federal size limit is assumed for the commercial fleets, and above the Florida minimum size limit for the recreational fleets.

Assessment Model Results

Dr. Forrestal discussed the results from the proposed base model, beginning with estimates of landings from the directed fleets. Recreational landings comprise the bulk of total landings, and follow an increasing trend over the time series. Fits to commercial discards are underestimated in the early part of the time series; however, commercial discards are thought to be very low. Recreational discards are underestimated by the model in many years for all modes, with recreational discards increasing with time. Predictably, the commercial longline fleet tends to select for larger, older fish than the commercial vertical line and recreational for-hire fleets, which do the same compared to the recreational private vessel fleet, followed by the smallest and youngest fish being selected by the recreational shore mode. Retention is knife-edged at the minimum size limit. The base model is modestly underestimating retention of younger ages from the directed recreational fleets compared to observed data. A tradeoff for the model is apparent between ages and lengths, in that there are fewer years of data available if using both ages and lengths for composition data in a year. Some residual patterning is seen in the combined video survey, which shows more larger fish in the early part of the time series compared to the more recent portion (pre- versus post-2014). The model is putting the least emphasis on length composition data from the commercial nets and traps fleet and the Reef Fish Visual Census, and the highest on the length and age composition data from the commercial longline fleet and the length composition from the recreational shore mode.

Dr. Forrestal showed the model fits to indices of relative abundance, which show fits that follow trends well for most surveys except the FWRI age-0 and age-1 surveys. Recruitment is estimated to be increasing over time, with a decrease in the last 2 years. Steepness is fixed at 0.99, indicating a poor stock-recruitment relationship. The initial and present stock size is thought to have been larger than estimated by SEDAR 51. The model is also estimating a larger number of younger fish than SEDAR 51. An SSC member asked about the estimated fleet retention for the early part of the time series from SEDAR 51. Dr. Forrestal replied that discussions with fishermen determined that it was unlikely that fishermen would have kept smaller fish following the institution of the minimum size limit; thus, this estimation of retention was corrected in SEDAR 75. The SSC

member also asked about the decline in selectivity of larger fish in the Reef Fish Visual Census. Dr. Forrestal replied that the Reef Fish Visual Census surveys up to a depth limited by recreational divers around the inner reef, which would result in the survey not seeing larger, older fish.

Diagnostics

Dr. Forrestal reviewed the jitter analysis, which showed model stability with the variation of model parameters by up to 10%. Likelihood profiling showed some instability with commercial nets and traps data, which informs the model the least. No directional retrospective patterns are observed. Non-random patterns in residuals are observed in the recreational shore and combined video lengths, in the FWRI age-1 index, and in the recreational for-hire ages. A joint residuals plot assessing goodness of fit shows a root mean squared error of 47.5% for the indices, which is considered undesirable; fits to lengths and ages are considered acceptable. The model is sensitive to changes to natural mortality (M), with the data not supporting a lower estimate of M. An SSC member asked about the size at sexual maturity, noting the difference between the physiological (smaller) versus functional (larger) size at which 50% of individuals are estimated to be sexually mature. The SSC member thought that a best practices examination for whether to use physiological versus functional sexual maturity was needed; Dr. Forrestal agreed, and added that a sensitivity run examining that was not possible due to time constraints. Another SSC member added that such an effort looking at length at sexual maturity is underway.

Projections

Dr. Forrestal summarized the projections settings, which set relative fishing mortality at the average of 2018 – 2020 and selectivity and retention at the values estimated for 2020. Recruitment follows the Beverton-Holt stock-recruit relationship, and with interim landings using the mean of landings from 2018 – 2020 for 2021 – 2023. Data for 2021 and 2022 have not been provided as final yet to the SEFSC. As of 2020, the stock is estimated as not overfished (2020 spawning stock biomass [SSBCurrent]/SSB at the maximum sustainable yield [MSY] proxy of 30% spawning potential ratio [30%SPR] = 1.6; $SSB_{Current}$/minimum stock size threshold [MSST; $0.5*SSB_{SPR30\%}$] = 3.2), and not undergoing overfishing (fishing mortality [F] from 2018 – 2020/$F_{SPR30\%}$ = 0.659). The stock has not been overfished or undergoing overfishing throughout the time series. Council staff noted that Amendment 51 to the Reef Fish Fishery Management Plan established an MSY proxy at the yield at $F_{26\%SPR}$, as opposed to the $F_{30\%SPR}$ that was used in the proposed base model. Council staff explained that when the terms of reference for the assessment were submitted, Amendment 51 had not yet been implemented and $F_{30\%SPR}$ is a common MSY proxy for many reef fish stocks and thus was used as a default value. The SSC discussed estimates of recruitment, and whether to use a subset of more recent years or the entire model-derived time series. SSC members thought a consistent approach would be worth investigating. An SSC member thought that the recreational shore mode CPUE might be driving some of the model's estimated increase in recent recruitment, but not the lengths or ages from that fleet due to small sample sizes. Dr. Siegfried added that 2020 data lack contrast due to representing the terminal year in the model. Another SSC member noted that the SSC has in the past used the last 10 years to inform recruitment when a stock is overfished, or when there is some ancillary information to inform using a similar shorter time period. They stated that in this case, there is no clear explanation for why recruitment has increased, and with a healthy stock projection, no immediate reason for being

more conservative with estimating recruitment. Shore landings and the magnitude of recreational discards have increased over time; further, length and age compositions from the fishery-independent fleets are also observing greater numbers of smaller fish, which may also indicate positive recruitment. The SSC discussed whether the stock was in fact as productive as inferred by the F_{MSY} proxy, and the duration of time to use to inform recruitment. Another SSC member thought it may be useful to examine regional estimates of landings over time.

The SSC discussed the use of $F_{26\%SPR}$ for gray snapper, and the parallels drawn at the time for Amendment 51 with the productivity of gray snapper compared to red snapper. At the SSC's January 2019 meeting, the SEFSC presented updated projections for gray snapper using three different values for F_{MSY} proxies ($F_{26\%SPR}$, $F_{30\%SPR}$, and $F_{40\%SPR}$), along with changing the MSST from 1-M*B_{MSY} to 0.5*B_{MSY}. The SSC found the presented analyses to be statistically sound and appropriate, and ultimately recognized that 26% SPR is scientifically acceptable as a proxy for MSY, but maintained its previous recommendation of the more risk averse proxy using 30% SPR because of the uncertainty in the SEDAR 51 assessment. Here, the SSC requested to see projections for SEDAR 75 using an MSY proxy of $F_{26\%SPR}$, consistent with the status quo from Amendment 51 to compare to the results of the current proposed base model.

The SSC discussed recruitment recommendations for the projections. Currently, the overfishing limit (OFL) uses the average model-derived recruitment deviations over the time period from the Beverton-Holt stock recruit relationship, and the acceptable biological catch (ABC) is decremented at 75% of the F_{MSY} proxy. The SSC noted that although recruitment has been observed to be much higher than the recent long-term mean, it is not expected to remain that high. SSC members discussed the merits of using long- and short-term recruitment means for OFL versus the ABC. Dr. Siegfried cautioned that $F_{26\%SPR}$ represents the most optimistic plausible stock productivity estimate by the SSC in 2019, and recruitment is higher than the mean in recent history; however, the model does carry substantial uncertainty about certain parameters like recruitment, so it may be reasonable to consider those facts when evaluating the amount of risk to accept in the OFL and ABC projections. The SSC expressed some reservation about relying heavily on the recent recruitment estimates, absent as yet unheard clear justification of where that strong recruitment signal is coming from. As such, the SSC recommended continuing to use the long-term average recruitment deviations for the OFL. Dr. Tom Frazer, the Council representative, asked that a constant catch scenario for five years (i.e., 2024 – 2028) also be provided for the OFL and ABC. The SSC agreed that the ABC should be projected using 75% of the F_{MSY} proxy. For the interim year of 2021, the SSC recommended using the preliminary recreational and commercial landings from the Southeast Regional Office's Annual Catch Limit Monitoring Database[3].

Updated Projections

Dr. Forrestal described the 2021 recreational landings in pounds whole weight by fleet, and noted that these values were converted to numbers of fish for model input. The F_{MSY} proxy was updated to $F_{26\%SPR}$ concurrent with Amendment 51. Under $F_{26\%SPR}$, the stock is not estimated to be overfished or undergoing overfishing as of 2020. The actual landings for 2021 were added, and the mean of landings from 2019 – 2021 were used to inform the interim years of 2022 and 2023.

[3] https://www.fisheries.noaa.gov/southeast/2020-2021-final-gulf-mexico-stock-annual-catch-limit-landings

OFL and ABC projections for both $F_{26\%SPR}$ and $F_{30\%SPR}$ are shown in the table below, with ABC projected at the yield at 75% of F_{MSY} for each MSY proxy.

Table: OFL and ABC projections in millions of pounds whole weight (mp ww) under $F_{30\%SPR}$ and $F_{26\%SPR}$ for Gulf of Mexico gray snapper in MRIP-FES units.

	$F_{30\%SPR}$		$F_{26\%SPR}$	
Year	**OFL**	**ABC**	**OFL**	**ABC**
2024	7.758	5.820	9.402	7.063
2025	7.171	5.620	8.351	6.633
2026	6.601	5.394	7.405	6.199
2027	6.088	5.167	6.610	5.795
2028	5.647	4.952	5.969	5.438

An SSC member noted that the stock currently has more biomass in the water than is needed to sustain present harvest levels at either F_{MSY} proxy. An SSC member asked about the effect of setting the catch limits below the maximum allowed under each proxy. Another SSC member replied that the constant catch projection does exactly that. An SSC member added that recruitment and biomass would be expected to change with time, with another SSC member noting that $F_{26\%SPR}$ is likely at the lower end of the acceptable spectrum of plausible MSY proxies for gray snapper. The SSC did not consider gray snapper less productive than red snapper, with respect to selecting an F_{MSY} proxy, but did acknowledge that $F_{26\%SPR}$ was among the lowest observed in the Gulf. The SSC acknowledged a planned discussion about setting F_{MSY} proxies for March 2023.

Motion: The SSC moves to accept the SEDAR 75 Gulf of Mexico Gray Snapper Operational Assessment as consistent with the best scientific information available. Under the current F_{MSY} proxy of $F_{26\%SPR}$, the model derived estimates indicate the stock is not overfished and is not undergoing overfishing.

Motion carried without opposition and 3 absent.

Motion: Based on the projection settings accepted by the SSC for the SEDAR 75 Operational Assessment the SSC recommends the following catch levels for Gulf of Mexico Gray Snapper: OFL be set as the yield (million pounds whole weight; mp ww) at $F_{26\%SPR}$ and ABC as the yield (mp ww) at 75% of $F_{26\%SPR}$ for the period 2024-2028.

Year	OFL (mp ww)	ABC (mp ww)
2024	9.402	7.063
2025	8.351	6.633
2026	7.405	6.199
2027	6.610	5.795
2028	5.969	5.438

The SSC also supports the constant catch scenario (which is a mean of the 5-year period) that results in an OFL of 7.547 mp ww and an ABC of 6.226 mp ww.

Motion carried without opposition and with 3 absent.

Meeting Participants

Standing SSC
Jim Nance, *Chair*
Luiz Barbieri, *Vice Chair*
Harry Blanchet
David Chagaris
Roy Crabtree
Benny Gallaway
Doug Gregory
David Griffith
Paul Mickle
Will Patterson
Sean Powers
Steven Scyphers
Jim Tolan
Richard Woodward

Special Reef Fish SSC
Jason Adriance
Mike Allen
John Mareska

Special Ecosystem SSC
Mandy Karnauskas
Josh Kilborn
Steven Saul

Special Socioeconomic SSC
Luke Fairbanks
Cindy Grace-McCaskey
Jack Isaacs

Council Representative
Tom Frazer

A list of all meeting participants can be viewed here.