

Adjustment of SEDAR61 Gulf Red Grouper Projected Catch Streams Using Mean Weight of Recreationally Landed Fish from ACL Monitoring

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Keywords

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Abstract

This document describes the adjustment of SEDAR61 assessment expected recreational landings in weights using a mean weight scalar approach. The mean weight scalar is the ratio of the mean weight of Red Grouper landed by the recreational fishery (from the ACL monitoring dataset developed at the Southeast Fisheries Science Center), to the mean weight of Red Grouper expected by the SEDAR61 assessment model. Adjustments to projected yields streams are provided along with an adjusted OverFishing Limit and an adjusted Acceptable Biological Catch following the recommendations by the Gulf of Mexico Fishery Management Council's Scientific and Statistical Committee.

Introduction

The Standard SEDAR61 stock assessment (<http://sedarweb.org/sedar-61>) for Red Grouper fit to recreational landings in numbers of fish (see Figure 4.2 in Full SEDAR61 Stock Assessment Report). Gulf assessments have traditionally fit to recreational landings in numbers because numbers are the native units of recreational monitoring surveys. The assessment model used the mean weight of retained Red Grouper (based on lengths) to convert recreational landings into weights. A comparison between mean size of landed Red Grouper predicted by the assessment model and the ACL monitoring dataset revealed that the assessment model underpredicted the size of landed Red Grouper. Since Red Grouper are monitored in terms of weights for

management, we adjusted the assessment predicted recreational landings in weights using a mean weight scalar for Red Grouper discussed below.

Materials and Methods

ACL Monitoring Dataset

Recreational landings in numbers and weights were obtained from the Southeast Fisheries Science Center (SEFSC) Annual Catch Limits (ACL) monitoring dataset (**Table 1**). These data include landings estimates from the Marine Recreational Information Program (MRIP-Fishing Effort Survey [FES]-adjusted), formerly the Marine Recreational Fisheries Statistics Survey, and the Southeast Region Headboat Survey. Recreational landings derived from MRIP-FES were comprised of Red Grouper landed whole and observed by interviewers (“Type A”) and Red Grouper reported as killed by the fishers (“Type B1”). Weight estimates were developed by the SEFSC and used the Marine Recreational Information Program (MRIP) sample data to obtain an average weight by strata using the following hierarchy (from coarsest to finest): species, region, year, state, mode, wave, and area (Matter and Rios 2013). Average weights were then multiplied by the landings estimates in numbers to obtain estimates of landings in weight and converted to gutted weights. Final estimates of landings were available through 2019.

Assessment Predicted Recreational Landings in Numbers

The SEDAR61 Red Grouper assessment model fit to recreational landings in numbers with considerable uncertainty (**Table 2**). An output of the assessment model was the predicted recreational landings in weights, which were obtained by taking the predicted catch-at-age and multiplying them by a weight derived from the growth curve, selectivity assumptions, and the length-weight conversion.

Assessment Projection Specifications

Retained yields were projected starting in 2020 under assumed conditions of recent average recruitment, catch allocations of 59.3% commercial and 40.7% recreational (GMFMC 2021), selectivity and retention similar to 2017, and assuming the 2018 red tide event had a similar impact on the population as the 2005 red tide event. Additional details on projection specifications are provided in Section 5.2 of the Full SEDAR61 Stock Assessment Report. For SEDAR61, the OverFishing Limit (OFL) was set as the average projected yield between 2020 and 2024 for the projection achieving 30% spawning potential ratio in equilibrium. Following the revised allocations specified above, this led to an OFL of 4.66 million pounds gutted weight and an Acceptable Biological Catch (ABC) of 4.26 million pounds gutted weight, which was based on a 30% probability of overfishing, as recommended by the Gulf of Mexico Fishery Management Council’s Scientific and Statistical Committee (GMFMC SSC). The adjustments presented herein were based on updated projections for the SEDAR61 assessment model using the adjusted recreational catches to ensure that projected allocations from 2020 throughout the projection period remained at 59.3% commercial and 40.7% recreational (GMFMC 2021).

Mean Weight Scalar

The assessment predicted landings in weights for 2020 through 2024 were adjusted by a mean weight scalar. The mean weight scalar (MW Scalar) was determined as:

$$MW \text{ Scalar} = \frac{2019 \text{ mean weight from ACL monitoring dataset}}{2019 \text{ projected mean weight by SEDAR61 assessment model}}$$

Mean weight in 2018 was not considered representative due to concerns over how the 2018 red tide event impacted the size and age structure of the Red Grouper population. Mean weight in 2020 was also not considered representative due to sampling issues experienced due to COVID-19.

Results and Discussion

Comparison of Mean Weight of Landed Red Grouper

The assessment model predicted a mean size of about 4 pounds gutted weight (range: 3.7-4.3) per Red Grouper landed, which is considerably lower than the mean weight of about 6.1 pounds gutted weight (range: 2.7-7.6) based on the ACL monitoring dataset (**Figure 1**). The underestimation was caused by the growth curve, which was externally fit and fixed in the assessment model, and the assumed distribution regarding the variability-at-length (i.e., the coefficient of variation). The assessment model ultimately inferred the weights, which were lower than observed in the ACL monitoring dataset. After adjusting for the mean weight of Red Grouper landed by the recreational fishery based on the ACL monitoring dataset, the recreational landings estimates are closer to the landings used to monitor ACLs (**Figure 2**).

Adjustment to Projected Yield Streams, OFL and ABC

The assessment predicted landings in weights for 2020 through 2024 were adjusted by a mean weight scalar of 1.597. Assuming the same decisions on how to specify OFL and ABC would be made by the GMFMC SSC, this analysis results in an OFL of 5.99 million pounds gutted weight and an ABC of 5.57 million pounds gutted weight. These results can be considered for interim use until the next scheduled Red Grouper assessment.

References

Gulf of Mexico Fishery Management Council (GMFMC). 2021. Revised Draft Reef Fish Amendment 53. Red Grouper Allocations and Annual Catch Levels and Targets. National Marine Fisheries Service, NA15NMF4410011, Tampa, Florida.

Tables

Table 1. Recreational landings of Red Grouper in numbers and weights (pounds gutted weight) from the SEFSC ACL monitoring dataset accessed March 2021. The mean weight of landed Red Grouper (pounds gutted weight) was determined by dividing the estimates of weight by numbers.

Year	Number	Weight	Mean Weight
1986	1,253,263	3,361,932	2.683
1987	847,713	2,495,130	2.943
1988	1,638,290	4,717,002	2.879
1989	2,351,753	7,632,792	3.246
1990	639,378	4,014,324	6.278
1991	608,242	3,835,736	6.306
1992	974,795	6,338,446	6.502
1993	864,533	5,159,771	5.968
1994	580,434	3,868,766	6.665
1995	553,816	3,496,543	6.314
1996	147,678	910,312	6.164
1997	177,087	1,142,957	6.454
1998	211,812	1,513,889	7.147
1999	491,659	3,428,552	6.973
2000	612,808	4,242,230	6.923
2001	367,036	2,435,455	6.635
2002	451,178	3,172,347	7.031
2003	356,913	2,201,496	6.168
2004	1,233,846	7,983,238	6.470
2005	485,596	3,081,978	6.347
2006	377,438	2,655,064	7.034
2007	316,788	2,031,717	6.413
2008	258,027	1,604,325	6.218
2009	211,125	1,609,246	7.622
2010	338,182	1,963,762	5.807
2011	282,933	1,534,112	5.422
2012	696,535	4,131,722	5.932

Table 1 Continued. Recreational landings of Red Grouper in numbers and weights (pounds gutted weight) from the SEFSC ACL monitoring dataset accessed March 2021. The mean weight of landed Red Grouper (pounds gutted weight) was determined by dividing the estimates of weight by numbers.

Year	Number	Weight	Mean Weight
2013	872,842	4,990,310	5.717
2014	870,135	5,367,913	6.169
2015	542,994	3,790,613	6.981
2016	407,617	2,632,749	6.459
2017	248,270	1,692,513	6.817
2018	281,882	2,053,446	7.285
2019	263,461	1,638,047	6.217

Table 2. Input (with log-scale standard errors, SE) and expected (Exp) landings for the recreational fishery in weight (B, pounds gutted weight) and number (N) for Gulf of Mexico Red Grouper. The mean body weight (MW, pounds gutted weight) expected by the assessment model was determined by dividing the expected landings in weights by numbers of fish. The mean weight scalar (MW Scalar) is the ratio between the ACL monitoring mean weight (**Table 1**) and the assessment expected mean weight (Exp MW). Adjusted landings were determined by multiplying the assessment predicted biomass (Exp B) by the mean weight scalar (MW Scalar).

Year	SE	Input N	Exp N	Exp B	Exp MW	MW Scalar	Adjusted B
1986	0.05	1,248,540	1,187,050	4,676,991	3.940	0.6808	3,184,313
1987	0.3	847,710	401,954	1,579,246	3.929	0.7492	1,183,097
1988	0.3	1,617,440	903,609	3,547,850	3.926	0.7333	2,601,691
1989	0.3	2,351,750	1,763,040	6,907,361	3.918	0.8284	5,722,079
1990	0.3	565,315	453,855	1,782,873	3.928	1.5983	2,849,521
1991	0.3	595,541	530,945	2,083,650	3.924	1.6069	3,348,280
1992	0.3	930,369	648,226	2,550,943	3.935	1.6523	4,214,984
1993	0.3	677,700	478,096	1,884,941	3.943	1.5138	2,853,408
1994	0.3	574,165	491,749	1,941,829	3.949	1.6879	3,277,654
1995	0.3	553,818	580,187	2,298,184	3.961	1.5939	3,663,038
1996	0.3	147,679	166,297	660,867	3.974	1.5511	1,025,083
1997	0.3	177,087	229,529	916,211	3.992	1.6169	1,481,429
1998	0.3	211,813	331,708	1,334,851	4.024	1.7761	2,370,826

Table 2 Continued. Input (with log-scale standard errors, SE) and expected (Exp) landings for the recreational fishery in weight (B, pounds gutted weight) and number (N) for Gulf of Mexico Red Grouper. The mean body weight (MW, pounds gutted weight) expected by the assessment model was determined by dividing the expected landings in weights by numbers of fish. The mean weight scalar (MW Scalar) is the ratio between the ACL monitoring mean weight (**Table 1**) and the assessment expected mean weight (Exp MW). Adjusted landings were determined by multiplying the assessment predicted biomass (Exp B) by the mean weight scalar (MW Scalar). Gray shading identifies the first two projection years where input landings in numbers were fixed at 2018 final estimates (2019 assumed identical at the time of projection development for SEDAR61).

Year	SE	Input N	Exp N	Exp B	Exp MW	MW Scalar	Adjusted B
1999	0.3	491,657	629,023	2,548,893	4.052	1.7209	4,386,452
2000	0.3	612,857	582,334	2,320,450	3.985	1.7373	4,031,271
2001	0.3	367,038	391,870	1,576,488	4.023	1.6494	2,600,241
2002	0.3	451,176	400,263	1,617,359	4.041	1.7401	2,814,351
2003	0.3	356,915	374,211	1,428,267	3.817	1.6161	2,308,193
2004	0.3	1,234,420	1,074,320	4,211,970	3.921	1.6503	6,951,072
2005	0.3	485,616	452,022	1,853,677	4.101	1.5477	2,868,891
2006	0.3	377,453	351,907	1,434,909	4.078	1.7252	2,475,468
2007	0.3	316,790	273,017	1,114,475	4.082	1.5711	1,750,992
2008	0.3	258,029	432,713	1,799,607	4.159	1.4950	2,690,465
2009	0.3	209,833	317,532	1,290,077	4.063	1.8761	2,420,306
2010	0.3	338,181	399,218	1,495,779	3.747	1.5498	2,318,187
2011	0.3	282,933	530,875	2,042,620	3.848	1.4092	2,878,498
2012	0.3	696,535	860,610	3,520,403	4.091	1.4501	5,104,985
2013	0.3	872,840	1,068,150	4,535,763	4.246	1.3464	6,106,947
2014	0.3	870,134	924,319	3,946,710	4.270	1.4448	5,702,177
2015	0.3	542,995	506,343	2,140,311	4.227	1.6515	3,534,754
2016	0.3	407,616	327,821	1,360,958	4.152	1.5558	2,117,356
2017	0.3	248,199	218,995	872,581	3.984	1.7109	1,492,938
2018	NA	210,613	210,613	802,325	3.809	1.9123	1,534,267
2019	NA	210,613	210,613	819,843	3.893	1.5972	1,309,469

Table 3. Expected (Exp) landings for the recreational fishery in weight (B, pounds gutted weight) for Gulf of Mexico Red Grouper. The mean weight scalar (MW Scalar) is the ratio between the ACL monitoring mean weight and the assessment expected mean weight (Exp MW; **Table 2**). Adjusted recreational landings (Rec Adj B) were determined by multiplying the assessment predicted recreational weights (Rec Exp B) by the mean weight scalar (MW Scalar). Adjusted is the total catch stream after adjusting the SEDAR61 assessment predicted recreational landings in weights by the mean weight scalar (MW Scalar) and adding them to the projected commercial landings in weights.

Year	Rec Exp B	MW Scalar	Rec Adj B	Adjusted
2020	1,642,120	1.5972	2,622,826	6,443,770
2021	1,573,668	1.5972	2,513,494	6,175,135
2022	1,497,516	1.5972	2,391,863	5,876,300
2023	1,448,697	1.5972	2,313,888	5,684,655
2024	1,470,781	1.5972	2,349,161	5,771,170
Mean	1,526,556	1.5972	2,438,246	5,990,206

Table 4. Estimated probability of overfishing in 2020 through 2024 for Gulf of Mexico Red Grouper after adjusting recreational landings in weights. The probability of overfishing was determined by summing up the area under each probability density function (PDF) curve of retained yield (millions of pounds).

Value	Retained Yield	Probability of Overfishing
OFL	5.99	0.50
	5.84	0.43
	5.78	0.40
ABC	5.57	0.30

Figures

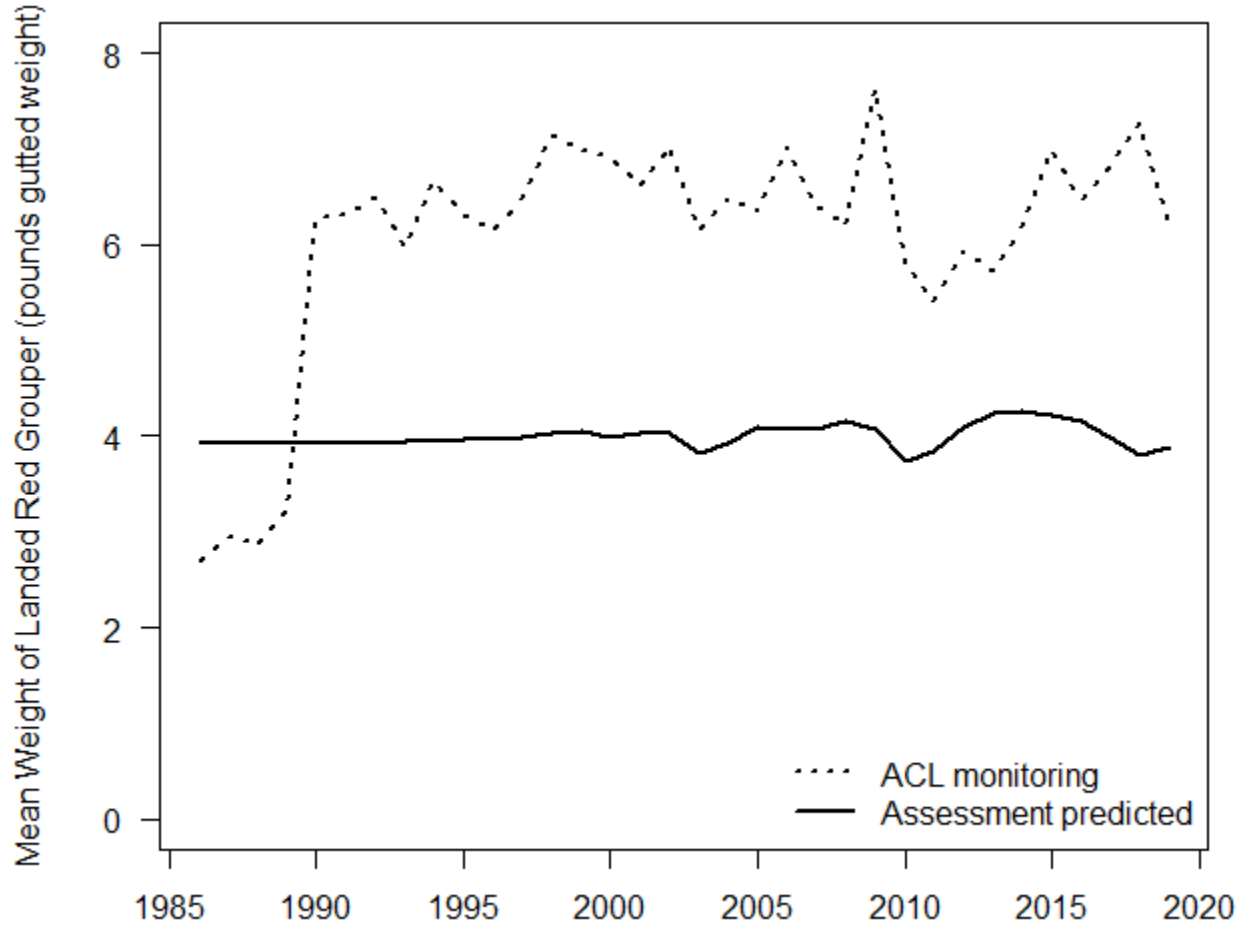


Figure 1. Comparison of mean weight of Gulf of Mexico Red Grouper landed by the recreational fishery based on the SEDAR61 assessment model predicted landings and the ACL monitoring dataset.

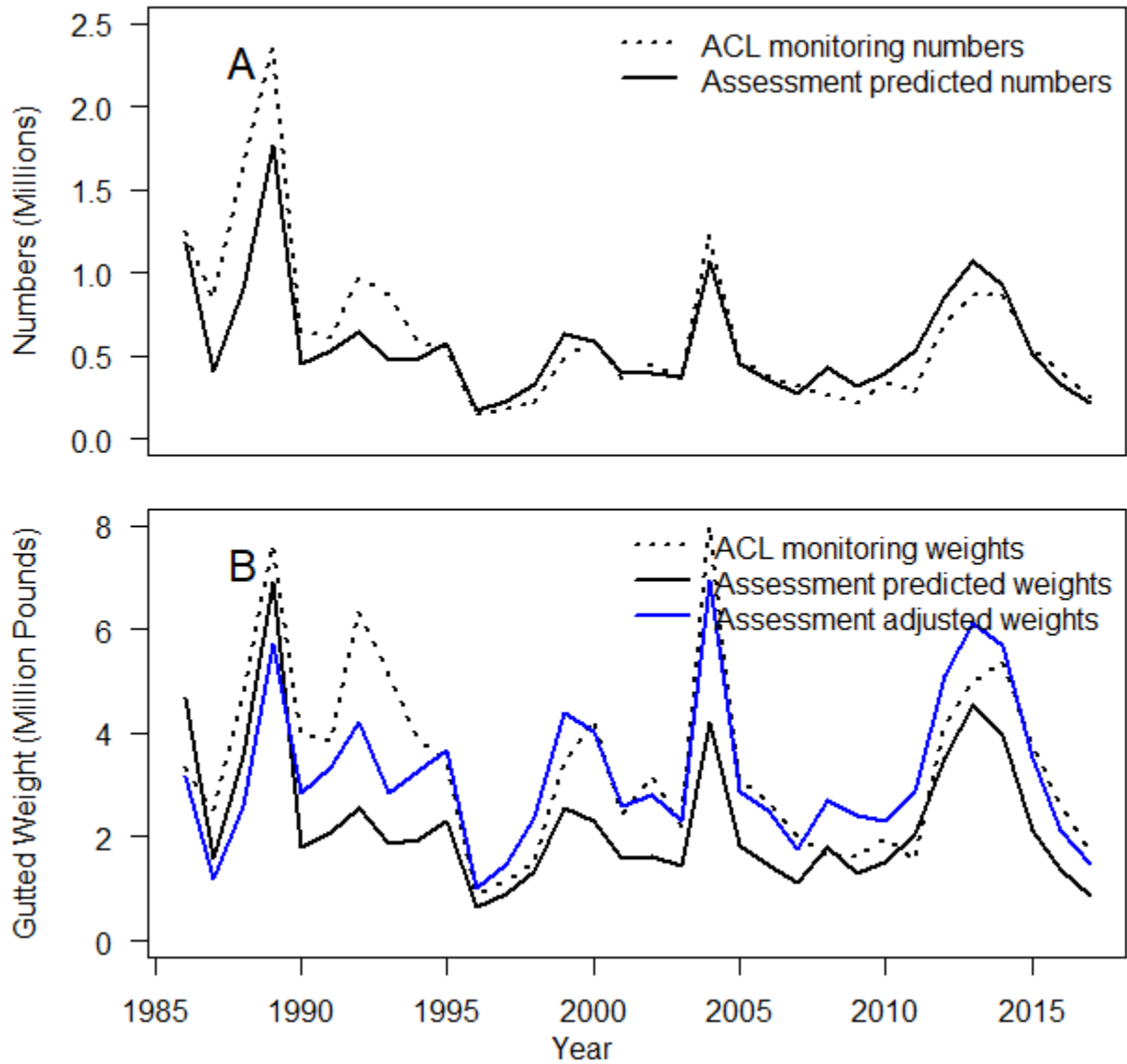


Figure 2. Comparison of Gulf of Mexico Red Grouper assessment predicted numbers (A) and gutted weights (B) compared to the ACL monitoring data. The blue line reflects the adjusted recreational weight estimates based on assessment predicted numbers and the mean weight from the ACL monitoring dataset.

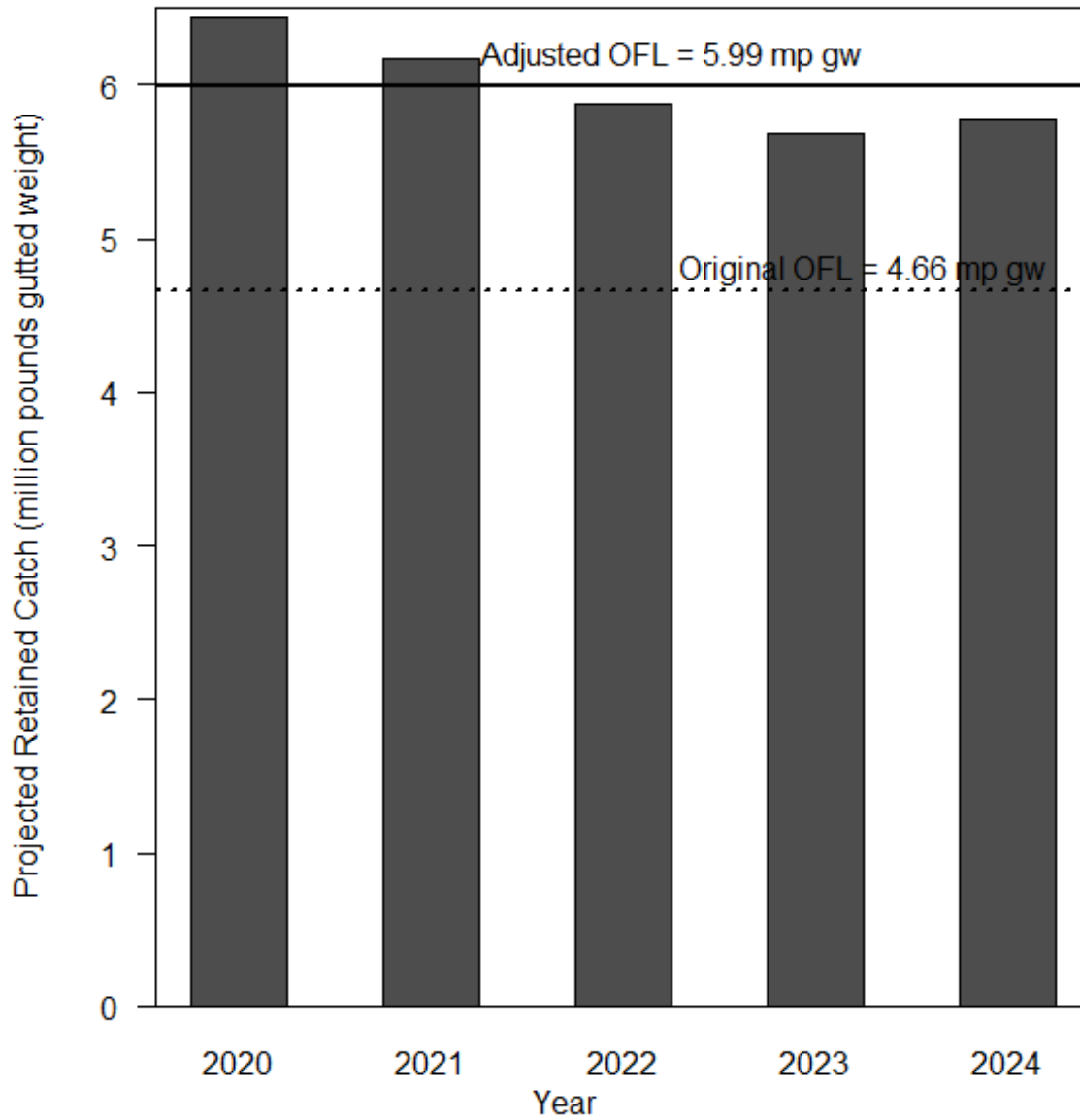


Figure 3. Projected yield streams for Gulf of Mexico Red Grouper after adjusting the recreational weight estimates based on the mean weight scalar. Original OFL refers to the OFL adopted by Amendment 53. The Adjusted OFL is the recommended adjustment following scaling of the recreational landings.