

Modification of Gulf of Mexico Red Grouper Catch Limits



Draft Framework Action to the Fishery Management Plan for the Reef Fish Resources in the Gulf of Mexico

August 2021



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ENVIRONMENTAL ASSESSMENT COVER SHEET

Name of Action

Framework Action to the Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico: Modification of Gulf of Mexico Red Grouper Catch Limits including Environmental Assessment, Regulatory Impact Review, and Regulatory Flexibility Act Analysis.

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Type of Action

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ABBREVIATIONS USED IN THIS DOCUMENT

ABC	acceptable biological catch
ACL	Annual Catch Limit
ACT	Annual Catch Target
AM	accountability measure
APAIS	Access Point Angler Intercept Survey
BSIA	best scientific information available
Council	Gulf of Mexico Fishery Management Council
FMP	Fishery Management Plan
Gulf	Gulf of Mexico
GMFMC	Gulf of Mexico Fishery Management Council
gw	gutted weight
IA	interim analysis
mp	million pounds
MRIP	Marine Recreational Information Program
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OFL	overfishing limit
SEDAR	Southeast Data Assessment and Review
SEFSC	Southeast Fisheries Science Center
SSC	Scientific and Statistical Committee

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CHAPTER 1. INTRODUCTION

1.1 Background

Gulf of Mexico (Gulf) red grouper is managed under the Fishery Management Plan (FMP) for Reef Fish Resources in the Gulf of Mexico (Reef Fish FMP). This framework action to modify the Gulf red grouper overfishing limit (OFL), acceptable biological catch (ABC), annual catch limits (ACL), and annual catch targets (ACT) is being developed by the Gulf Fishery Management Council (Council) based on the interim analysis the Southeast Fisheries Science Center (SEFSC) conducted for Gulf red grouper and presented to the Gulf Scientific and Statistical Committee (SSC) at its August 2021 meeting. The interim analysis was based on an OFL that included an adjustment to the recreational landings in weight projected by the Southeast Data Assessment and Review (SEDAR) 61 assessment model. Recreational landings in weight projected by the SEDAR 61 assessment model from 2020 through 2024 were multiplied by a mean weight scalar, which was defined as the ratio of mean weight of recreationally harvested red grouper from the ACL monitoring dataset to the assessment predicted mean weight of retained red grouper for 2019.

The most recent Southeast Data Assessment and Review (SEDAR) for red grouper (SEDAR 61, 2019) was completed in September 2019 and used updated recreational data from the Marine Recreational Information Program (MRIP) Access Point Angler Intercept Survey (APAIS) and Fishery Effort Survey (FES), which collectively estimate larger than previously calculated catch and effort data for the recreational sector. The full SEDAR 61 stock assessment can be found at <http://sedarweb.org/sedar-61>.

Reef Fish Amendment 53

Amendment 53 to the Gulf Reef Fish FMP was developed by the Council to address the results of SEDAR 61 for red grouper and subsequent OFL and ABC **Error! Bookmark not defined.** recommendations from the SSC. The purposes of Amendment 53 were to revise the red grouper allocation between the commercial and recreational sectors using the best scientific information available and to modify the allowable harvest of red grouper based on results of the recent stock assessment and subsequent OFL and ABC **Error! Bookmark not defined.** recommendations from the SSC.

Amendment 53 would revise the red grouper sector allocations between commercial and recreational based on the Accumulated Landings System/Individual Fishing Quota (IFQ) program data for the commercial landings and the FES-adjusted MRIP data, excluding the shore mode, for recreational landings. These datasets are also used to monitor the quotas for all stocks, including red grouper, and are therefore referred to as the ACL monitoring datasets. At their June 2021 meeting, the Council approved an alternative that sets the commercial and recreational allocations at 59.3% and 40.7% respectively, and sets the buffer between the commercial ACL and ACT at 5% and the buffer between the recreational ACL and ACT at 9%. Amendment 53 also modifies the OFL, ABC, the total and sector ACLs, and sector ACTs as outlined in Table 1.1.1.

Table 1.1.1. Red Grouper Commercial and Recreational Catch Limits Approved in Amendment 53

	OFL*	ABC	Total ACL	Comm ACL	Comm ACT	Rec ACL	Rec ACT
Preferred Alternative 3 (59.3% commercial: 40.7% recreational)	4.66	4.26	4.26	2.53	2.40	1.73	1.57

*All values are in mp gw.

Reef Fish Amendment 53 (GMFMC 2021) was approved by the Council at their June 2021 meeting. At this time, it has not been approved and implemented by the Secretary of Commerce. Actions taken in this framework are contingent upon approval of Amendment 53 by the Secretary of Commerce (Secretary) and implementation by NMFS. The analyses conducted by the SEFSC (Analysis 1: weight adjustment to recreational landings in SEDAR61 projections; Analysis 2: Interim Analysis using results of Analysis 1) and discussed herein are reliant upon the new sector allocations (59.3% commercial: 40.7% recreational) in Amendment 53.

Mean Weight Adjustments to SEDAR 61 Recreational Landings - August 2021

In August 2021, the SEFSC provided an adjustment to the SEDAR 61 projection methodology by applying a mean weight per fish scalar for recreationally harvested fish. The SEDAR 61 stock assessment analyzed red grouper recreational landings in numbers of fish. Gulf assessments have traditionally fit to recreational landings in numbers of fish because numbers (rather than weight) are the units currently used in recreational monitoring surveys. The SEDAR 61 assessment model used the mean weight of retained red grouper (based on lengths) to convert recreational landings in numbers into weight. A comparison between mean weight of landed red grouper predicted by the assessment model and the ACL Monitoring Dataset revealed that the assessment model underpredicted the weight of landed red grouper. Since red grouper are monitored in terms of weight for management, the August 2021 SEFSC mean weight analysis adjusted the assessment-predicted recreational landings for the projections from 2020 through 2024 in weight using a mean weight per fish scalar. The mean weight per fish scalar (MW Scalar) was determined as:

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

Mean weight for 2019 was considered the most representative dataset, and was thus used for the projections. Mean weight of red grouper in 2018 was not considered representative due to concerns over how the 2018 red tide event impacted the size and age structure of the population. Mean weight in 2020 was also not considered representative due to sampling issues experienced due to COVID-19, including concessions in sample coverage and sampling intensity during MRIP waves 2 (March and April) and 3 (May and June) to comply with federal, state, and local COVID-19 protocols.

The SEDAR 61 assessment model predicted a mean weight of approximately 4 pounds (lbs) gw per red grouper landed by the recreational sector, which is considerably lower than the mean

weight of approximately 6.1 lbs gw for recreationally landed red grouper based on the ACL Monitoring Dataset (Figure 1.1.1). No adjustments were necessary for the commercial sector. The underestimation of the weights used in the projections ultimately comes from 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 inferred the mean weight of landed red grouper each year, which were lower than observed in the ACL Monitoring Dataset. The assessment-predicted landings in weight for 2020 through 2024 were adjusted by a mean weight scalar of 1.597, and projections for the SEDAR 61 assessment were rerun using the 59.3% commercial: 40.7% recreational allocation as defined in Reef Fish Amendment 53 and the adjusted recreational landings in weight to determine OFL and ABC. The updated projections resulted in an OFL of 5.99 mp gw and an ABC of 5.57 mp gw. A full description of the mean weight per fish adjustment to SEDAR 61 predicted recreational landings and updated projections can be found in Appendix B. During the August 2021 Gulf SSC meeting, the SSC determined that this revised mean weight estimation methodology, and the subsequent projections for red grouper, constituted the best scientific information available (BSIA).

Use of the mean weight scalar to adjust recreational landings used in the assessment model does not affect the sector allocations determined for the preferred alternative in Reef Fish Amendment 53, as the allocations were based on recreational landings in weight obtained from the ACL Monitoring Dataset. The ACL Monitoring Dataset landings still represent BSIA for setting the red grouper sector allocations and monitoring the catch limits.

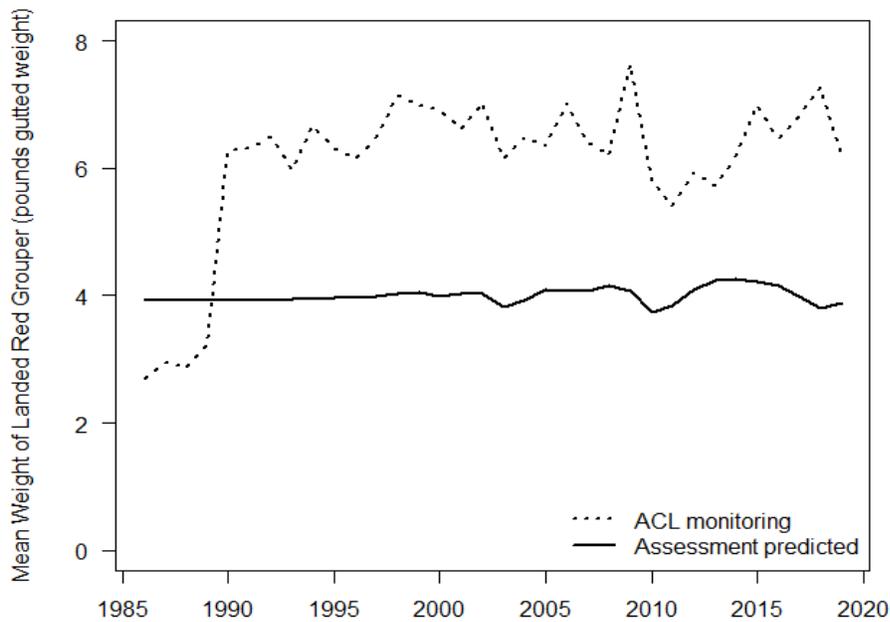


Figure 1.1.1. Comparison of mean weight of Gulf red grouper landed by the recreational sector based on the SEDAR61 assessment model predicted landings and the ACL monitoring dataset.

Updated Interim Analysis for Gulf Red Grouper - August 2021

Since 2018, interim analyses have been conducted annually to more closely monitor the stock condition of red grouper than is possible with stock assessments which typically are only conducted every four to five years for red grouper. In January 2021, an IA was presented to the SSC that indicated that harvest levels could be increased. However, this result was considered preliminary as catch levels are dependent upon the sector allocations that were being evaluated as part of Reef Fish Amendment 53. The Council requested an updated interim analysis based on the allocations selected in Amendment 53 at its June 2021 meeting. In response, the SEFSC prepared an IA that incorporated the changes to mean weight used for projections based on the SEDAR 61 model and used the general methodology proposed by Huynh et al. (2020) that is superior to the approach that was used previously.

Adjustments to the SEDAR 61-adjusted ABC of 5.57 mp gw (i.e. ABC following the mean weight adjustment to SEDAR 61 projections) were made in the IA using two separate moving average periods of 3- or 5- years. The moving average uses a reference period (3-year average from 2017-2019; 5-year 2015-2019) to compare to the recent period (3-year 2018-2020; 5-year 2016-2020). A standardized index was employed using a fishery-independent index (i.e., NMFS Bottom Longline Survey data) and delta-lognormal generalized linear model methods described in Pollack (2021). In 2020, a new index was created where the data were limited to those stations completed in the eastern Gulf (east of 87° W and south of 28.5° N) and at depths less than 118 m (387 feet) through the entire time series. Recent index values were slightly below the reference index values for both the 3-year and 5-year scenarios, with index ratios of 0.89 and 0.91, respectively. Multiplying each index ratio by the reference catch resulted in adjusted catch recommendations from 5.57 million pounds gutted weight to 4.96 million pounds gutted weight using the 3-year average and 5.07 million pounds gutted weight using the 5-year average. Implementing either of the presented IA variations would reduce the ABC from its reference value, but would be higher than the ABC of 4.26 million pounds gutted weight proposed in Amendment 53, which was prior to adjusting the ABC for recreational weight estimates (SEFSC 2021). A full description of the methods used in the 2021 red grouper IA can be found in Appendix C.

August 2021 Scientific and Statistical Committee Meeting

At its August 2021 meeting, the Gulf Council's SSC accepted the new mean weight estimation methodology for recreationally caught grouper. The SSC also accepted the updated methodology and interim analysis results for red grouper. The SSC recommended an OFL of 5.99 mp gw and an ABC of 4.96 mp gw. The ABC was based on the 3-year moving average relative to the OFL. The SSC chose to use the 3-year moving index average because it was slightly more conservative and thought to be more representative of recent population trends than the 5-year index average and because of uncertainty regarding the impacts of the 2021 red tide event in Florida.

1.2 Purpose and Need

The purpose is to modify the OFL, ABC, ACLs, and ACTs for Gulf red grouper based on the results of the new stock analyses for Gulf red grouper.

The need is to revise the OFL, ABC, ACLs, and ACTs consistent with the best available science for Gulf red grouper, and to continue to achieve optimum yield (OY) consistent with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

1.3 History of Management

The following summary describes management actions that affect the management of red grouper in the Reef Fish FMP. More information on the Reef Fish FMP can be obtained from the Council.¹ A history of red grouper management through 2019 is presented in Reef Fish Amendment 53.²

Amendments to the Reef Fish FMP

Amendment 1 was implemented in January 1990. It set a 20-inch TL minimum size limit on red grouper; set a five-grouper recreational daily bag limit; set an 11.0 mp ww commercial quota for grouper, with the commercial quota divided into a 9.2 mp ww shallow-water grouper quota and a 1.8 mp ww deep-water grouper quota; and defined shallow-water grouper as black grouper, gag, red grouper, Nassau grouper, yellowfin grouper, yellowmouth grouper, rock hind, red hind, speckled hind, and scamp; and defined deep-water grouper as misty grouper, snowy grouper, warsaw grouper, and yellowedge grouper. The amendment also allowed a two-day possession limit for charter vessels and headboats on trips that extended beyond 24 hours, provided the vessel has two licensed operators aboard as required by the United States Coast Guard (USCG), and each passenger can provide a receipt to verify the length of the trip. In addition, the amendment limited fishermen fishing under a bag limit to a single day limit; established a longline and buoy gear boundary at the 50-fathom depth contour west of Cape San Blas, Florida, and the 20-fathom depth contour east of Cape San Blas, inshore of which the directed harvest of reef fish with longlines and buoy gear was prohibited, and limited the retention of reef fish captured incidentally in other longline operations (e.g., shark) to the recreational daily bag limit; limited trawl vessels to the recreational size and daily bag limits of reef fish; established fish trap permits, allowing a maximum of 100 fish traps per permit holder; prohibited the use of entangling nets for directed harvest of reef fish; limited retention of reef fish caught in entangling nets for other fisheries to the recreational daily bag limit; established the fishing year to be January 1 through December 31; and established a commercial reef fish vessel permit.

Amendment 30B was implemented in May 2009. It set an interim allocation of red grouper between the recreational and commercial sectors; made adjustments to the red grouper TACs; established ACLs and accountability measures (AM) for the commercial and recreational red grouper sectors and the commercial aggregate shallow-water grouper fishery; adjusted recreational grouper bag limits and seasons; adjusted commercial grouper quotas; reduced the

¹ http://www.gulfcouncil.org/fishery_management_plans/index.php.

² https://gulfcouncil.org/wp-content/uploads/B-5d-RF-AM-53-Red-Grouper_6_16_2021.pdf

red grouper commercial minimum size limit; replaced the one-month commercial grouper closed season with a four-month seasonal area closure at the Edges; eliminated the end date for Madison-Swanson and Steamboat Lumps marine protected areas; and required that vessels with a federal charter vessel/headboat permit for Gulf reef fish must comply with the more restrictive of state or federal reef fish regulations when fishing in state waters.

Amendment 29 was implemented in January 2010 and established an IFQ program for the commercial harvest of grouper and tilefish species in the reef fish fishery.

Generic ACL/AM Amendment, largely implemented in January 2012 with other elements implemented later in the same year, established in-season and post-season AMs for all stocks that did not already have such measures defined. The AM states that if an ACL is exceeded, in subsequent years an in-season AM will be implemented that will close all shallow-water grouper fishing when the ACL is reached or projected to be reached.

Amendment 32 was implemented in March 2012. It set the red grouper commercial ACL at 6.03 mp gw and the recreational ACL at 1.90 mp gw; modified grouper IFQ multi-use allocations; added an overage adjustment and in-season measures to the red grouper recreational AMs to avoid exceeding the ACL; and added an AM for the red grouper bag limit that would reduce the four red grouper bag limit in the future to three red grouper, and then to two red grouper, if the red grouper recreational ACL is exceeded.

An **emergency rule**, implemented in May 2019, reduced the red grouper commercial and recreational ACLs and ACTs consistent with a stock ACL of 4.16 mp gw, to provide a temporary reduction in harvest levels while a framework action was developed to reduce catch limits on a long-term basis. The commercial ACL is 3.16 mp gw; the commercial quota is 3.00 mp gw. The recreational ACL is 1.00 mp gw; the recreational ACT is 0.92 mp gw.

An **April 2019 framework action**, implemented in October 2019, reduced the catch limits for red grouper consistent with the May 2019 emergency rule.

Amendment 53, if approved and implemented, will modify the commercial and recreational sector allocations of red grouper to 59.3% and 40.7%, respectively, based on landings from 1986-2005 in MRIP-FES units. It will also set the OFL at 4.66 mp gw, the ABC at 4.26 mp gw, and the total ACL at 4.26 mp gw. The commercial ACL will be 2.53 mp gw; the recreational ACL will be 2.40 mp gw. The commercial ACL/ACT buffer will be retained at 5%; the recreational ACL/ACT buffer will increase from 8% to 9%. The commercial ACT will be 1.73 mp gw; the recreational ACT will be 1.59 mp gw.

CHAPTER 2. MANAGEMENT ALTERNATIVES

2.1 Action 1 - Modify the Gulf of Mexico (Gulf) Red Grouper Overfishing Limit (OFL) Acceptable Biological Catch (ABC), Annual Catch Limits (ACL) and Annual Catch Targets (ACT)

Alternative 1: No Action. Retain the red grouper OFL, ABC, ACLs, and ACTs established in Reef Fish Amendment 53, as shown in the table below. The commercial and recreational sector allocations are, respectively, 59.3% and 40.7%. The commercial buffer between the ACL and ACT is 5%; the recreational buffer is 9%.

OFL	ABC	Total ACL	Comm ACL	Rec ACL	Comm ACT/Quota	Rec ACT
4.66	4.26	4.26	2.53	1.73	2.40	1.57

* Values are in millions of pounds, gutted weight.

Alternative 2: Modify the red grouper OFL, ABC, ACLs, and ACTs based on the recommendation of the Scientific and Statistical Committee (SSC), as determined from the 2021 red grouper stock analyses provided by the Southeast Fisheries Science Center and using the sector allocations as well as the ACL and ACT buffers for red grouper set forth in Reef Fish Amendment 53.

OFL	ABC	Total ACL	Comm ACL	Rec ACL	Comm ACT/Quota	Rec ACT
5.99	4.96	4.96	2.94	2.02	2.79	1.84

* Values are in millions of pounds, gutted weight.

Discussion:

Alternative 1 (No Action) would maintain the OFL, ABC, ACLs, and ACTs established in Amendment 53 and is contingent upon Amendment 53 being implemented. The values from Amendment 53 are used in **Alternative 1** since the Southeast Fisheries Science Center's (SEFSC) analyses for determining the OFL and ABC in **Alternative 2** are contingent upon the 59.3% commercial and 40.7% recreational sector allocations established in Amendment 53.

Alternative 2, which is also contingent upon implementation of Amendment 53, would increase the OFL, ABC, ACLs, and ACTs and are determined from the 2021 red grouper stock analyses analysis provided by the SEFSC. The OFL and ABC would increase by 1.33 and 0.70 million pounds (mp) gutted weight (gw), respectively, compared with **Alternative 1**. The SSC recommended the OFL and ABC values at its August 2021 meeting. The SEFSC presented two options for determining the ABC based on a 3-year moving average and on a 5-year moving

average.³ The SSC recommended use of a 3-year moving average and therefore a more conservative level for the ABC, which is thought to be more representative of recent population trends than the 5-year moving average and because of uncertainty about the 2021 red tide event in Florida. The stock ACL is set equal to the stock ABC. The commercial ACL and recreational ACL are set using the 59.3% commercial and 40.7% recreational allocations established in Amendment 53 and would increase by 0.41 and 0.29 mp gw, respectively, compared with **Alternative 1**. The commercial ACT and recreational ACT are set using the 5% commercial ACL/ACT buffer and 9% recreational ACL/ACT buffer established in Amendment 53 and would increase the ACTs by 0.39 mp gw and 0.27 mp gw, respectively, compared with **Alternative 1**. These buffers were established from landings from 2016-2019 and were not updated for this framework action with 2020 landings for either sector for the following reasons. In 2020, dockside and observer sampling efforts were negatively affected across the Gulf as state and federal samplers adhered to changing health advisories in the wake of the COVID-19 pandemic, which resulted in gaps in sample coverage which varied in space and time, but were primarily constrained to MRIP waves 2 and 3 (March-April and May-June). To resolve these sampling gaps, data from previous fishing years were used to impute the missing data in 2020. Due to these several factors, the 2016-2019 fishing years have been used in the Council's ACL/ACT Control Rule for red grouper to determine the sector-specific buffers between the ACL and the ACT. These years constitute finalized and complete catch and effort data for both fishing sectors at this time.

³ A detailed description of the equations for a 3-year and a 5-year moving average is in Appendix C. Briefly, the approach of considering a three- or five-year moving average allows for an accounting of the most recent interannual variability in the representative index of relative abundance, which by proxy is also considerate of recent changes in fishery management.

CHAPTER 3. AGENCIES, ORGANIZATIONS AND PERSONS CONSULTED

The following have or will be consulted:

National Marine Fisheries Service

- Southeast Fisheries Science Center
- Southeast Regional Office
- Protected Resources
- Habitat Conservation
- Sustainable Fisheries

NOAA General Counsel

Environmental Protection Agency

United States Coast Guard

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GMFMC = Gulf of Mexico Fishery Management Council; NOAA GC = National Oceanic and Atmospheric Administration General Counsel; SEFSC = Southeast Fisheries Science Center; SERO = Southeast Regional Office of the National Marine Fisheries Service

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APPENDIX A. OTHER APPLICABLE LAW

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.) provides the authority for management of stocks included in fishery management plans (FMP) in federal waters of the exclusive economic zone (EEZ). However, management decision-making is also affected by a number of other federal statutes designed to protect the biological and human components of U.S. fisheries, as well as the ecosystems that support those fisheries. Major laws affecting federal fishery management decision-making include the Endangered Species Act (Section 3.3.3), E.O. 12866 (Regulatory Planning and Review, Chapter 5) and E.O. 12898 (Environmental Justice, Section 3.5). Other applicable laws are summarized below.

Administrative Procedure Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (5 U.S.C. Subchapter II), which establishes a “notice and comment” procedure to enable public participation in the rulemaking process. Under the Act, the National Marine Fisheries Service (NMFS) is required to publish notification of proposed rules in the *Federal Register* and to solicit, consider, and respond to public comment on those rules before they are finalized. The Act also establishes a 30-day waiting period from the time a final rule is published until it takes effect. Proposed and final rules will be published before implementing the actions in this amendment.

Coastal Zone Management Act

Section 307(c)(1) of the federal Coastal Zone Management Act of 1972 (CZMA), as amended, requires federal activities that affect any land or water use or natural resource of a state’s coastal zone be conducted in a manner consistent, to the maximum extent practicable, with approved state coastal management programs. The requirements for such a consistency determination are set forth in the National Oceanic and Atmospheric Administration (NOAA) regulations at 15 CFR part 930, subpart C. According to these regulations and CZMA Section 307(c)(1), when taking an action that affects any land or water use or natural resource of a state’s coastal zone, NMFS is required to provide a consistency determination to the relevant state agency at least 90 days before taking final action.

Upon submission to the Secretary of Commerce, NMFS will determine if this plan amendment is consistent with the Coastal Zone Management programs of the states of Alabama, Florida, Louisiana, Mississippi, and Texas to the maximum extent possible. Their determination will then be submitted to the responsible state agencies under Section 307 of the CZMA administering approved Coastal Zone Management programs for these states.

Data Quality Act

The Data Quality Act (Public Law 106-443) effective October 1, 2002, requires the government to set standards for the quality of scientific information and statistics used and disseminated by

federal agencies. Information includes any communication or representation of knowledge such as facts or data, in any medium or form, including textual, numerical, cartographic, narrative, or audiovisual forms (includes web dissemination, but not hyperlinks to information that others disseminate; does not include clearly stated opinions).

Specifically, the Act directs the Office of Management and Budget to issue government wide guidelines that “provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies.” Such guidelines have been issued, directing all federal agencies to create and disseminate agency-specific standards to: (1 ensure information quality and develop a pre-dissemination review process; (2 establish administrative mechanisms allowing affected persons to seek and obtain correction of information; and (3 report periodically to Office of Management and Budget on the number and nature of complaints received.

Scientific information and data are key components of FMPs and amendments and the use of best available information is the second national standard under the Magnuson-Stevens Act. To be consistent with the Magnuson-Stevens Act, FMPs and amendments must be based on the best information available. They should also properly reference all supporting materials and data, and be reviewed by technically competent individuals. With respect to original data generated for FMPs and amendments, it is important to ensure that the data are collected according to documented procedures or in a manner that reflects standard practices accepted by the relevant scientific and technical communities. Data will also undergo quality control prior to being used by the agency and a pre-dissemination review.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966, (Public Law 89-665; 16 U.S.C. 470 *et seq.*) is intended to preserve historical and archaeological sites in the United States of America. Section 106 of the NHPA requires federal agencies to evaluate the impact of all federally funded or permitted projects for sites on listed on, or eligible for listing on, the National Register of Historic Places and aims to minimize damage to such places.

Historical research indicates that over 2,000 ships have sunk on the Federal Outer Continental Shelf between 1625 and 1951; thousands more have sunk closer to shore in state waters during the same period. Only a handful of these have been scientifically excavated by archaeologists for the benefit of generations to come. Further information can be found at:

<http://www.boem.gov/Environmental-Stewardship/Archaeology/Shipwrecks.aspx>

The proposed action does not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places nor is it expected to cause loss or destruction of significant scientific, cultural, or historical resources. In the Gulf of Mexico (Gulf), the *U.S.S. Hatteras*, located in federal waters off Texas, is listed in the National Register of Historic Places. Fishing activity already occurs in the vicinity of this site, but the proposed action would have no additional adverse impacts on listed historic resources, nor would they alter any regulations intended to protect them.

Executive Orders (E.O.)

E.O. 12630: Takings

The E.O. on Government Actions and Interference with Constitutionally Protected Property Rights that became effective March 18, 1988, requires each federal agency prepare a Takings Implication Assessment for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Clearance of a regulatory action must include a takings statement and, if appropriate, a Takings Implication Assessment. The NOAA Office of General Counsel will determine whether a Taking Implication Assessment is necessary for this amendment.

E.O. 12962: Recreational Fisheries

This E.O. requires federal agencies, in cooperation with states and tribes, to improve the quantity, function, sustainable productivity, and distribution of U.S. aquatic resources for increased recreational fishing opportunities through a variety of methods including, but not limited to, developing joint partnerships; promoting the restoration of recreational fishing areas that are limited by water quality and habitat degradation; fostering sound aquatic conservation and restoration endeavors; and evaluating the effects of federally-funded, permitted, or authorized actions on aquatic systems and recreational fisheries, and documenting those effects. Additionally, it establishes a seven-member National Recreational Fisheries Coordination Council (NRFCC) responsible for, among other things, ensuring that social and economic values of healthy aquatic systems that support recreational fisheries are considered by federal agencies in the course of their actions, sharing the latest resource information and management technologies, and reducing duplicative and cost-inefficient programs among federal agencies involved in conserving or managing recreational fisheries. The NRFCC also is responsible for developing, in cooperation with federal agencies, States and Tribes, a Recreational Fishery Resource Conservation Plan - to include a five-year agenda. Finally, the E.O. requires NMFS and the United States Fish and Wildlife Service to develop a joint agency policy for administering the ESA.

E.O. 13089: Coral Reef Protection

The E.O. on Coral Reef Protection requires federal agencies whose actions may affect U.S. coral reef ecosystems to identify those actions, utilize their programs and authorities to protect and enhance the conditions of such ecosystems, and, to the extent permitted by law, ensure actions that they authorize, fund, or carry out do not degrade the condition of that ecosystem. By definition, a U.S. coral reef ecosystem means those species, habitats, and other national resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States (e.g., federal, state, territorial, or commonwealth waters).

Regulations are already in place to limit or reduce habitat impacts within the Flower Garden Banks National Marine Sanctuary. Additionally, NMFS approved and implemented Generic Amendment 3 for Essential Fish Habitat (GMFMC 2005), which established additional habitat

areas of particular concern (HAPCs) and gear restrictions to protect corals throughout the Gulf. There are no implications to coral reefs by the actions proposed in this amendment.

E.O. 13132: Federalism

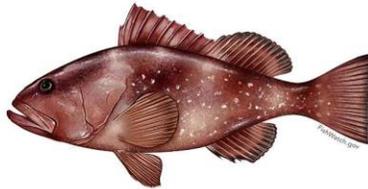
The E.O. on Federalism requires agencies in formulating and implementing policies, to be guided by the fundamental Federalism principles. The E.O. serves to guarantee the division of governmental responsibilities between the national government and the states that was intended by the framers of the Constitution. Federalism is rooted in the belief that issues not national in scope or significance are most appropriately addressed by the level of government closest to the people. This E.O. is relevant to FMPs and amendments given the overlapping authorities of NMFS, the states, and local authorities in managing coastal resources, including fisheries, and the need for a clear definition of responsibilities. It is important to recognize those components of the ecosystem over which fishery managers have no direct control and to develop strategies to address them in conjunction with appropriate state, tribes and local entities (international too).

No Federalism issues were identified relative to the action to modify the management of the recreational harvest of greater amberjack. Therefore, consultation with state officials under Executive Order 12612 was not necessary. Consequently, consultation with state officials under Executive Order 12612 remains unnecessary.

E.O. 13158: Marine Protected Areas

This E.O. requires federal agencies to consider whether their proposed action(s) will affect any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural or cultural resource within the protected area. There are several marine protected areas, HAPCs, and gear-restricted areas in the eastern and northwestern Gulf. The existing areas are entirely within federal waters of the Gulf. They do not affect any areas reserved by federal, state, territorial, tribal or local jurisdictions.

APPENDIX B. ADJUSTMENT OF SEDAR 61 GULF RED GROUPER PROJECTED CATCH STREAMS USING MEAN WEIGHT OF RECREATIONALLY LANDED FISH FROM ACL MONITORING



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

Gulf Branch
Sustainable Fisheries Division
NOAA Fisheries - Southeast Fisheries Science Center

August 2, 2021

Keywords

Red Grouper, Gulf of Mexico, SEDAR61, Recreational Landings, Mean Weight, Catch Advice Adjustment

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

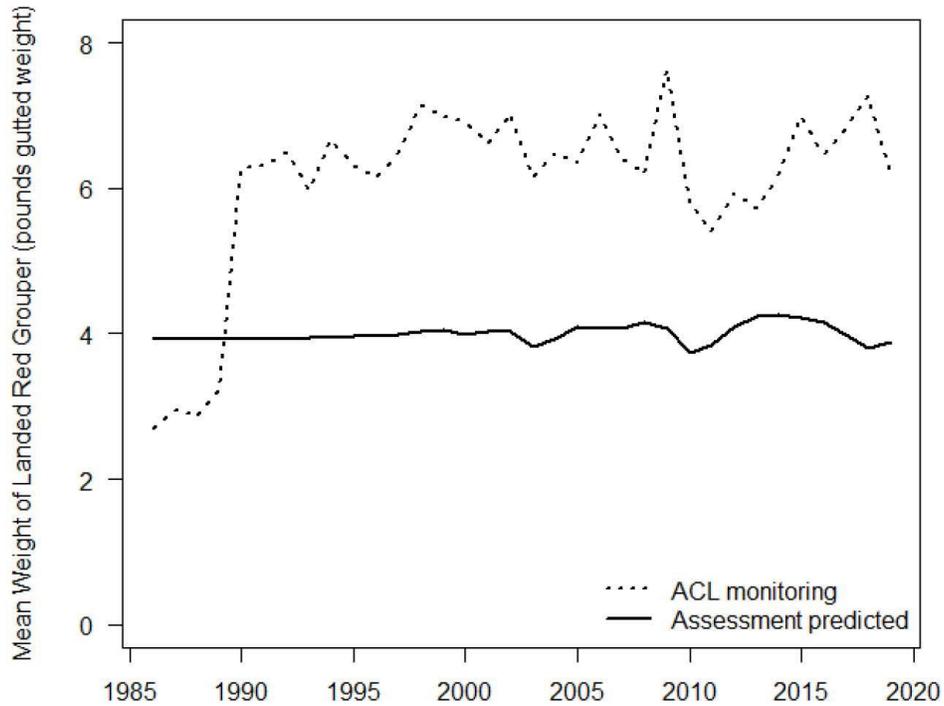


Figure 1. Comparison of mean weight of Gulf of Mexico Red Grouper landed by the recreational fishery based on the SEDAR61 assessment model predicted landings and the ACL monitoring dataset.

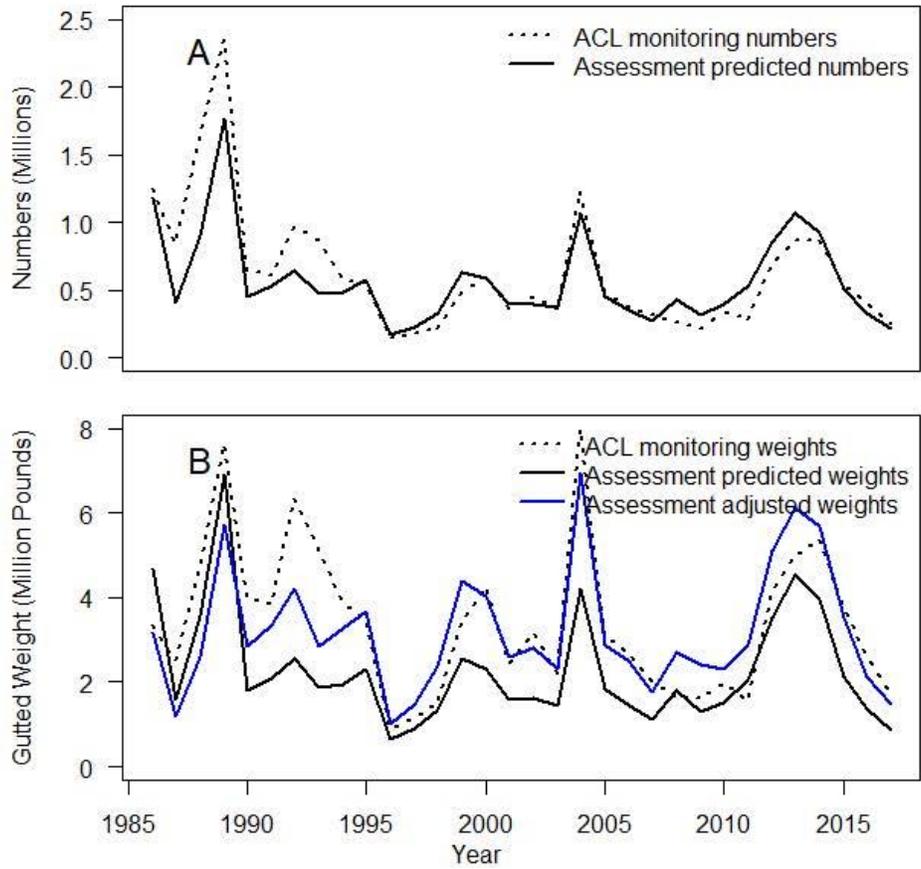


Figure 2. Comparison of Gulf of Mexico Red Grouper assessment predicted numbers (A) and gutted weights (B) compared to the ACL monitoring data. The blue line reflects the adjusted recreational weight estimates based on assessment predicted numbers and the mean weight from the ACL monitoring dataset.

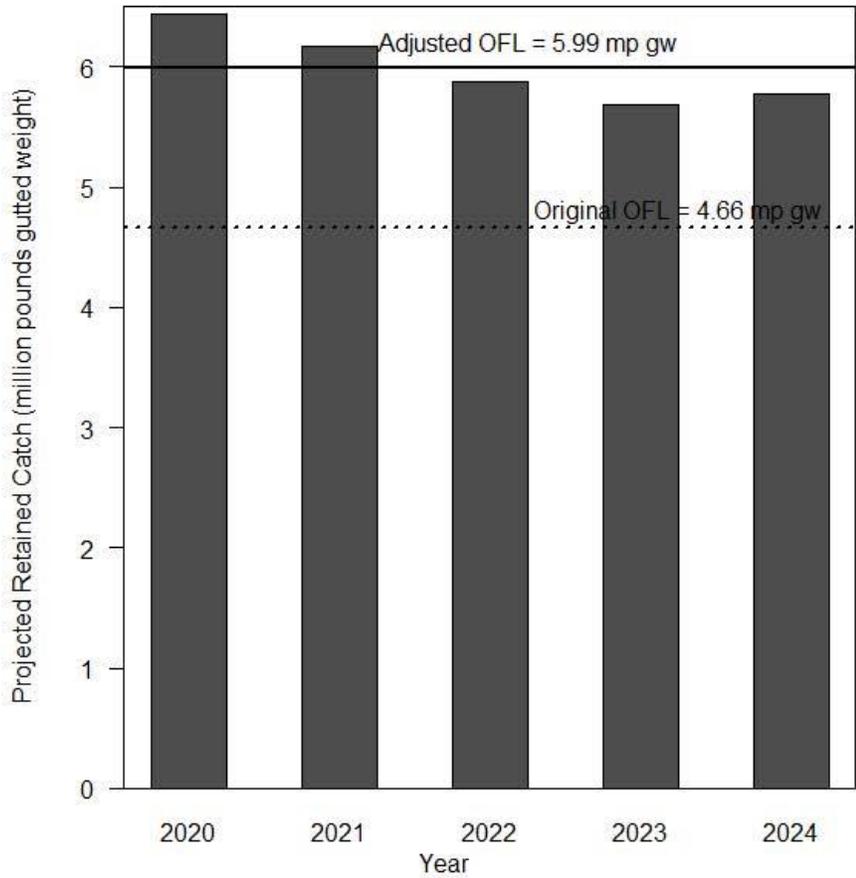
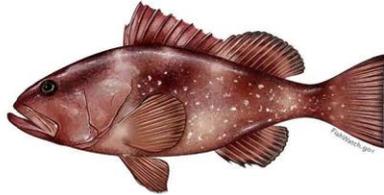


Figure 3. Projected yield streams for Gulf of Mexico Red Grouper after adjusting the recreational weight estimates based on the mean weight scalar. Original OFL refers to the OFL adopted by Amendment 53. The Adjusted OFL is the recommended adjustment following scaling of the recreational landings.

APPENDIX C. UPDATED INTERIM ANALYSIS FOR GULF OF MEXICO RED GROUPEL



Updated Interim Analysis for Gulf of Mexico Red Grouper

Gulf Branch
Sustainable Fisheries Division
NOAA Fisheries - Southeast Fisheries Science Center

August 2, 2021

Keywords

Interim Analysis, Index of Abundance, Red Grouper, Gulf of Mexico, Reduced Spatial Area, Recreational Landings Weight-Adjusted ABC

Abstract

An Interim Analysis (IA) was conducted for Red Grouper following the Standard SEDAR61 stock assessment (<http://sedarweb.org/sedar-61>). This updated IA applies an index-based harvest control rule tested through simulation and recently implemented in the 2020 IAs for both Red Snapper and Gray Triggerfish. Data from the NMFS Bottom Longline Survey were used to produce an index of relative abundance updated through 2020 following the same methodology and approach described in Pollack et al. (2018), with the exception of reduced spatial coverage. The reduced spatial coverage index of abundance was ultimately utilized because the 2020 index value for the full spatial area index was considered an overestimate due to reduced spatial coverage from COVID, mechanical issues, and weather delays (SEFSC 2020a). Adjusted catch advice is presented and takes into account the allocations finalized in Amendment 53 and a post-SEDAR61 assessment adjustment to the Acceptable Biological Catch (ABC).

Introduction

Interim analyses (IA) 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. For example, unpredictable events can occur such as a change in recruitment (e.g., pulse or failure), environmental disasters (e.g., red tides or hurricanes) or man-made disasters (e.g., Deepwater Horizon). The first IA for Red Grouper occurred in 2018. While IAs have been conducted regularly since the first application, none have been formally used to adjust catch advice (**Table 1**). Further, the projection-based approach applied for Red Grouper to date has not yet been simulation tested to ensure adequate performance.

Recently, support has grown for an index-based harvest control rule that relies solely on the observed index and uses the ratio between recent and reference time periods to adjust the catch advice. This approach has been simulation tested for Vermilion Snapper (Hunyh et al. 2020) and was formally accepted by the Gulf of Mexico Fishery Management Council's Scientific and Statistical Committee for the 2020 IAs for both Red Snapper and Gray Triggerfish. In addition to documenting acceptable performance for this index-based approach, Hunyh et al. (2020) showed that this approach performed well when circumstances arise that are not accounted for in projections, such as episodic natural mortality (e.g., red tide mortality). Therefore, this updated approach was preferred over the previously applied projection-based harvest control rule for Red Grouper, which compared the observed index of abundance to the index of abundance projected and expected by the SEDAR61 assessment model. The new approach removes the reliance on projected abundance from the SEDAR61 assessment model and its inherent assumptions (e.g., assumed red tide mortality in 2018 during the projection).

Concerns were raised over the status of Red Grouper in the Gulf of Mexico following the Standard SEDAR61 stock assessment (terminal year of) due to an inability to harvest quotas (Figure 1). In 2020, both the commercial and recreational fisheries harvested about 80% of their quotas.

Materials and Methods

Index Data Source

The NMFS Mississippi Laboratories have conducted standardized bottom longline surveys in the Gulf of Mexico, Caribbean, and Western North Atlantic since 1995. The objective of these surveys is to provide fisheries independent data for stock assessment purposes. These surveys are conducted annually and provide an important source of fisheries independent information on large coastal sharks, snappers and groupers from the GOM and Atlantic. In 2011, a Congressional Supplement Sampling Program was conducted where high levels of survey effort were maintained from April through October (Campbell et al. 2012). For this analysis of Red Grouper, only Congressional Supplement Sampling Program data collected during the same time period as the annual survey (August/September) were used to supplement missing data from the NMFS Bottom Longline Survey in 2011.

Index of Abundance

A standardized index was developed using NMFS Bottom Longline Survey data using delta-lognormal generalized linear model methods described in Pollack (2021) (at the end of this document). A new index was created where the data were limited to those stations completed in the eastern GOM (east of 87° W and south of 28.5° N) and at depths less than 118 m through the entire time series. The index computed by this method is a mathematical combination of yearly abundance estimates from two distinct generalized linear models: a binomial (logistic) model which describes proportion of positive abundance values (i.e. presence/absence) and a lognormal model which describes variability in only the nonzero abundance data (cf. Lo et al. 1992). Additional details on survey design, data filtering and exclusions and modeling approach are provided in Pollack et al. (2018) and Pollack (2021).

Interim Approach

This updated IA of Red Grouper sought to quantify a target ABC adjustment 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). Following the 2020 IA for Red Snapper, the approach presented in Huynh et al. (2020) was modified to add an additional source of tolerance for changing the catch advice. The harvest control rule takes the following forms depending on the number of years used in the moving average:

$$\text{3-year moving average: } C_{y+1} = C_{ref} * (\frac{1}{3} \sum_{k=y-2}^y I_k) / (\frac{1}{3} \sum_{ref=y_{ref}-1}^{y_{ref}+1} I_{ref}) \text{ (Equation 1)}$$

$$\text{5-year moving average: } C_{y+1} = C_{ref} * (\frac{1}{5} \sum_{k=y-4}^y I_k) / (\frac{1}{5} \sum_{ref=y_{ref}-3}^{y_{ref}+1} I_{ref}) \text{ (Equation 2)}$$

where:

C_{y+1} = Adjusted catch recommendation for year $y+1$ (2021; considered for implementation starting in 2022)

C_{ref} = reference level catch level (5.57 million pounds gutted weight) to be adjusted. This ABC is based on finalized allocations of 59.3% commercial and 40.7% recreational from Amendment 53 (GMFMC 2021) and a post-SEDAR61 assessment adjustment to the Acceptable Biological Catch (ABC). This ABC adjustment adjusted the projected recreational landings in weights using a mean weight scalar. The mean weight scalar was obtained by dividing the mean weight of Red Grouper landed by the recreational fishery based on the ACL monitoring dataset to the mean weight expected by the SEDAR61 assessment model (SEFSC 2021). This IA assumes that this ABC would have been implemented a year after the 2017 terminal year of SEDAR61 (Y_{ref} = 2018).

I_k = average of the observed index values during the recent period (3-year 2018-2020 or 5-year 2016-2020) for the reduced spatial area.

I_{ref} = average of the observed index values during the reference period (3-year 2017-2019 or 5-year 2015-2019) for the reduced spatial area.

The time period of the moving average for I_{ref} and I_k was either 3 or 5 years to provide results with two ranges of tolerance for changes in catch advice.

Splitting the adjusted catch from the IA by sector was completed by using the allocation fractions listed above from Amendment 53 (GMFMC 2021).

Results

Index of Abundance

Figure 2 provides a comparison of the updated index for the reduced area of the Eastern Gulf of Mexico through 2020 to the SEDAR61 index with 95% confidence intervals. All updated index values fell within the confidence interval for the SEDAR61 index and the trends between indices were similar (**Figure 2**). For the reduced area index, relative abundance peaked in 2011 and was

lowest in 2008, but did not show as large of an increase in relative abundance in 2020 as compared to the full area index (SEFSC 2020a; Pollack 2020).

Interim Analysis

Adjustments to the SEDAR61-adjusted ABC (5.57 million pounds gutted weight; SEFSC 2021) were made using two separate moving average periods of 3- or 5- years. Recent index values were slightly below the reference index values for both the 3-year (**Figure 3**) and 5-year scenarios (**Figure 4**), with index ratios of 0.89 and 0.91, respectively (**Table 2**). Multiplying each index ratio by the reference catch resulted in adjusted catch recommendations from 5.57 million pounds gutted weight to 4.96 million pounds gutted weight using the 3-yr average and 5.07 million pounds gutted weight using the 5-yr average (**Table 3**). Implementing either of the presented IA variations will reduce the ABC from its reference value, but will be higher than the ABC of 4.26 million pounds gutted weight implemented by Amendment 53, which was prior to adjusting the ABC for recreational weight estimates (SEFSC 2021).

Discussion

This IA provides updated recommendations for Gulf of Mexico Red Grouper using an approach vetted through simulations and recently implemented for Red Snapper (SEFSC 2020b) and Gray Triggerfish (SEFSC 2020c). Prior IAs for Red Grouper applied a projection-based management procedure, however this approach was discontinued for numerous reasons. First, the simulation study by Hunyh et al. (2020) supported the application of this approach using vermilion snapper as an example species. Second, the results derived from the projection-based approach previously applied were strongly dependent upon assumptions made during the SEDAR61 assessment projections, such as the impact of the 2018 red tide event (assumed similar to the 2005 red tide event) and the catches input for 2019 (assumed removal of the commercial ACL in 2019 (realized catches were lower) and recreational landings similar to 2018 (realized 2019 catches were higher). Removing the reliance on projected abundance and instead comparing reference and recent index trends from the observed index is preferred because the observed index more accurately represents “real-time” trends in the population. Third, the projection-based approach applied previously used a static ABC projection but was designed to work off of projected ABC values (i.e., varying annually).

Future simulation work focused on Red Grouper can provide additional support for base index selection and harvest control rule parameterization decisions on output obtained from a Management Strategy Evaluation (MSE). In the southeast, these MSEs will be conducted using an extension to the Stock Synthesis (SS) 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 while sustaining the natural resource, 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, preferences for stability are generally universal.

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- Southeast Fisheries Science Center (SEFSC). 2021. Adjustment of SEDAR61 Gulf Red Grouper Projected Catch Streams Using Mean Weight of Recreationally Landed Fish from ACL Monitoring. 10 pp.

Tables

Table 1. History of interim analyses (IA) conducted and outcomes for Gulf of Mexico Red Grouper.

Year	Outcome
18-Oct	Projection-based IA deemed suitable by SSC for interim catch advice but ultimately not used to set 2019 ACL in Emergency Rule or Framework Action (2017 landings used because they were lower)
19-Dec	Projection-based IA used as a health check by SSC to evaluate assumption of 2018 red tide on population but not used to set catch advice due to allocation decisions needed
20-Dec	Projection-based IA not recommended for use in setting catch advice by SSC due to concerns over the 2020 index value and allocation decisions needed
21-Mar	Projection-based IA using reduced area index not recommended for use in setting catch advice by SSC due to allocation decisions needed
21-Aug	IA using reduced area index and revised allocations undergoing review by SSC

Table 2. Index reference (I_{ref}), index recent (I_k), and index ratios (I_{ratio}) for the 2020 NMFS Bottom Longline Survey index averaged over 3- and 5-year time periods. The reference value I_{ref} was the average of index values from 2017-2019 or 2015-2019. The recent index value, I_k , was the average of index values for 2018-2020 or 2016-2020.

Value	3-year moving average	5-year moving average
I_{ref}	0.68	0.72
I_k	0.61	0.65
I_{ratio}	0.89	0.91

Table 3. 2021 Interim Assessment (IA) Acceptable Biological Catch (ABC) catch advice using the NMFS Bottom Longline Survey index for a reduced spatial area, with a 3-or 5-year moving average for reduced tolerance to changes in catch advice. Values presented are in millions of pounds gutted weight.

Value	3-year moving average	5-year moving average
ABC	4.96	5.07
Commercial	2.94	3.01
Recreational	2.02	2.06

Figures

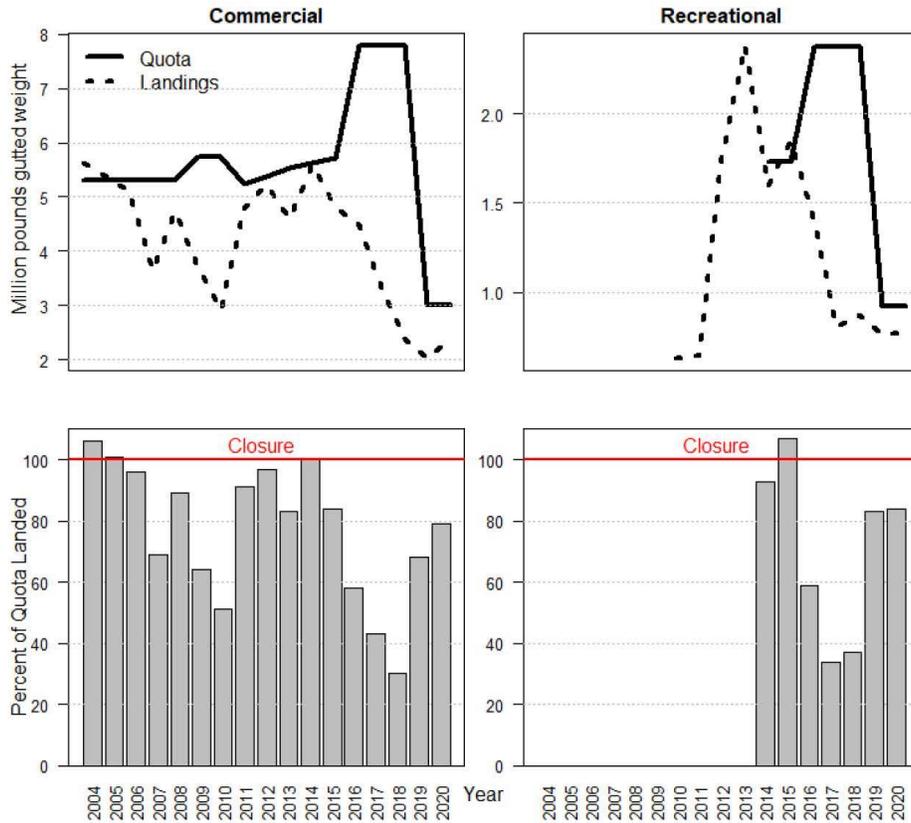


Figure 1. Commercial and recreational landings (dashed line) and quotas (thick line) for Red Grouper in the Gulf of Mexico. Bars represent the percent of quota landed, with the thick red line indicative of closures due to the quota being exceeded. Commercial data from 2010 were obtained from the Quotas and Catch Allowances, accessed June 30, 2021 (<https://secatchshares.fisheries.noaa.gov/additionalInformation> [select Commercial Quotas/Catch Allowances (all years)]), remaining years were obtained from the Gulf of Mexico Historical Commercial Landings and Annual Catch Limits (ACLs), updated October 23, 2020 (<https://www.fisheries.noaa.gov/southeast/gulf-mexico-historical-commercial-landings-and-annual-catch-limit-monitoring>). Recreational data from 2010 through 2019 were obtained from recreational historical landings, accessed June 23, 2021 (<https://www.fisheries.noaa.gov/southeast/recreational-fishing-data/gulf-mexico-historical-recreational-landings-and-annual-catch>), preliminary data from 2020 were obtained June 23, 2021 from <https://www.fisheries.noaa.gov/southeast/2020-and-2021-gulf-mexico-recreational-landings-and-annual-catch-limits-acls-and-annual>.

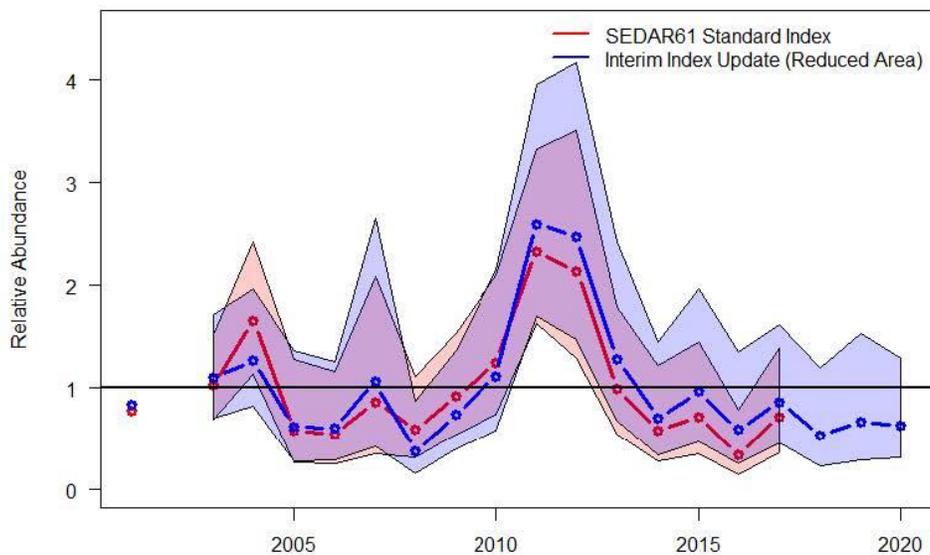


Figure 2. Comparison of NMFS Bottom Longline Survey index of abundance derived for Red Grouper in the Gulf of Mexico for SEDAR61 (full spatial area) compared to the index updated through 2020 for the reduced area in the Eastern Gulf of Mexico with confidence intervals. All indices have been standardized to a mean of 1.

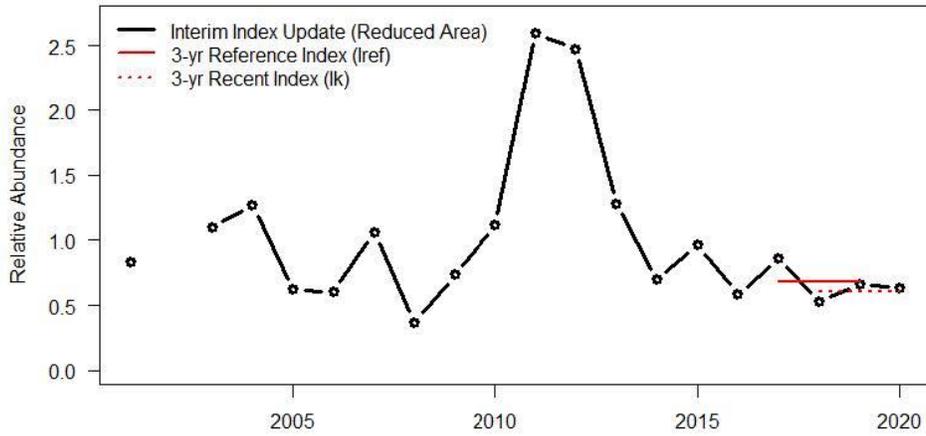


Figure 3. Comparison of the index of abundance derived for Red Grouper in the Gulf of Mexico through 2020 for the reduced area in the Eastern Gulf of Mexico with the reference index value (solid line) and recent index value (dashed line) using a 3-year moving average.

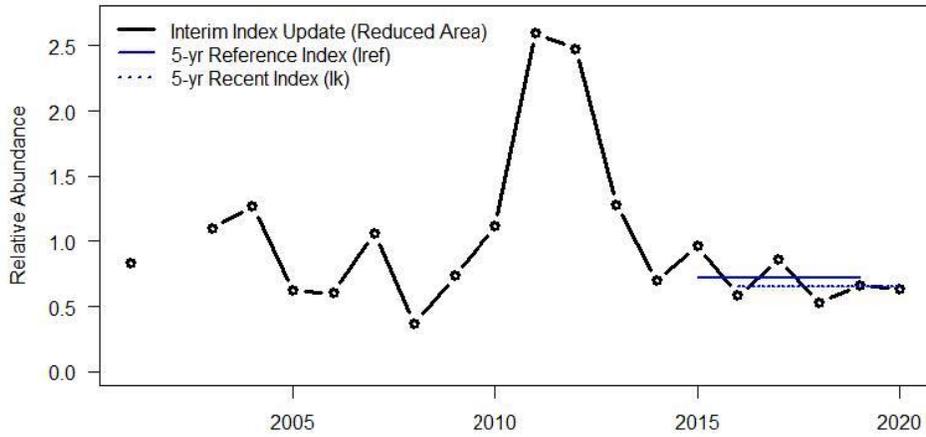


Figure 4. Comparison of the index of abundance derived for Red Grouper in the Gulf of Mexico through 2020 for the reduced area in the Eastern Gulf of Mexico with the reference index value (solid line) and recent index value (dashed line) using a 5-year moving average.

Appendix

An Updated Index of Relative Abundance for Red Grouper Captured During the NMFS Bottom Longline Survey from a Reduced Area in the Eastern Gulf of Mexico

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This document serves to update the index of relative abundance for red grouper (*Epinephelus morio*) captured during the NMFS Bottom Longline Survey in the Gulf of Mexico (GOM) through 2020. As noted in the previous document, sampling in 2020 was limited to an area roughly south of 28.5° N in the eastern GOM due to complications from COVID-19, weather (i.e. hurricanes), and mechanical issues. A question was raised about how the index was affected by this limited coverage, considering the data typically extends further north to the Florida panhandle. Therefore, a new index was created where the data were limited to those stations completed in the eastern GOM (east of 87° W and south of 28.5° N) and at depths less than 118 m (Figure 1) through the entire time series. The analysis follows the same methodology (delta-lognormal model) as outlined in Pollack et al. (2018), except that the area variable was removed due to the reduced survey area.

The final delta-lognormal NMFS Bottom Longline Survey index of red grouper abundance retained year and depth in the binomial and lognormal submodels. The updated annual abundance index is shown in Table 1. Figure 2 shows the comparison between the updated index from the reduced spatial area and the indices from the previous 2020 Update and SEDAR 61. When examining the original 2020 Update index and the 2020 Update index from the reduced area, there does not appear to be any difference in the trends of red grouper abundance.

Literature Cited

Pollack, A.G., David S. Hanisko and G. Walter Ingram, Jr. 2018. An Index of Relative Abundance for Red Grouper Captured During the NMFS Bottom Longline Survey in the Northern Gulf of Mexico. SEDAR61-WP-02. SEDAR, North Charleston, SC. 19 pp.

Table 1. Index of red grouper abundance developed using the delta-lognormal (DL) model for 2001-2020 for the NMFS Bottom Longline Survey (reduced area). The nominal frequency of occurrence, the number of samples (N), the DL Index (number per 100 hook hour), the DL indices scaled to a mean of one for the time series, the coefficient of variation on the mean (CV), and lower and upper confidence limits (LCL and UCL) for the scaled index are listed.

Survey Year	Frequency	N	DL Index	Scaled Index	CV	LCL	UCL
2001	0.22222	54	1.12113	0.83603	0.36061	0.41545	1.68238
2002							
2003	0.39189	74	1.47565	1.10039	0.22531	0.70512	1.71725
2004	0.42647	68	1.70252	1.26958	0.22227	0.81831	1.96971
2005	0.27273	33	0.83131	0.61991	0.40836	0.28263	1.35969
2006	0.31429	35	0.81096	0.60474	0.37568	0.29239	1.25074
2007	0.26923	26	1.42127	1.05985	0.48346	0.42380	2.65046
2008	0.24242	33	0.49831	0.37159	0.44741	0.15814	0.87316
2009	0.35000	40	0.98529	0.73473	0.31744	0.39536	1.36541
2010	0.31707	41	1.49276	1.11316	0.33651	0.57819	2.14311
2011	0.44444	72	3.48325	2.59747	0.21226	1.70693	3.95263
2012	0.52941	34	3.32402	2.47873	0.26427	1.47417	4.16785
2013	0.42857	28	1.71615	1.27973	0.32803	0.67522	2.42545
2014	0.37037	27	0.93856	0.69989	0.37742	0.33733	1.45210
2015	0.35484	31	1.28871	0.96099	0.37050	0.46903	1.96899
2016	0.30769	26	0.78804	0.58764	0.43497	0.25559	1.35109
2017	0.43333	30	1.15140	0.85860	0.32492	0.45564	1.61796
2018	0.29630	27	0.70685	0.52710	0.42932	0.23155	1.19989
2019	0.29630	27	0.89194	0.66512	0.43571	0.28892	1.53119
2020	0.32353	34	0.85120	0.63474	0.36666	0.31196	1.29148

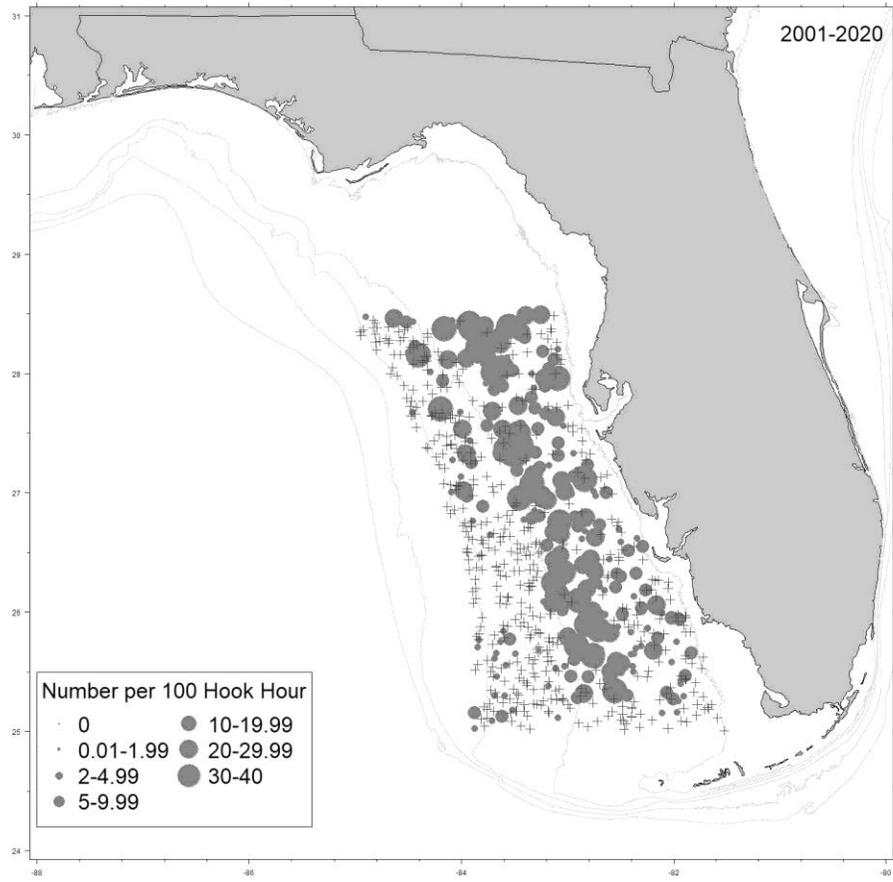


Figure 1. Stations sampled from 2001 to 2020 (limited to the area used for the index – reduced to match the sampling area covered in 2020) during the NMFS Bottom Longline Survey with the CPUE for red grouper.

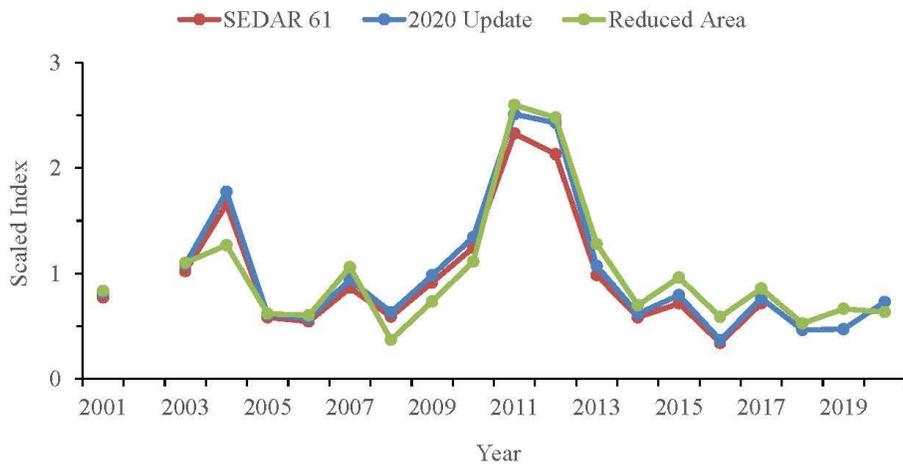


Figure 2. Annual index of abundance for red grouper from the NMFS Bottom Longline Survey from 2001 – 2020 from the reduced area compared to the indices of abundance submitted for the 2020 Update and SEDAR 61.