Gulf of Mexico Cobia

SEDAR 28 Update Executive Summary

July 2020

This document serves as a summary of the full SEDAR 28 Update Stock Assessment Report (SAR), which can be found at *http://sedarweb.org/docs/sar/2019_S28UpdateSAR.pdf*.

Stock

This assessment documents the status of the Cobia (*Rachycentron canadum*) resource in the Gulf of Mexico (Gulf) through 2018 and projects the quotas starting in 2021. The Gulf Cobia stock ranges from Texas around Florida to the Florida/Georgia state line.

Stock Status

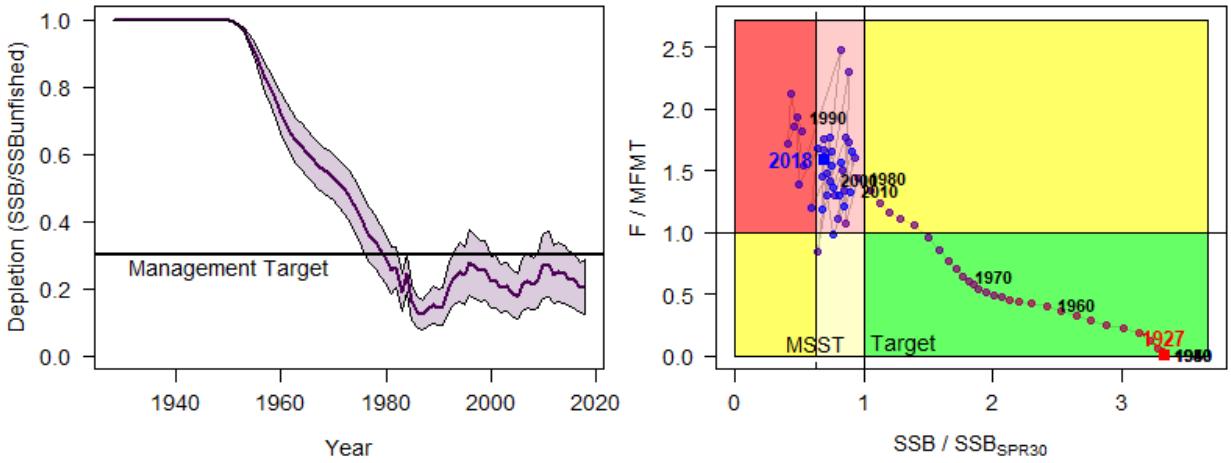

Figure 1: Stock depletion for Gulf Cobia with 95% asymptotic confidence intervals (shaded region) [left panel]. Kobe plot showing the progression of exploitation status from 1927 to 2018, where Target refers to Spawning Stock Biomass (SSB) = SSB at 30% Spawning Potential Ratio (i.e., ratio of 1) and the Minimum Stock Size Threshold (MSST) is denoted [right panel].

Projections were to be completed by forecasting fishing mortality (F) at maximum sustainable yield (F_{MSY}) 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 a spawning potential ratio (SPR) of 30% as the benchmark for defining the minimum stock size threshold (MSST) and maximum fishing mortality threshold (MFMT), the assessment found that Gulf Cobia is undergoing overfishing but is not overfished (Figure 1). However, the terminal year depletion estimate, which is the SSB in the last year of the assessment (SSB_{2018}) divided by the estimated virgin SSB (SSB_0), of 21% remains below the 30% SPR target (Table 1). In 2018, the

stock was being harvested at 144% of MFMT and SSB was 111% of MSST. The Kobe plot illustrates that over the course of the years included in the assessment (i.e., 1927-2018), the stock has experienced overfishing every year from 1975 through 2018 with the exception of 1983 and 2009. Prolonged overfishing reduced stock biomass below $SSB_{SPR30\%}$ (i.e., below Target where SSB = SSB at 30% SPR) for some years, with the stock estimated to have been overfished (i.e., below MSST) from 1985 to 1991 and then again in 2005 before gradually recovering in recent years (Figure 1).

Table 1: Summary of Magnuson-Stevens Reauthorization Act benchmarks and reference points for SEDAR 28 Update. SSB is in metric tons, whereas F is a harvest rate (total biomass killed / total exploitable biomass).

Reference Point Criteria		**Current Benchmarks**	
Base natural mortality (M)	0.38	SSB_{2018}	3,725
Steepness	0.789	$F_{Current\ (geom.\ mean:\ 2016\text{-}2018)}$	0.332
Generation Time	5.51	SSB_{2018} / SSB_0 (SPR_{2018})	0.21
SSB_0 (Unfished)	18,016	SSB_{2018} / $SSB_{SPR30\%}$	0.69
Target SSB = $SSB_{SPR30\%}$	5,406	SSB_{2018} / MSST	1.11
MSST = (1-M)*$SSB_{SPR30\%}$	3,352	--MSST Overfished?	No
F_{MSY}	Not Estimable	$F_{Current}$ / MFMT	1.44
MFMT = $F_{SPR30\%}$	0.231	--Overfishing?	Yes
F_{OY} (F at optimum yield)	0.18		

Scientific and Statistical Committee (SSC) Recommendations [July 2020]

The SEDAR 28 Update stock assessment and projections are scheduled to be reviewed by the SSC on July 21, 2020.

Socioeconomic and Ecosystem Considerations

Although no socioeconomic or ecosystem considerations were incorporated into the SEDAR 28 Update, information on Gulf Cobia was collected from anglers via the Gulf of Mexico Fishery Management Council's Something's Fishy tool. This tool facilitates input from stakeholders into the stock assessment process by querying those stakeholders about a particular species ahead of its assessment. Stakeholders could identify as private recreational, federal for-hire, commercial, or a combination of any of the characterizations (i.e., private recreational and federal for-hire). Between January 8 and February 7, 2020, 584 individual responses were received with several individuals indicating more than one stakeholder identification resulting in 646 sector characterizations. Most identified as private anglers (85%, n=551) whose observations were made off Northwest and Central Florida. Responses were analyzed manually (reader-validated) and using automated sentiment analysis (performed using the tidytext package in R) to determine if they indicated positive, negative, or neutral trends in the Gulf Cobia stock. The manual analysis includes all submitted responses (n = 646), while the automated analysis excludes responses without text in the comments for each question (n = 405).

Manual analysis indicated a negative trend in the perception of stock abundance for a slight majority of respondents (52%), with many comments indicating smaller average sizes in recent years. In addition, negative trends in Gulf Cobia abundance were noted such as spring migrations had either diminished or moved further offshore and the population decline had been occurring since about 2010. For the automated analysis, 46% of respondents indicated a negative trend in the perception of stock abundance relating to key words such as less, decline, limits, fewer, and small/smaller.

Projections

The retained yield and associated depletion were projected under the assumption that all recent fishery dynamics would continue indefinitely (e.g., relative fishing effort, selectivity and retention) and that recruitment would remain constant at the mean value from 2005-2014 (1.26 million fish per year). Forecasts were carried out at the F_{MSY} proxy ($F_{SPR30\%}$) in order to determine the overfishing limits (OFLs) (Figure 2). Forecasts begin in 2021, because the 2019 and 2020 fishing years are already completed or underway. Since the stock is currently below the SPR 30% target, forecasts indicate that a reduction in yield is required in the near-term in order to allow the stock to build towards the target SPR (Figure 2). An optimum yield (OY; yield resulting from fishing at 75% of $F_{SPR30\%}$) projection was also completed. The trends obtained from the OY projection are the same as the OFL run, but result in a relatively higher SPR (35%) with slightly lower annual yield (Figure 2).

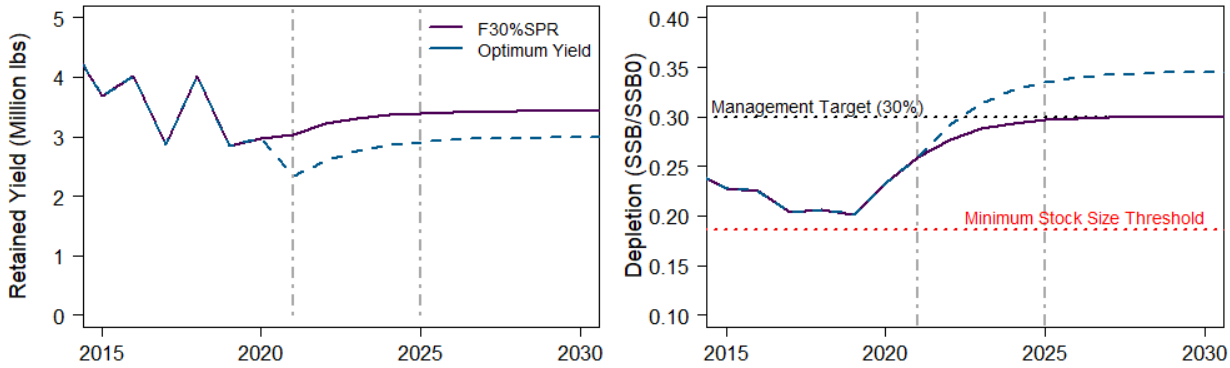

Figure 2: Retained Yield [left panel] and resulting Depletion [right panel] for projections fishing at $F_{SPR30\%}$ (Base Model) and at 75% of this level (Optimum Yield). All scenarios assume recent average recruitment (2005-2014), and reference points are marked with horizontal dotted lines.

Data and Assessment

The assessment model used was Stock Synthesis. Removal data used in the model include landings and/or discards for a combined commercial fishing fleet and a combined recreational fishing fleet. Bycatch removals from the Gulf shrimp fleet were also included. Fishery-dependent indices of relative abundance were included for the recreational headboat fishery and the recreational combined charter-private fishery (Figure 3). No fishery-independent indices are available at this time. Both indices indicate a slight declining trend from 2010 to 2018. Size-based selectivity patterns were specified for the commercial and recreational fisheries, and age-based selectivity was specified for the shrimp trawl fishery. Age composition was modeled as a set of conditional ages at length, and retention functions associated with the minimum size limit were size-based where selected fish below the time-varying minimum retention were discarded.

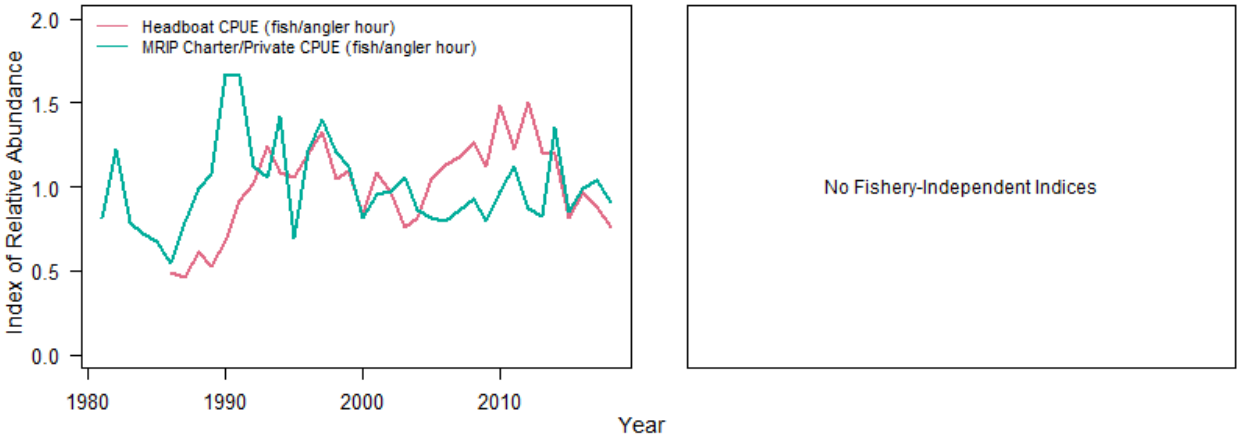

Figure 3: Gulf Cobia observed indices from SEDAR 28 Update by fishery (left panel) and survey (right panel), 1981-2018.

Life history equations and parameters used in SEDAR 28 Update 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. An age-specific vector of M was obtained using the Lorenzen estimator and a target M of 0.38/year. Fecundity was assumed to be directly proportional to female weight and SSB was defined in metric tons. The Beverton-Holt stock-recruitment model was used in this assessment with steepness (the fraction of virgin recruits produced at 30% of the equilibrium SSB) and virgin recruitment estimated.

Table 2: Overview of life history equations and recommended parameters used in SEDAR 28 Update. 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= -10.024 cm , b= 0.900559
Length to Weight	$W(t) = a * L(t)^b$	a= 9.64E-06 $kg*cm^{-b}$, b= 3.03
Age to Length	$L(t)=L_{inf}*[1-e^{-K(t-t0)}]$	L_{inf}= 128.15 cm , K= 0.42 yr^{-1} , t_0= -0.53 yr
Base M	$M=\exp[1.46 - 1.01 * \ln(t_{max})]$	t_{max}= 11 yr , M= 0.38
Maturity	Expert Opinion (see SEDAR28)	probability of being mature: 0 (ages 0, 1), 0.5 (age 2), 1 (ages 3+)
Annual Fecundity	$BF(t) = a * W(t)^b$	a= 1.00E+00 $eggs*cm^{-3*b}$, b= 1
Recruitment	$R_{yr}=[4hR_0SSB_{yr}]*[SSB_0(1-h)+SSB_{yr}(5h-1)]^{-1}$	h= 0.789 , R_0= 1.91 million recruits

Recruitment

With the recruit variance term fixed at 0.6, steepness was estimated to be 0.789 and virgin recruitment was estimated at 1.91 million fish. Since the early 1980s (when recruitment deviations were estimated), recruitment has fluctuated with no consistent trend (Figure 4). The lowest recruitment estimate occurred in 1983, with only 0.16 million recruits in comparison to the 2.34 million recruits estimated in 1982. Recent recruitment is lower on average than the mean recruitment throughout the time series.

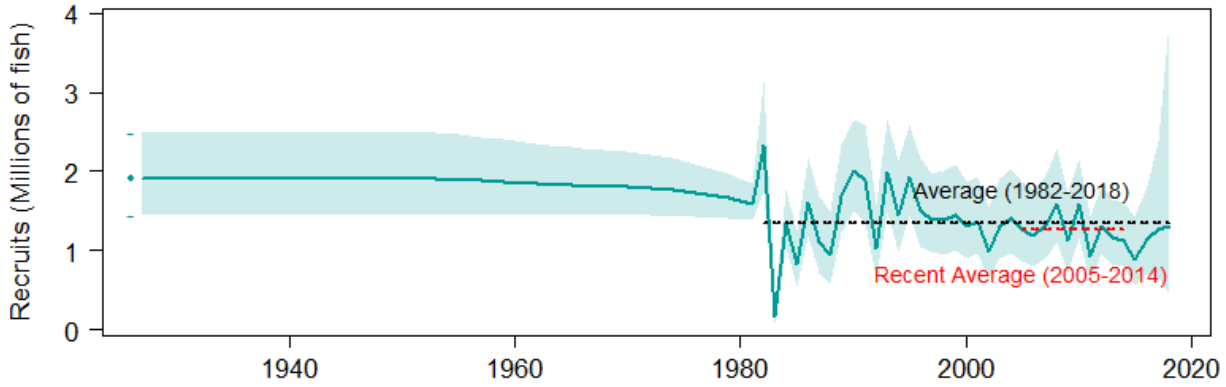

Figure 4: Estimated recruitment (millions of fish) for Gulf Cobia with 95% asymptotic confidence intervals (shaded region). Thin dashed lines represent average recruitment during the time series where recruitment was estimated (upper black line) and the recent period used for projections (2005-2014; lower red line).

Landings

Commercial landings of Gulf Cobia came from a variety of sources: Bureau of Commercial Fisheries reports (1927-1949); National Marine Fisheries Service's Office of Science and Technology (1950-1961); the Annual Landings System (1962-2018), Florida Fish and Wildlife Conservation Commission (1997-2018), and the Gulf Fisheries Information Network (2000-2018). From 1945 to 2018, estimated commercial landings averaged 0.11 million pounds (mp) whole weight (ww), with a low of 0 mp ww in 1945, and a peak of 0.37 mp ww in 1996. Since 1986, estimates have averaged 0.22 mp ww, with a low of 0.07 mp ww in 2018, and a peak of 0.37 mp ww in 1996 (Figure 5). [See Table 4 of the full SEDAR 28 Update document for commercial landings used in the assessment.]

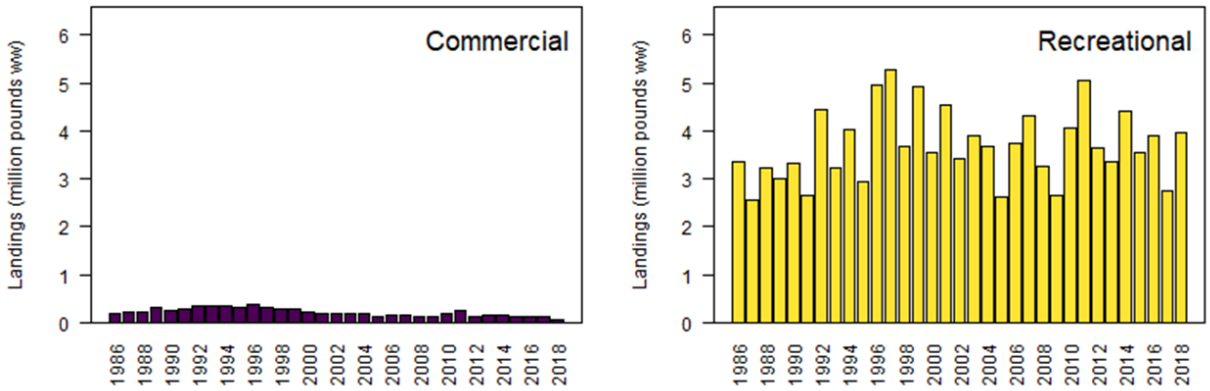

Figure 5: Final Gulf Cobia landings estimates from SEDAR 28 Update for commercial and recreational fisheries in millions of pounds whole weight, 1986-2018.

Recreational landings of Gulf Cobia were obtained from the Marine Recreational Information Program (MRIP-Fishing Effort Survey [FES]-adjusted), the Southeast Region Headboat Survey (SRHS), the Texas Parks and Wildlife Department (TPWD), and Louisiana's LA Creel Survey for all Gulf states and the east coast of Florida. 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 Cobia landed whole and observed by interviewers ("Type A") and Gulf Cobia reported as killed by the fishers ("Type B1"). From 1950 to 2018, estimated recreational landings averaged 3.48 mp ww, with a low of 0.06 mp ww in 1950, and a peak of 7.09 mp ww in 1982. Since 1986, estimates have averaged 3.69 mp ww, with a low of 2.55 mp ww in 1987 and a peak of 5.28 mp ww in 1997 (Figure 5). [See Table 5 of the full SEDAR 28 Update document for recreational landings used in the assessment.]

Discards

Commercial discards of Gulf Cobia were estimated beginning in 1993 using a catch-per-unit-effort expansion approach that used the coastal observer program (2007-2017) in conjunction with total fishing effort from the commercial reef fish logbook program (1993-2018). While this approach deviates from SEDAR 28, this methodology has been used consistently in recent reef fish assessments. A discard mortality rate of 5% for the commercial fleet was applied following the SEDAR 28 recommended methodology. Commercial discards averaged 0.001 mp ww from 1986 to 2018, with a low of 0 mp ww in 2018 and a peak of 0.001 mp ww in 1998.

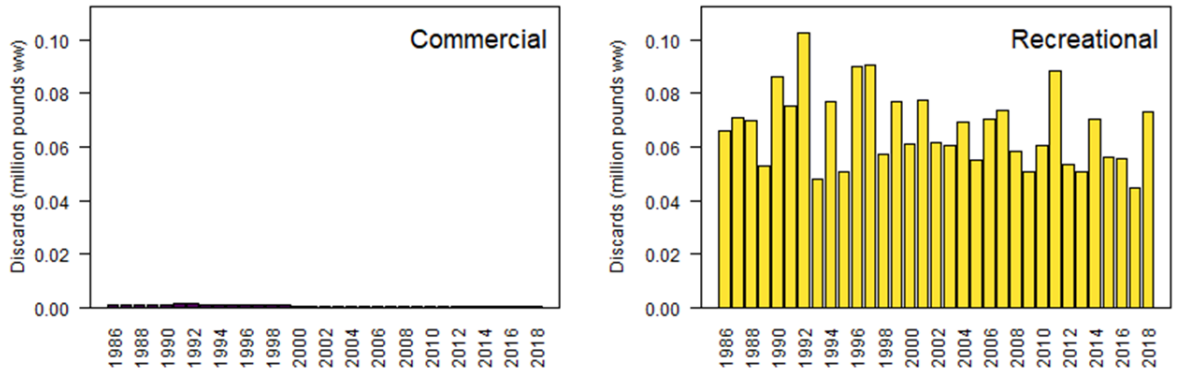

Figure 6: Final Gulf Cobia discard estimates from SEDAR 28 Update assessment for commercial (left panel, by fleet) and recreational (right panel) fisheries in millions of pounds whole weight, 1986-2018.

Cobia recreational discards were derived from MRIP estimates of live released fish (B2), self-reported discards in the SRHS logbook, and TPWD. A discard mortality rate of 5% for the recreational fleet was applied following the SEDAR 28 recommended methodology. Gulf Cobia recreational dead discard estimates averaged 0.07 mp ww from 1986-2018, with a low of 0.04 mp ww in 2017 and a peak of 0.1 mp ww in 1992.