Tab B, No. 9(d)

Gulf of Mexico Greater Amberjack

SEDAR 70 Executive Summary

January 2021

This document serves as a summary of the full SEDAR 70 Stock Assessment Report (SAR), which can be found at *http://sedarweb.org/sedar-70*.

Stock

This assessment documents the status of the Greater Amberjack (*Seriola dumerili*) resource in the Gulf of Mexico (Gulf) through 2018 and projects the catch limits starting in 2022. The Gulf Greater Amberjack stock ranges from Texas to Florida, including Monroe County north of the Florida Keys.

Stock Status

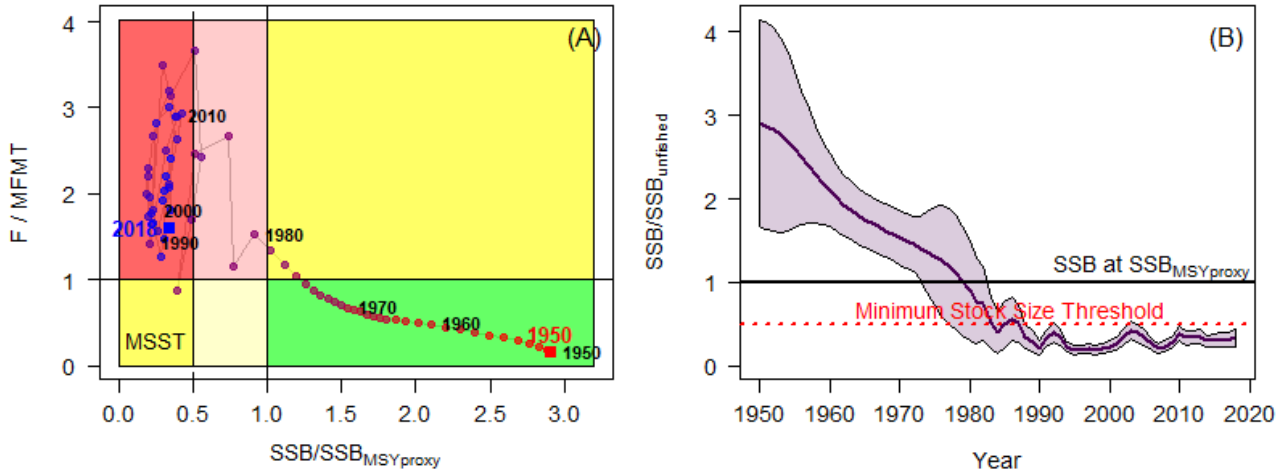

Figure 1: (A) Kobe plot showing the progression of exploitation status for Gulf Greater Amberjack from 1950 to 2018, with the Minimum Stock Size Threshold (MSST) denoted. Each point reflects a single year, labels are specified every 10 years, and colors gradually change from red (1950) through purple and ultimately blue (2018). (B) Ratio of Spawning Stock Biomass (SSB) to unfished SSB relative to the MSY$_{Proxy}$ with 95% asymptotic confidence intervals (shaded region).

Projections were to be completed by forecasting fishing mortality (F) at maximum sustainable yield (F_{MSY}) from the terminal year (2018) using the base assessment model configuration. However, it was not possible to calculate MSY and its associated reference points (F_{MSY} and biomass at MSY; B_{MSY}) since the spawner-recruit relationship was deemed unreliable; therefore, a proxy for F_{MSY} was required. Using an MSY$_{Proxy}$ of 30% spawning potential ratio (SPR) as the benchmark in defining the MSST and maximum fishing mortality threshold (MFMT) in Table 1, the assessment results indicate that Gulf Greater Amberjack was undergoing overfishing ($F_{Current}$/MFMT = 1.73) and was overfished ($SSB_{Current}$/MSST = 0.68) as of the terminal year of the assessment (2018). The Kobe plot illustrates that since 1950, the stock has experienced overfishing between 1977 and 2018,

and has been overfished between 1984 and 2018 (Figure 1). The terminal year estimate of SSB_{2018} divided by the estimated virgin SSB (SSB_0) of 10% remains well below the SPR of 30% at the $SSB_{MSYproxy}$ (Figure 1).

Table 1: Summary of Magnuson-Stevens Reauthorization Act benchmarks and reference points for SEDAR 70. SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total exploitable biomass), and $F_{Current}$ is the geometric mean of F from 2016 - 2018.

Reference Point Criteria		**Current Benchmarks**	
SPR at $SSB_{MSYproxy}$	30%	SSB_{2018}	2,433
Base natural mortality (M)	0.28	$F_{Current\ (geom.\ mean:\ 2016\text{-}2018)}$	0.302
Steepness	0.777	SSB_{2018} / SSB_0 (SPR_{2018})	0.1
Generation Time	7.59	SSB_{2018} / $SSB_{MSYproxy}$	0.34
SSB_0 (Unfished)	23,733	SSB_{2018} / MSST	0.68
$SSB_{MSYproxy}$	7,119	--MSST Overfished?	Yes
MSST = (0.5)*$SSB_{MSYproxy}$	3,560	$F_{Current}$ / MFMT	1.729
MFMT = $F_{MSYproxy}$	0.175	--Overfishing?	Yes
F_{OY} (F at optimum yield)	0.131		

Scientific and Statistical Committee (SSC) Recommendations

The SEDAR 70 stock assessment and projections were reviewed by the Gulf SSC on January 5, 2021. Modifications to projection specifications were requested by the SSC, and updated projections were reviewed on January 7, 2021. Requested modifications included using the reported landings for 2019 and using the average of 2016-2018 landings for both 2020 and 2021 for each fleet. Landings from 2019 were not included in the averaged value input for 2020 and 2021 as they remain preliminary. The SSC accepted the SEDAR 70 stock assessment as the best scientific information available, and deemed it appropriate for providing management advice. The SSC made the following recommendations (in millions of pounds [mp] whole weight [ww]) for the overfishing limit (OFL) and acceptable biological catch (ABC) for 2022 – 2024, based on a rebuilding plan to rebuild the stock by 2027:

OFL mp ww

2022	1.637
2023	2.223
2024	2.781

ABC mp ww

2022	1.255
2023	1.767
2024	2.270

Socioeconomic and Ecosystem Considerations

Although no socioeconomic or ecosystem considerations were incorporated into SEDAR 70, information on Gulf Greater Amberjack was collected from recreational and commercial fishermen via the Gulf of Mexico Fishery Management Council's Something's Fishy tool. This tool incorporates stakeholder input into the stock assessment process via a survey about the species prior to assessment. Stakeholders may identify as private recreational, federal for-hire, commercial, or a combination thereof. Sixty-nine (N = 69) responses were gathered from April 26 through May 26,

2020, with a majority being private angler respondents. Manual classification (reader-validated) of responses identified the majority of comments as positive or neutral, with many comments suggesting the stock is prolific but causing an ecological problem or being a nuisance to fishermen. The automated sentiment analysis (performed via the R 'tidytext' [*https://cran.r-project.org/web/packages/tidytext/index.html*] package and a Bing lexicon library [*https://cran.r-project.org/web/packages/lexicon/lexicon.pdf*]) indicated the majority of comments were either positive (e.g., large, plenty, abundant) or negative (small, limits, problem). Responses when categorized by location indicated many of the negative comments (from the manual analysis) were from eastern Gulf respondents and were possibly due to dissatisfaction with regulations, whereas many of the positive comments in the western Gulf indicated good health.

Projections

Projected retained yields (mp ww) and associated ratios of SSB to SSB_0 were projected under the assumption that all recent fishery dynamics would continue indefinitely (e.g., relative fishing effort, selectivity, and retention) at the average of the 2016-2018 estimated values, and that recruitment would remain constant at the mean value from 2009 to 2018 (1.65 million fish per year). Forecasts begin in 2022, since the 2019, 2020 and 2021 fishing years are already completed or underway. Forecasts were carried out at the $F_{MSYproxy}$ with a P* of 0.5 in order to determine the OFLs (Figure 2). The stock is currently (2018) below the MSST and $SSB_{MSYproxy}$ (Table 1), and forecasts indicate reduced yields starting with 1.255 mp ww in the near-term will allow the stock to rebuild to $SSB_{MSYproxy}$ by 2027 (Figure 2).

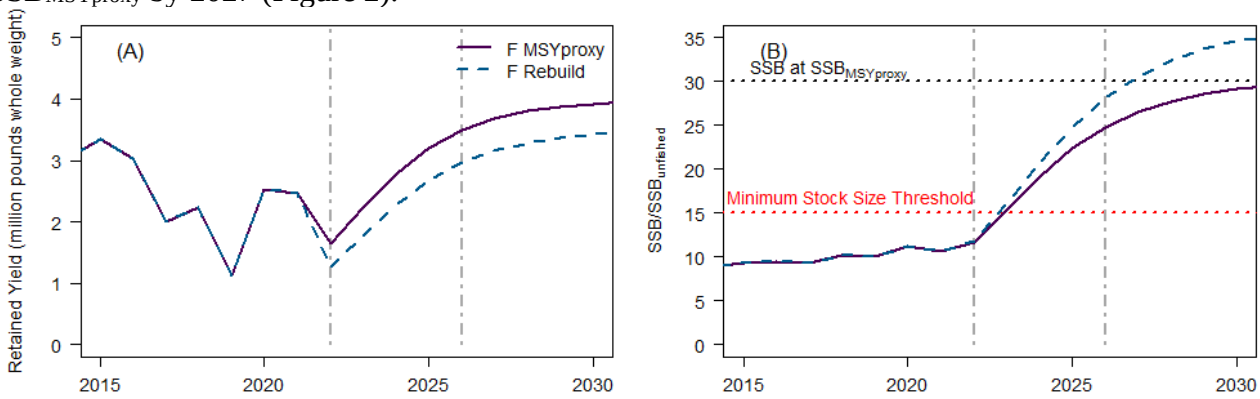

Figure 2: (A) Retained Yield and (B) resulting ratios of SSB to unfished SSB (expressed as a percentage) for projections fishing at $F_{MSYproxy}$ (Base Model) and at $F_{Rebuild}$ which will rebuild the stock to the $SSB_{MSYproxy}$ by 2027. All scenarios assume recent average recruitment (2009-2018), and reference points (defined in Table 1) are marked with horizontal dotted lines. Vertical dashed lines identify the first five years of projected yields: 2022 through 2026.

Data and Assessment

The assessment model used was Stock Synthesis (version 3.30_15). Removal data include landings and/or discards for two commercial fishing fleets (vertical line and longline) and two recreational fishing fleets (headboat and charter/private). Fishery-dependent indices of relative abundance were included for the commercial longline fishery, the recreational headboat fishery and the recreational charter-private fishery (Figure 3). The combined video survey (SEAMAP Mississippi Labs, Panama City Lab, and Florida Fish and Wildlife Conservation Commission) was included as a fishery-independent index of relative abundance (Figure 3).

Relative abundance trends showed declines in the 1980s, relatively low abundance during the 1990s, and has remained variable for the remainder of the time series. Length and age composition data were used to estimate selectivity for each fishery and survey. Length composition data were available for discards, and time-varying retention functions were used to allow for varying discards at size due to the impacts of fishery minimum size limits and bag limits.

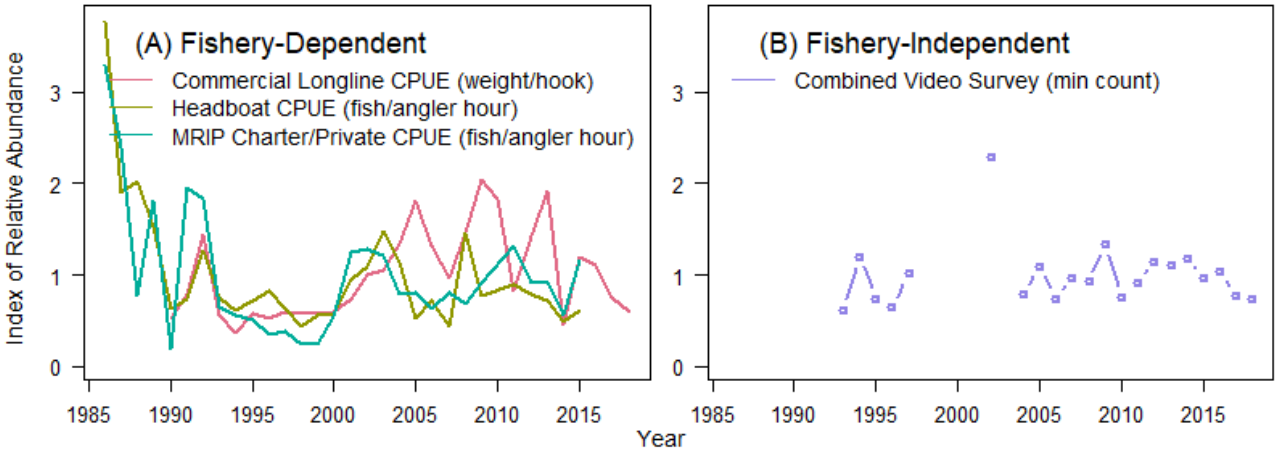

Figure 3: Gulf Greater Amberjack observed indices from SEDAR 70 by (A) fishery and (B) survey, 1986-2018.

Life history equations and parameters used in SEDAR 70 are reported in Table 2. A fixed length-weight relationship was used to convert body length (cm) to body weight (kg). Growth was modeled externally using a single size-modified von Bertalanffy growth curve for both sexes combined, which considers the non-random sampling due to minimum size restrictions (Table 2). An age-specific vector of natural mortality was obtained using the Lorenzen estimator and a target M of 0.28 per year. Fecundity was assumed to be directly proportional to weight and SSB was defined in mature female biomass (metric tons). The Beverton-Holt stock-recruitment model was used in this assessment, with steepness fixed at 0.777 and virgin recruitment estimated.

Table 2: Overview of life history equations and recommended parameters used in SEDAR 70. All lengths and weights were reported in fork length (FL) and whole weight (ww), respectively.

Definition	Equation	Parameters
Total to Fork	$FL = a + b * TL$	a= -24.703 mm , b= 0.912
Length to Weight	$W(t) = a * L(t)^b$	a= 7.05E-05 $kg*cm^{-b}$, b= 2.633
Age to Length	$L(t)=L_{inf}*[1-e^{-K(t-t0)}]$	L_{inf}= 130.706 cm , K= 0.23 yr^{-1} , t_0= -0.757 yr
Base M	$M=exp[1.46 - 1.01 * ln(t_{max})]$	t_{max}= 15 yr , M= 0.28
Maturity	$P_{mat}= 1/(1+e^{slope*[Length-Length50\%]})$	slope= -0.1 , L50%= 82.7 cm
Recruitment	$R_{yr}=[4hR_0SSB_{yr}]*[SSB_0(1-h)+SSB_{yr}(5h-1)]^{-1}$	h= 0.777 , R_0= 3.7 million recruits

Recruitment

With steepness fixed at 0.777, the recruit variance term was estimated at 0.524 and virgin recruitment was estimated at 3.7 million fish. Starting in the early 1970s, when recruitment

deviations were first estimated, recruitment remained above average for most years until the late 1980s (Figure 4). Recruitment remained below average throughout the remainder of the time series, with the exception of the late 1990s/early 2000s and mid-2000s. The lowest recruitment estimate occurred in 1995, at 0.87 million recruits, compared to 6.11 million recruits estimated in 1985.

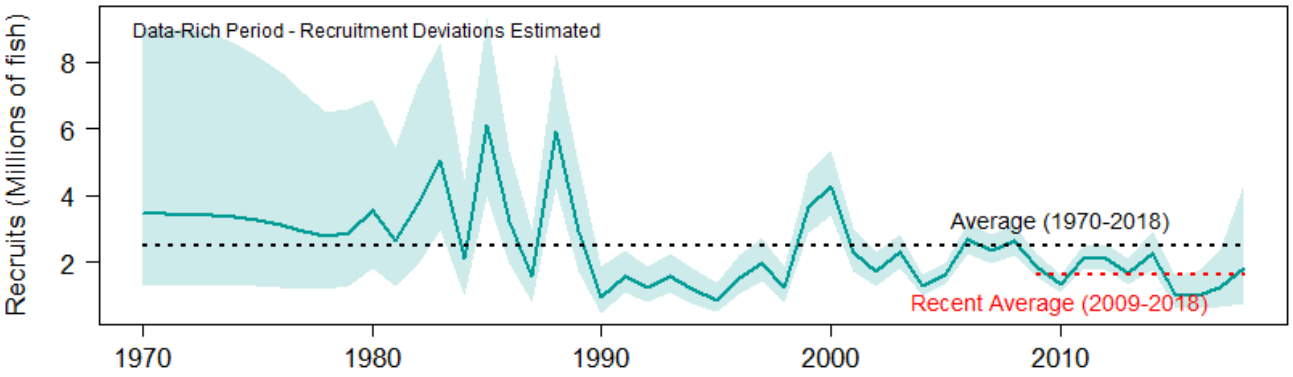

Figure 4: Estimated recruitment (millions of fish) for Gulf Greater Amberjack with 95% asymptotic confidence intervals (shaded region). Dashed horizontal lines represent average recruitment during the time series where recruitment was estimated (black line) and the recent period used for projections (2009-2018; red line).

Landings

Commercial landings of Gulf Greater Amberjack were obtained from the SEFSC's Accumulated Landings System (1963-2018) and the Gulf of Mexico Fisheries Information Network (Louisiana Trip Ticket 2000-2017 and Alabama Trip Ticket 2002-2017). From 1963 to 2018, estimated vertical line fishery landings averaged 0.53 mp ww, with a low of 0.01 mp ww in 1965, and a peak of 1.73 mp ww in 1991. Since 1986, estimates have averaged 0.82 mp ww, with a low of 0.3 mp ww in 2018, and a peak of 1.73 mp ww in 1991 (Figure 5). From 1964 to 2018, estimated longline fishery landings averaged 0.06 mp ww, with a low of 0 mp ww in 1975, and a peak of 0.35 mp ww in 1988. Since 1986, estimates have averaged 0.09 mp ww, with a low of 0.01 mp ww in 2012, and a peak of 0.35 mp ww in 1988 (Figure 5). [See Table 4 of the full SEDAR 70 SAR for commercial landings used in the assessment.]

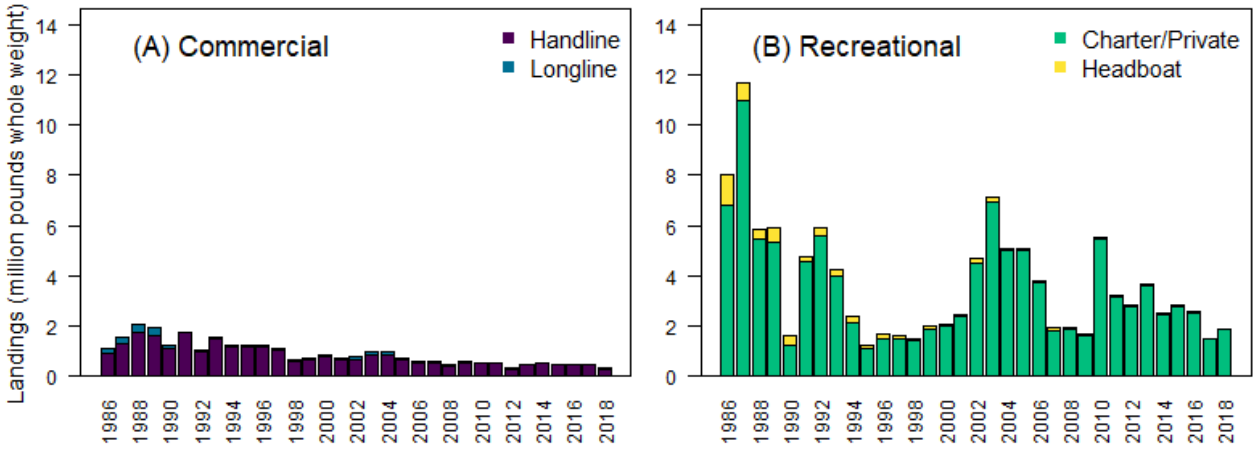

Figure 5: Final Gulf Greater Amberjack landings estimates from SEDAR 70 for commercial and recreational fisheries in millions of pounds whole weight, 1986-2018.

Recreational landings of Gulf Greater Amberjack were obtained from the Marine Recreational Information Program (MRIP-Fishing Effort Survey [FES]-adjusted), the Southeast Region Headboat Survey (SRHS), Texas Parks and Wildlife Department (TPWD), and the Louisiana Creel Survey. Following the three-year transition period for MRIP, estimates of fishing effort for the private and shore modes were obtained from the FES, and the 2013 design change in the Access Point Angler Intercept Survey was accounted for during the transition. A charter calibration analysis was conducted by the Southeast Fisheries Science Center on the newly released MRIP data to correct for the change from the Coastal Household Telephone Survey to the For-Hire Telephone Survey. Recreational landings derived from MRIP were comprised of Gulf Greater Amberjack landed whole and observed by interviewers ("Type A") and those reported as killed by the fishers ("Type B1"). From 1950 to 2018, estimated charter/private landings averaged 3.94 mp ww, with a low of 1.11 mp ww in 1995, and a peak of 10.98 mp ww in 1987. Since 1986, estimates have averaged 3.46 mp ww, with a low of 1.11 mp ww in 1995 and a peak of 10.98 mp ww in 1987 (Figure 5). From 1950 to 2018, estimated headboat landings averaged 0.13 mp ww, with a low of 0.01 mp ww in 1950, and a peak of 1.16 mp ww in 1986. Since 1986, estimates have averaged 0.2 mp ww, with a low of 0.02 mp ww in 2017 and a peak of 1.16 mp ww in 1986 (Figure 5). [See Table 5 of the full SEDAR 70 SAR for recreational landings used in the assessment.]

Discards

Commercial discards of Gulf Greater Amberjack were estimated beginning in 1993 using a catch-per-unit-effort expansion approach that used the coastal observer program (2007-2018) in conjunction with total fishing effort from the commercial reef fish logbook program (1993-2018). While this approach deviates from SEDAR 33 Update (2016), this methodology has been used consistently in recent reef fish assessments. A discard mortality rate of 10% was applied for both the commercial vertical line and longline fleets, following the SEDAR33 Benchmark recommendation and as applied in the SEDAR 33 Update. Commercial vertical line fleet dead discards estimated by the assessment model averaged 0.03 mp ww from 1986-2018, with a low of 0.001 mp ww in 1986 and a peak of 0.1 mp ww in 1991 (Figure 6). Commercial longline fleet dead discards estimated by the assessment model averaged 0.002 mp ww from 1986-2018, with a low of 0 mp ww in 1986 and a peak of 0.01 mp ww in 1990 (Figure 6).

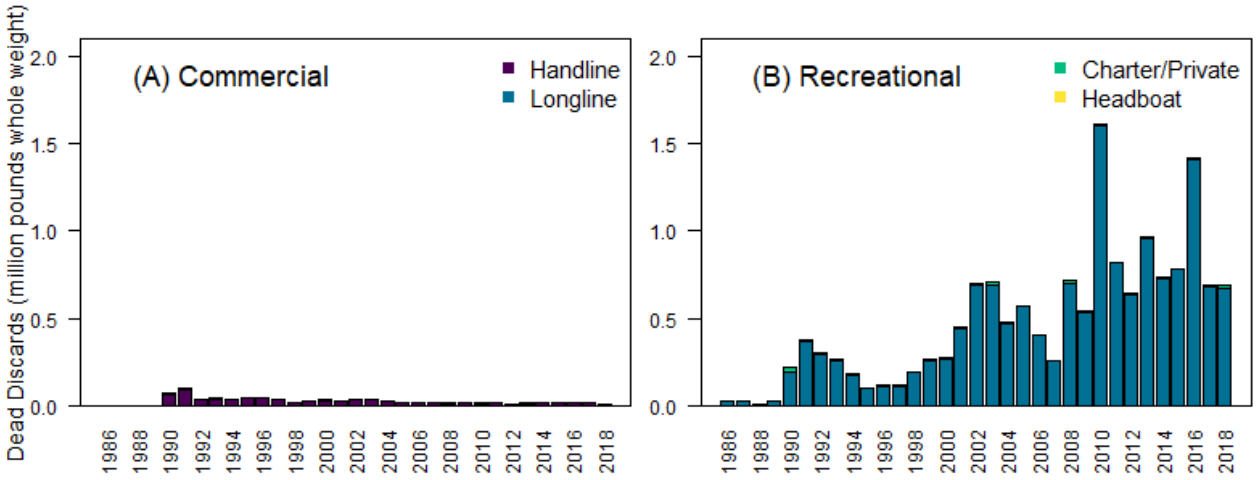

Figure 6: Final Gulf Greater Amberjack discard estimates from SEDAR 70 assessment for commercial (A, by fleet) and recreational (B, by fleet) fisheries in millions of pounds whole weight, 1986-2018. See Table 16 in the full SEDAR 70 SAR for headboat discards which are minor.

Gulf Greater Amberjack recreational discards were derived from MRIP estimates of live released fish (B2) between 1981 and 2018 and using the MRIP charter for-hire discard ratio as a proxy for headboat discards. No discard estimates were provided from Texas. A discard mortality rate of 20% was assumed for the charter/private and headboat fleets as recommended for the SEDAR 33 Benchmark and as applied in the SEDAR 33 Update. Dead discard estimates for the charter/private fleet averaged 0.47 mp ww from 1986-2018, with a low of 0.01 mp ww in 1988 and a peak of 1.61 mp ww in 2010 (Figure 6). Dead discard estimates from headboats averaged 0.008 mp ww from 1986-2018, with a low of 0 mp ww in 1987 and a peak of 0.03 mp ww in 1990 (Figure 6).