Gulf of Mexico Fishery Management Council
Scientific and Statistical Committee
Review of SEDAR 67: Gulf Vermilion Snapper
June 1, 2020
Webinar

Mr. Matt Smith of the Southeast Fisheries Science Center presented the SEDAR 67 standard assessment for Gulf of Mexico (Gulf) vermilion snapper, which follows the SEDAR 45 assessment completed in 2016. SEDAR 45 found Gulf vermilion snapper to be healthy, meaning it was not overfished and was not undergoing overfishing, based on data through 2014. SEDAR 67 updated the information in SEDAR 45 through 2017, evaluated new data sources, and reconsidered discards and shrimp bycatch estimates.

Continuity Model

Mr. Smith began by reviewing the continuity model (CM), which is based almost entirely on the work done in SEDAR 45. The CM demonstrated good fits to length composition (in fork length) data, and used externally estimated values for age and growth that were then fixed within the CM. Vermilion snapper shows high fecundity compared to other reef fish. Natural mortality (M) was estimated externally also, with estimates of M prorated for age-0 fish by assuming a June spawn. Landings time series and age composition data were updated for the commercial and recreational fisheries through 2017, with only handline gear being considered for commercial fisheries as landings were very low from bottom longline gear. Declining age composition data from both fleets in recent years was attributed to large recruitment events in 2015 and 2016 resulting in a decrease in mean age, as opposed to any overfishing on older fish. Commercial effort has remained relatively consistent over time. Recreational landings come primarily from the private and for-hire (charter and headboat) fleets in the eastern Gulf, with a large increase in landings observed in 2016 and 2017. Recreational data were collected through the Marine Recreational Information Program (MRIP), including calibrations for the Fishing Effort Survey (FES) back to 1981. Discards were not included in the CM for any directed fisheries. Shrimp bycatch was scaled by upweighting effort in areas with vermilion snapper; shrimp effort has decreased overall in recent years. Fishery-independent surveys showed no change in trend from SEDAR 45, outside of the estimated increase in abundance seen in 2016-2017. Data from Monroe County, Florida are included in the Gulf, consistent with data decisions from SEDAR 45 (Gulf vermilion snapper) and SEDAR 55 (South Atlantic vermilion snapper), since the official placement of the Florida Keys in MRIP is in the Gulf.

The CM was a single area (Gulf-wide), single season, sexes combined model using data from 1950 through 2017. Spawning stock biomass (SSB) was measured as the number of eggs, with growth estimated internally (Beverton-Holt). Age-based selectivity was applied for the directed fisheries, and time blocks were applied to retention functions to account for management changes. Length-based selectivity was used for fishery-independent surveys, and shrimp selectivity was fixed using a super-year approach. The use of MRIP-FES data resulted in an increase in estimated spawning output, with all stock-recruitment relationship parameters being freely estimated in the model. The

large spike in recruitment in 2015 and 2016 (largest and second largest on record, respectively) was supported by several data sources.

Base Model

The base model (BM) for SEDAR 67 was set up very similarly to the CM, with the following exceptions: the combined video survey (Panama City Lab, Pascagoula Lab, and FWRI video surveys) was included; commercial catch-per-unit-effort (CPUE) was truncated at 2007 due to the red snapper individual fishing quota (IFQ) program, and discards from the directed fisheries were included in, but not fit by the model. The combined video survey showed evidence of a large spawning event in 2016. There were good fits between observed and predicted length composition data, with larger fish being observed more often in the northern Gulf than in the south. The methods for estimating CPUE for species affected by IFQ programs are not yet optimal; however, truncating these data at 2007 had little effect on model performance. Discards were included from the directed fisheries in the model, but the model was not made to fit those data. Commercial discards are lower than previously estimated, with the majority of discards coming from the private and for-hire modes of the recreational sector. Since discard numbers are low compared to landings, attempting to include these data in the analysis destabilizes the model and severely underestimates the number of young fish. Discard mortality was set at 15%, with a sensitivity run of 50% showing little effect on biomass as a result of discard mortality. This sensitivity run resulted in the model increasing estimates of recruitment to compensate for the increase in estimated dead discards.

The BM fit directed landings and shrimp bycatch well, but fits to commercial CPUE were poor. Fits to recreational indices were best post-1997, and fishery-independent indices were fit moderately well. Estimates of fishing mortality (F) were highest for the shrimp fleet; however, the private and for-hire fleets represent the most substantial portion of F in recent years. The stock recruitment relationship is poorly understood and poorly fit; however, 2015 and 2016 were shown to be the largest recruitment events on record, and are supported by the fishery-independent surveys. The model showed, from 1950-2017, that vermilion snapper has never been overfished. Overfishing is not occurring as of 2017, but was estimated to have occurred from 1992-2004. Steepness and recruitment were found to be highly correlated, and no pathological trends were observed in spawning output during retrospective analyses. The BM showed stable performance during jitter analyses, with some minor issues seen when trying to fit both age and length composition data simultaneously. The BM was somewhat sensitive to the removal of the combined video index, the removal of which drops the estimate of recruitment in 2015 and 2016, and the subsequent estimate of SSB. The CM and BM matched up well until 2013, with the subsequent divergence in estimates of SSB driven by recent high recruitment. The resultant management reference points from the BM are shown in Table 1.

Table 1. Summary of Magnuson-Stevens Fishery Conservation and Management Act benchmarks and reference points for SEDAR 67. SSB is in billions of eggs, whereas F is a harvest rate (total numbers killed / total exploitable numbers [age 1+]).

Reference Point Criteria		**Current Benchmarks**	
Base natural mortality (M)	0.25	SSB_{2017}	352,682
Steepness	0.713	$F_{Current}$ (geo. mean: 2015-2017)	0.075
Generation Time	7.23	SSB_{2017} / SSB_0 (SPR_{2017})	0.52
SSB_0 (Unfished)	672,597	SSB_{2017} / $SSB_{SPR30\%}$	1.75
SSB_{MSY} = $SSB_{SPR30\%}$	201,747	SSB_{2017} / MSST	3.5
MSST = 0.5*$SSB_{SPR30\%}$	100,874	--MSST Overfished?	No
F_{MSY}	Not Estimable	$F_{Current}$ / MFMT	0.56
MFMT = $F_{SPR30\%}$	0.135	--Overfishing?	No
F_{OY} (F at optimum yield)	0.115		

Projections

Projections of future yields were done under two scenarios. Due to a poor relationship in the spawner-recruit curve, a proxy of F at 30% spawning potential ratio (SPR; $F_{SPR30\%}$) was used as the MSY proxy. The second projection scenario generated as 75% of $F_{SPR30\%}$ (OY). Per Amendment 44 to the Council's Reef Fish Fishery Management Plan, the minimum stock size threshold (MSST) was specified as 50% of the SSB at maximum sustainable yield (MSY; SSB_{MSY}). Recruitment in projection years was fixed at the geometric mean of 2005-2014; 2015 and 2016 were excluded, since those years did not represent typical recruitment events for this stock. Projections begin in 2021, with the gap years of 2018 using actual landings and 2019 and 2020 using the mean of landings from 2016-2018. Fixing recruitment and other parameters within the model underestimates uncertainty, and makes forecasting using the P* method in the Council's Acceptable Biological Catch (ABC) Control Rule difficult.

Projections at $F_{SPR30\%}$ result in the largest relative increase in projected catch, due largely to strong recent recruitment and recent landings being below the annual catch limit (ACL). This combination leads the model to estimate an abundance of fish above the target biomass level (SSB_{MSY}), and as such results in projections that "spike" to high levels before asymptotically decreasing to an equilibrium level. Fishing in future years is presumed to occur at $F_{SPR30\%}$; if the actual F in those years is lower, then "spikes" may occur in successive projections in the future. Projections at 75% of $F_{SPR30\%}$ are lower, and may help account for underestimates of uncertainty inherent in these projections (see Table 2). The increase in projected biomass is due to two main factors: primarily, the transition from the Coastal Household Telephone Survey effort data to the FES in MRIP and the recent strong recruitment events in 2015 and 2016. The effect of the MRIP-FES data on the equilibrium yield is shown in Table 3.

Table 2. Yield projections at 75% of $F_{SPR30\%}$ from SEDAR 67.

Year	SSB	$SSB/SSB_{FSPR30\%}$	SSB/MSST	SSB/SSB_0	Yield (mp ww)
2021	3.73E+14	1.85	3.70	0.55	9.37
2022	3.28E+14	1.62	3.25	0.49	7.87
2023	2.96E+14	1.47	2.94	0.44	6.89
2024	2.75E+14	1.36	2.72	0.41	6.29
2025	2.61E+14	1.30	2.58	0.39	5.95
2026	2.52E+14	1.25	2.50	0.37	5.74
2027	2.46E+14	1.22	2.44	0.37	5.62
2028	2.42E+14	1.20	2.40	0.36	5.54
2029	2.39E+14	1.18	2.37	0.35	5.48
2030	2.37E+14	1.17	2.34	0.35	5.45

Table 3. Comparison of CM and BM reference points and equilibrium yields as a result of including MRIP-FES data for the recreational private and charter for-hire fleets. Equilibrium yield is shown in millions of pounds (mp), whole weight (ww).

Model	Terminal Year	SSB	R	$F_{SPR30\%}$	SSB_0	$SSB_{FSPR30\%}$	Equilibrium Yield
SEDAR 45	2014	1.91E+14	17343.3	0.103	6.56E+14	1.97E+14	3.35
SEDAR 45 FES	2014	2.28E+14	22561.0	0.14	6.51E+14	1.96E+14	5.19
SEDAR 67 Base	2017	2.22E+14	21965.8	0.135	6.73E+14	2.02E+14	5.91

The SSC discussed the large increase in projected ABC (which is presently set equal to the ACL) compared to the current ACL of 3.11 mp ww. It was acknowledged that these "spikes" in yield are common following an assessment for stocks which have not been historically harvested at F_{MSY} (or its proxy), and/or have experienced substantial recent recruitment events. Also, it is not expected that the stock will be regularly harvested at F_{MSY} in the future, given previous years' landings. The SSC thought it more appropriate to recommend average (constant catch) yields as opposed to annual yields, as constant catch may help account for year-to-year variability while also providing consistency for fishers. An SSC member also asked about reviewing the effect of "spikes" on the success of subsequent fishery management decisions to manage the stocks at or below their respective catch limits. Some SSC members expressed concern that by the time the projections go into effect, the fish created from the large recruitment events of 2015 and 2016 may be growing beyond the size commonly selected by the fishery. Further, some concern was expressed about for how long constant catch recommendations should be made.

Motion: The SEDAR 67 Gulf of Mexico Vermilion Snapper assessment is considered the best scientific information available and is suitable for management advice. The stock is not overfished nor undergoing overfishing.

***Motion carried without opposition*.**

Motion: The OFL is the yield at $F_{SPR30\%}$ and the ABC=OY is the yield at 75% of $F_{SPR30\%}$. For constant catch for the years 2021-2025, the OFL and ABC in millions of pounds, whole weight, are:

OFL: 8.60 mp ww
ABC: 7.27 mp ww

Motion carried 19 – 4 with 2 absent.