

An Interim Assessment for Gulf of Mexico Gray Triggerfish

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Keywords

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Abstract

An interim assessment was conducted for gray triggerfish following the withdrawal of the SEDAR 62 standard stock assessment (<http://sedarweb.org/sedar-62>). Catch advice for 2021 was produced by applying an index based harvest control rule, buffered through a three-year average, to the combined video index updated through 2019. The combined video index achieved its maximum value in 2009 and has since varied widely; however, it has generally trended upwards since 2012. Strict application of the interim assessment would imply that the current ABC of 305,300 pounds whole weight (GMFMC 2012) would increase to 456,900 pounds whole weight for the 2021 fishing year on the basis of a 1.5 time increase in the video index average for 2017-2019 relative to 2011-2013. ABC adjustments were also calculated for the catch advice generated from the $F_{REBUILD}$ projections produced during SEDAR 43. However, due to the fact that those projections were not used to set the current ABC, we do not recommend that approach to setting the new ABC. OFL adjustments were not calculated as part of this assessment and any ABC advice provided here is much lower than the current OFL of 1.22 million pounds whole weight. This OFL would remain for 2021 unless the Council chooses to make a modification.

Introduction

Interim assessments are designed to occur between regular stock assessments conducted through the Southeast Data Assessment and Review process (SEDAR) to provide the opportunity to adjust harvest recommendations based on current stock conditions. Presently, ABC recommendations for Gulf of Mexico gray triggerfish are based on projections conducted as part of the SEDAR 9 update assessment (SEDAR 2011). Most recently, the SEDAR 62 standard assessment was meant to update catch advice

using data through 2017; however, the assessment was withdrawn due to a number of unanticipated complications that could not be overcome within the assessment schedule. SEDAR 43 was the last accepted assessment for Gulf of Mexico gray triggerfish and was conducted in 2015 with a terminal data year of 2013 (SEDAR 2015). Despite SEDAR 43 being approved for use in management, the previously established ABC of 305,300 pounds whole weight was maintained. This interim assessment provides updated ABC advice recommendations for the SSC and Council to consider when setting catch levels for 2021.

Materials and Methods

Index Data Source

A combined video survey has been developed as a part of Gulf SEDAR assessments since 2015 (Pollack et al. 2015). The goal of the combined video survey is to apply a model-based approach to produce a single index of relative abundance from the spatially and temporally disparate video surveys conducted in the Gulf of Mexico. The NMFS SEAMAP reef fish video survey, carried out by NMFS Mississippi Laboratory, has the longest running time series (1992-1997, 2002, and 2004+), followed by the NMFS Panama City lab survey (2005+), with the most recent survey being the Florida Fish and Wildlife Research Institute SEAMAP survey, which began in 2008. The surveys use standardized deployment, camera field of view, and assessment methods to estimate relative abundance; however, there are variations in survey design and habitat characteristics in addition to the temporal and spatial differences that need to be accounted for in order to properly combine the data sources. To that end, a model-based approach that explicitly accounts for habitat was developed to facilitate the production of a combined index of abundance (Thompson et al. 2019).

Index of Relative Abundance

Preliminary Management Strategy Evaluations identified the video survey index as the index most likely to be reliable for use as an interim assessment index of gray triggerfish. Fishery dependent indices performed very poorly and trends in residuals for the SEAMAP trawl survey did not favor its use in this regard.

A standardized index was developed using data from the three video surveys as described in Thompson et al. 2019. Data were limited to those stations completed in the eastern GOM (east of 87° W). The combined video index was computed in two parts. First, categorical regression trees (CART) were created to identify survey-specific habitat variables that best explain differences in the gray triggerfish presence/absence data by sampling location. Fitting the CART models resulted in the creation of “nodes” (i.e., combinations of the significant habitat variables), for which presence/absence data were used to calculate proportion positive. These nodes were then classified as either poor, fair, or good habitat by comparing the node-specific proportion positive to the overall survey proportion positive. If a node's proportion positive was less than half the overall it was classified as poor, more than double the overall and it was classified as good, with all others being classified as fair. The resulting habitat classification variable was then associated with the individual data points and used to fit a generalized linear mixed model that accounted for year, survey, and habitat with interactions. Backwards variable selection and AIC were used to determine the best model.

Interim Assessment

The interim assessment of gray triggerfish sought to quantify a target ABC adjustment in 2021 through the use of a harvest control rule that utilizes recent trends in observed indices of abundance following the general methodology proposed by Huynh et al. (2020). The harvest control rule takes the form:

$$C_{y+1} = C_{ref} * \left(\frac{1}{3} \sum_{k=y-3}^{y-1} I_k\right) / I_{ref} \quad \text{Equation (1)}$$

where:

C_{ref} = Council specified reference catch level to be adjusted.

C_{y+1} = Adjusted catch recommendation for year $(y+1)$.

I_k = Index value in year k (**Table 1**).

I_{ref} = Reference index value from year(s) corresponding to the reference catch.

Equation 1 was modified slightly from that presented in Huynh et al. (2020) to account for the lack of index data in 2020. I_{ref} was either the average observed index value from 2011 - 2013 or the average observed index value from 2014 - 2016 depending on whether catch advice from the SEDAR 9 update or SEDAR 43 was being adjusted.

We present two approaches. The standard approach sets C_{ref} as the current ABC (305,300 pounds whole weight). The rebuilding C_{ref} approach uses rebuilding projections to modify the predicted ABC in year 2020 based on either the 8, 9 or 10 year rebuilding plan established using the SEDAR 43 assessment (**Table 2**). However, none of the rebuilding plan ABCs were implemented and we do not recommend an approach that modifies an ABC not actually in effect. The approaches presented were selected to give the SSC and Council the opportunity to review catch adjustments to the extant ABC set during the SEDAR 9 update assessment in 2011 and to the proposed ABCs recommended by the SSC during SEDAR 43 but subsequently not adopted by the Council.

Results

Interim Assessment

Combined video data for 2020 were not available for this assessment, meaning that adjustments to the 2021 ABC were made using data through 2019. All updated combined video index values fell within the confidence interval of the index submitted for SEDAR 62 and the trends between indices were very similar. Relative abundance peaked in 2009 and has varied widely since, hitting near time-series lows in 2012 and 2018 before rebounding in 2019 (**Figure 1**).

Standard C_{ref} approach

Adjustments to the SEDAR 9 update based catch advice (305,300 pounds whole weight) were made using a reference index value of 0.660 (average observed index from 2011 - 2013) and a recent index value of 0.988 (average observed index from 2017-2019) which resulted in a recent/reference index ratio of 1.496. Multiplying the index ratio by the reference catch resulted in an adjusted catch

recommendation of 456,900 pounds whole weight for 2021. Splitting the adjusted catch by sector was done using the previously established allocation fractions of 21% commercial and 79% recreational (GMFMC 2008) and resulted in sector specific catch recommendations of 95,900 and 361,000, respectively.

Rebuilding C_{ref} approach

Adjustments to the SEDAR 43 based catch advice were made using a reference index value of 1.055 (average observed index from 2014 - 2016) and a recent index value of 0.988 (average observed index from 2017-2019) which resulted in a recent/reference index ratio of 0.937. Multiplying the index ratio by the 8, 9, and 10 year rebuilding scenario reference catch levels (**Table 2; year 2020**) resulted in 2021 adjusted catch recommendations of 222,000, 394,400, and 522,700 pounds whole weight, respectively. Sector allocations were done as above and resulted in commercial quotas of 46,600, 82,800, and 109,800 and recreational quotas of 175,400, 311,600, and 412,900 for the 8, 9, and 10 year rebuilding scenarios, respectively.

Overfishing Limits

Although the index ratios used to adjust the ABC's could be used in a similar manner to adjust the OFL, that exercise was not undertaken as a part of this assessment. Consequently, the 1.22 million pounds whole weight OFL is recommended for use in 2021. It should be noted that this OFL was derived from SEDAR 43 (**Table 2**) and is a continuation of the rounded 2019 value recommended by the SSC at that time. The OFL is quite a bit higher than the ABC's because it's obtained from an equilibrium projection of $F_{SPR30\%}$ while the ABC's are obtained from 8, 9, or 10 year projections of $F_{REBUILD}$ with a P^* of 0.4 applied.

Discussion

This assessment provides recommendations for the 2021 ABC for Gulf of Mexico gray triggerfish with the presented options being status quo, modified status quo, or modified SEDAR 43 ABC's. The most risk averse approach would be to maintain the status quo and set 2021 ABC at 305,300 pounds whole weight. Status quo management would implement the lowest of the ABC options which would accelerate, relative to the other options, the rebuilding of Gulf gray triggerfish biomass. Gulf gray triggerfish are currently in a rebuilding plan with a target rebuilding date of 2025. The absence of a recent stock assessment makes it impossible to accurately gauge progress toward rebuilding as the interim approach does not assess stock status. Nonetheless, index of abundance trends indicate that it is likely that gray triggerfish biomass has increased in recent years. Additional biomass should support additional removals but it will take a full stock assessment to estimate the catch levels that maximize catch and maintain rebuilding timelines.

Implementing one of the modified options would increase catch in all but one scenario (SEDAR 43, 8 year rebuild). Of the modified options presented, the modified status quo (456,900 pounds) is recommended since it is linked to current management as compared to the options based on the *Rebuilding C_{ref}* values, which were never actually put into management. The modified status quo represents a significant (33%) increase in catch over status quo (**Table 3**) and the effect that increase has on the rebuilding of the gray triggerfish stock could not be determined from this analysis. The increase is

predicated on the increase in the stock implied by the ratio of the average video index for 2017-2019 relative to 2011-2013 (**Figure 1**) of 1.5. Regardless of what catch advice is ultimately implemented for 2021, only a new assessment of Gulf of Mexico gray triggerfish could fully evaluate progress towards rebuilding.

Future interim assessments will base index selection and harvest control rule parametrization decisions on output obtained from an MSE. In the southeast these MSE's will be conducted using an extension to the stock synthesis assessment software being developed by the SSMSE research program (<https://github.com/nmfs-fish-tools/SSMSE>). The SSMSE tool is still under active development which creates an opportunity for stakeholders to suggest specific performance metrics (e.g., probability of overfishing, average yield, catch stability, etc.) that would facilitate the process of selecting the index/harvest control rule combination that best achieves the desired management outcome for any species in the fisheries management plan. Many MSE tradeoffs are fundamentally about balancing varied and sometimes competing management goals and thus necessitate the involvement of management stakeholders. In these situations, the fundamental tradeoff is usually between total yield and interannual stability of yield (Miller et al. 2019). Often stakeholders prefer management procedures that result in greater stability (usually less than a 20% change in quota from one period to the next) over the management procedures that give the highest potential yield due to preferring market stability and predictability. While we have not conducted a full stakeholder-inclusive MSE as this requires an extended period of time, similar preferences for stability are generally universal.

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Figure 1. Combined video index for Gulf of Mexico gray triggerfish updated through 2019. Figure depicts the nominal index (orange), the standardized index (blue) and upper and lower confidence limits for the standardized index (dashed). The standard C_{ref} (2011 - 2013 average) is highlighted by the red circle, the rebuilding C_{ref} (2014 - 2016 average) is highlighted by the red triangle and the recent observed index (2017 - 2019 average) is shown by the red horizontal line. Vertical lines depict the terminal data year of SEDAR 9 update (2010) and SEDAR 43 (2013).

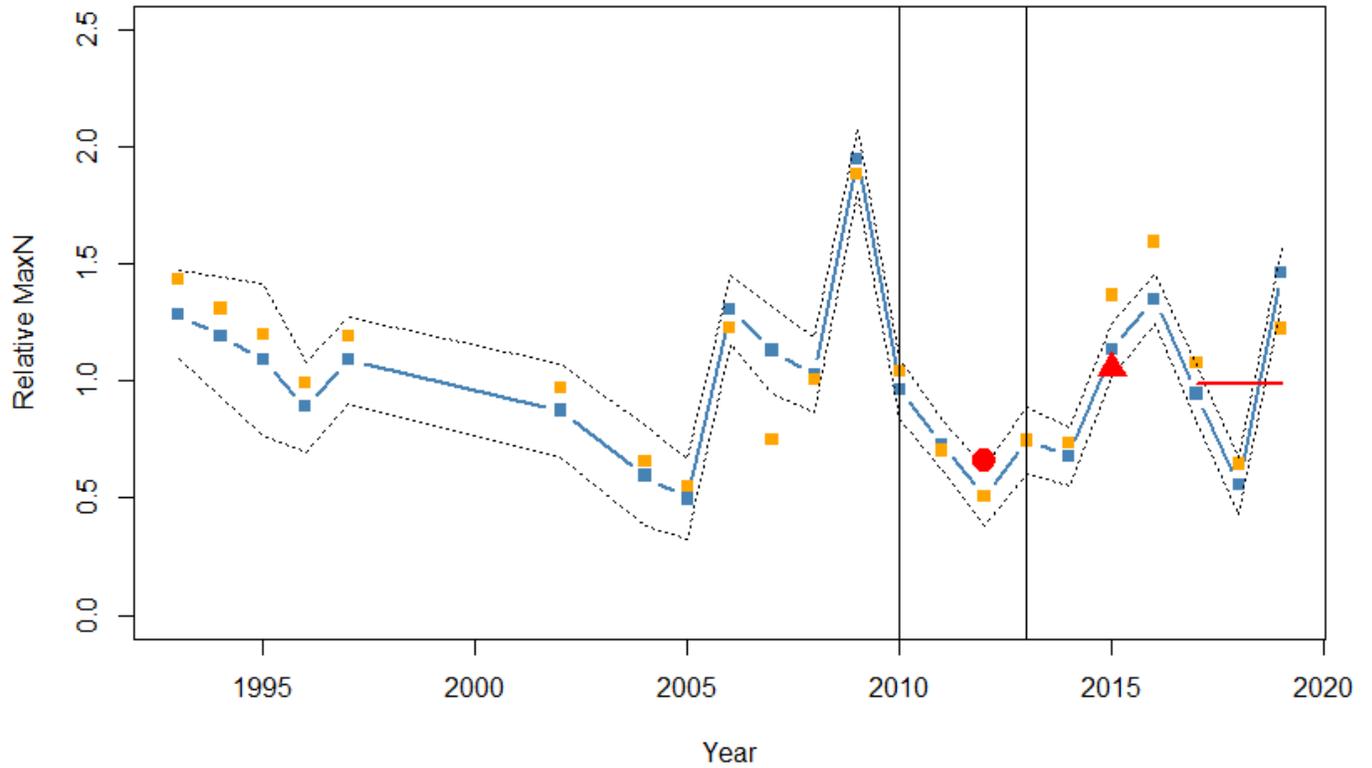


Table 1. Summary of output produced during the standardization of the combined video survey. Standardized index values were used in the interim assessment calculations.

Year	N	Proportion Positive	Standardized Index	Nominal Index	CV
1993	114	0.32	1.29	1.44	0.19
1994	82	0.37	1.19	1.31	0.26
1995	55	0.29	1.09	1.20	0.33
1996	133	0.29	0.89	0.99	0.19
1997	162	0.31	1.09	1.19	0.19
1998	–	–	–	–	–
1999	–	–	–	–	–
2000	–	–	–	–	–
2001	–	–	–	–	–
2002	151	0.21	0.87	0.97	0.20
2003	–	–	–	–	–
2004	149	0.19	0.60	0.66	0.21
2005	274	0.16	0.50	0.55	0.17
2006	370	0.26	1.31	1.23	0.14
2007	377	0.17	1.13	0.75	0.18
2008	291	0.22	1.03	1.01	0.16
2009	367	0.31	1.95	1.88	0.14
2010	509	0.17	0.97	1.04	0.13
2011	715	0.18	0.72	0.70	0.11
2012	668	0.13	0.51	0.50	0.12
2013	448	0.17	0.75	0.75	0.14
2014	672	0.17	0.68	0.74	0.13
2015	518	0.23	1.13	1.37	0.11
2016	565	0.29	1.35	1.59	0.11
2017	527	0.22	0.95	1.08	0.12
2018	423	0.17	0.56	0.65	0.12
2019	618	0.22	1.46	1.22	0.12

Table 2. Overfishing limits (OFL) and acceptable biological catch (ABC) estimated during the SEDAR 9 update assessment (ABC = optimum yield projection) and SEDAR 43 (ABC = projections of 8, 9, and 10 year $F_{REBUILD}$ scenarios with a P^* of 0.4)

Year	Assessment	OFL	ABC	ABC₂₀₂₄	ABC₂₀₂₅	ABC₂₀₂₆
				8-year rebuild	9-year rebuild	10-year rebuild
2012	SEDAR 9 -update	401,600	305,300	–	–	–
2013	SEDAR 9 -update	429,300	348,000	–	–	–
2014	SEDAR 9 -update	449,300	383,900	–	–	–
2015	SEDAR 9 -update	463,600	412,400	–	–	–
2016	SEDAR 9 -update	473,400	433,900	–	–	–
2017	SEDAR43	1,309,000	–	216,000	399,000	546,000
2018	SEDAR 43	1,287,000	–	227,000	412,000	554,000
2019	SEDAR 43	1,218,000	–	233,000	417,000	555,000
2020	SEDAR 43	1,187,000	–	237,000	421,000	558,000

Table 3. Sector-specific landings of Gulf of Mexico gray triggerfish reported by the ACL monitoring group at the Southeast Regional Office of NMFS. Total landings vary year to year due to overages and accountability measures reducing the effective ABC in subsequent years. The recreational fishery has experienced in-season closures annually since 2012 and the commercial season was closed in 2012 and then annually since 2017.

Year	Recreational Landings	Commercial Landings	Total Landings	ABC
2012	277,720	72,778	350,498	305,300
2013	453,251	63,086	516,337	305,300
2014	217,891	40,908	258,799	305,300
2015	94,174	48,013	142,187	305,300
2016	432,641	59,787	492,428	305,300
2017	62,731	63,264	125,995	305,300
2018	461,900	65,372	527,272	305,300
2019	310,868	62,203	373,071	305,300