Tab B, No. 5(b)
01/19/2022

Modifications to Vermilion Snapper Overfishing Limit, Acceptable Biological Catch and Annual Catch Limit

Framework Action
to the Fishery Management Plan for
Reef Fish Resources of the Gulf of Mexico
Including Environmental Assessment

January 2022

This is a publication of the Gulf of Mexico Fishery Management Council Pursuant to National Oceanic and Atmospheric Administration Award No. NA20NMF4410007.

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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 to Vermilion Snapper Catch Levels including Environmental Assessment.

This Environmental Assessment is being prepared using the 2020 CEQ NEPA Regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020, and reviews begun after this date are required to apply the 2020 regulations unless there is a clear and fundamental conflict with an applicable statute. 85 Fed. Reg. at 43372-73 (§§ 1506.13, 1507.3(a)). This Environmental Assessment began on April 30, 2021, and accordingly proceeds under the 2020 regulations

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Type of Action

( ) Administrative	( ) Legislative
( ) Draft	(X) Final

ABBREVIATIONS USED IN THIS DOCUMENT

ABC	acceptable biological catch
ACL	annual catch limit
ACT	annual catch target
AM	accountability measures
AP	Advisory Panel
APAIS	Access Point Angler Intercept Survey
CHTS	Coastal Household Telephone Survey
Council	Gulf of Mexico Fishery Management Council
EA	environmental assessment
EIS	environmental impact statement
F	fishing mortality
FES	Fishing Effort Survey
FHS	For-Hire Survey
FL	fork length
FMP	fishery management plan
Gulf	Gulf of Mexico Fishery
MFMT	maximum fishing mortality threshold
mp	million pounds
MRFSS	Marine Recreational Fisheries Statistics Survey
MRIP	Marine Recreational Information Program
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NS1	National Standards 1 Guidelines
OFL	overfishing limit
OY	optimum yield
Reef Fish FMP	Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico
RFA	Regulatory Flexibility Analysis
RIR	Regulatory Impact Review
SDC	status determination criteria
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	Southeast Data Assessment and Review
SEFSC	Southeast Fishery Science Center
SFA	Sustainable Fisheries Act
SPR	spawning potential ratio
SSB	spawning stock biomass
SSC	Scientific and Statistical Committee
TL	total length
ww	whole weight

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CHAPTER 1. INTRODUCTION

1.1 Background

Vermilion snapper is managed under the Fishery Management Plan (FMP) for the Reef Fish Resources of the Gulf of Mexico (Reef Fish FMP). This framework action would modify the overfishing limit (OFL), acceptable biological catch (ABC), and annual catch limit (ACL) for the vermilion snapper stock consistent with recommendations from the Gulf of Mexico Fishery Management Council's (Council) Scientific and Statistical Committee (SSC).

A recent stock assessment for *vermilion snapper* was completed in 2020 (SEDAR 67). After review by the SSC, the assessment was determined to represent the best scientific information available and was deemed suitable for management advice. The SSC determined that the stock was not overfished or experiencing overfishing, and could support higher catch levels. The SSC provided new catch recommendations to the Council, which are detailed in Chapter 2. Vermilion snapper is currently not overfished and is not experiencing overfishing.

Establishment of vermilion snapper catch limits

In 2012, the Generic Annual Catch Limits and Accountability Measures Amendment (Generic ACL/AM Amendment) for the Gulf established catch limits for vermilion snapper including the OFL, ABC, and ACL (GMFMC 2011). Amendment 47 (GMFMC 2017) to the Reef Fish FMP decreased the OFL, ABC, and ACL based on the results of the SEDAR 45 (2016) stock assessment, and the subsequent OFL and ABC recommendations from the Council's SSC. SEDAR 45 identified a proxy for fishing mortality at maximum sustainable yield (F_{MSY}) as 30% of the fishing mortality at a spawning potential ratio of 30% ($F_{SPR30\%}$). SEDAR 45 used a statistical catch-at-age model to evaluate vermilion snapper, and represented a more data-rich assessment of the stock than was previously performed under the SEDAR 9 (2006) and SEDAR 9 Update (2012) stock assessments. Amendment 47 also established a constant catch ACL of 3.11 mp ww based on 75% of the $F_{SPR30\%}$ proxy, which is the same yield used by the Council to define optimum yield (OY) for vermilion snapper. Vermilion snapper annual landings have been below this ACL since implementation in 2012. Therefore, this preferred alternative was not expected to have any change to the impact on vermillion population.

Vermilion snapper management and landings

Vermilion snapper is subject to a 10-inch total length (TL) minimum size limit for both commercial and recreational fishermen. The recreational bag limit is 10-fish per person per day within the 20-reef fish aggregate bag limit for vermilion snapper, lane snapper, gray triggerfish, almaco jack, and tilefishes (golden, blueline, and goldface). There is no commercial trip limit. The fishing season for vermilion snapper is open year-round from January 1 – December 31 and harvest is monitored as a single stock with no sector allocation. When the combined commercial and recreational catch reaches the stock ACL, or is projected to reach the stock ACL, the season is closed for both sectors for the remainder of the year. There is no post-season AM, such as an overage adjustment, for vermilion snapper.

Table 1.1.1 provides commercial and recreational landings for vermilion snapper from 2012 through 2020. The vermilion snapper stock ACL has been exceeded once, by approximately 3% in 2018, since implementation of the vermilion snapper stock ACL in 2012. 2018 was also the first year a reduced ACL was implemented by Amendment 47 (GMFMC 2017). The fishing season for vermilion snapper has never been closed in-season, prior to the end of the fishing year, due to the stock ACL being met. The National Marine Fisheries Service (NMFS) transitioned from monitoring the catch limit using the Marine Recreational Fisheries Statistics Survey (MRFSS) to the Marine Recreational Information Program's Coastal Household Telephone Survey (MRIP-CHTS) in 2018 following the implementation of catch limits based on SEDAR 45 (2016). The current stock ACL is monitored in MRIP-CHTS (presented in Table 1.1.1). Recreational landings, as currently recorded in the new MRIP Fishing Effort Survey (FES) data currency, and commercial landings are provided in Table 1.1.2. These MRIP-FES landings are currently calibrated back to the MRIP-CHTS data currency for quota monitoring purposes, since it is in the MRIP-CHTS data currency that the catch limits were established. A more detailed description on the recent changes to recreational catch and effort data can be found in Appendix A.

Table 1.1.1. Vermilion snapper landings by sector, stock ACL and percent ACL landed (2012 – 2020). Landings are in pounds whole weight (lbs ww) using MRIP-CHTS data units.

Year	Recreational	Commercial	Total Landings	Stock ACL	Total Landings (% ACL)
2012	719,926	2,441,360	3,161,286	3,420,000	92.4%
2013	1,131,054	1,418,401	2,549,455	3,420,000	74.5%
2014	1,147,574	1,745,222	2,892,796	3,420,000	84.6%
2015	1,053,269	1,352,934	2,406,203	3,420,000	70.4%
2016	1,118,252	1,565,364	2,683,616	3,420,000	78.5%
2017	1,479,681	1,612,859	3,092,540	3,420,000	90.4%
2018	1,797,815	1,398,445	3,196,260	3,110,000	102.8%
2019	1,355,763	1,283,633	2,639,396	3,110,000	84.9%
2020	1,058,136	860,613	1,918,750	3,110,000	61.7%

Source: MRIP data from MRIPACLspec_rec81_21wv3_01Sep21w2014to2020LACreel.xlsx; Commercial landings from M. Larkin (NMFS-SERO). September 24, 2021.

Table 1.1.2. Vermilion snapper recreational landings by mode (2012-2020) and commercial landings. Recreational landings are in lbs ww using MRIP-FES data units.

Year	Recreational				Commercial	Total
	Charter	Headboat	Private	Total		
2012	170,651	283,132	925,125	1,378,908	2,441,360	3,820,268
2013	302,959	302,328	1,220,917	1,826,204	1,418,401	3,244,605
2014	466,349	330,088	947,619	1,744,056	1,745,222	3,489,278
2015	367,276	338,865	836,032	1,542,173	1,352,934	2,895,107
2016	529,907	311,779	685,455	1,527,140	1,565,364	3,092,504
2017	660,805	430,518	1,355,116	2,446,438	1,612,859	4,059,297
2018	741,305	541,200	1,657,706	2,940,211	1,398,445	4,338,656
2019	458,612	409,294	1,393,872	2,261,779	1,283,633	3,545,412
2020	515,246	328,792	703,432	1,547,470	860,613	2,408,083

Source: FES data from MRIP_FES_rec81_21wv3_01Sep21w2014to2020LACreel.xlsx. September 24, 2021. Commercial landings from M. Larkin (NMFS-SERO). September 24, 2021.

Recent vermilion snapper stock assessments

In 2012, the vermilion snapper ABC and ACL were set at 3.42 million pounds (mp) ww based on Tier 3a of the Council's ABC Control Rule (GMFMC 2011). This data-poor method set the ABC based on the mean landings from 1999 through 2008, plus one standard deviation. An update assessment (SEDAR 9 Update 2012) determined the stock was neither overfished nor undergoing overfishing. Projections for the OFL and ABC conducted under Tier 1 of the ABC Control Rule, with a probability of overfishing (P*) = 39.8%, resulted in ABC yields higher than the existing 3.42 mp, suggesting that the ACL could be increased. However, members of the Council's Reef Fish Advisory Panel (AP), as well as fishermen who testified to the Council suggested that, based on their personal observations, the vermilion snapper stock was not as healthy as the assessment suggested. As a result, the 3.42 mp ww ACL was maintained in a 2013 framework action (GMFMC 2013).

In 2016, an assessment for vermilion snapper was conducted with data through 2014 (SEDAR 45 2016). Stock status was evaluated using an MSY proxy of 30% spawning potential ratio (SPR) for spawning stock biomass ($SSB_{30\%\ SPR}$) and fishing mortality ($F_{SPR30\%}$), under which the stock was deemed not overfished and not experiencing overfishing.

Projections were made for the OFL and ABC. However, the SSC considered the ABCs calculated under Tier 1 of the ABC Control Rule to be too close to the OFLs, and instead provided more conservative ABC projections based on the yield when fishing at 75% of the $F_{SPR30\%}$ proxy. This is the yield level that the Council uses to define optimum yield (OY) for vermilion snapper. Based on the results, the SSC offered two recommendations for ABC yield streams for the 5-year projection period from 2017 through 2021. The first was a declining yield stream from 3.21 mp ww in 2017 to 3.03 mp ww in 2021, and the second was a constant catch

ABC of 3.11 mp ww for the entire 5-year period. These two yield streams were considered biologically equivalent for maintaining the stock status. The Council selected the constant catch scenario (GMFMC 2017).

In 2020, an assessment for vermilion snapper was completed (SEDAR 67 2020) using data through the 2017 fishing year. This assessment considers new data sources, including recreational catch and effort data in the FES data currency, and reconsidered previous decisions regarding discards and shrimp bycatch estimates. Based on results from SEDAR 67, the stock is not overfished and not experiencing overfishing. When reviewing SEDAR 67, the Council's SSC determined that the results of the model represented the best scientific information available for vermilion snapper and were suitable for management advice. An OFL recommendation of 8.6 mp ww (in the MRIP-FES data currency) was made based on the yield at $F_{SPR30\%}$. The SSC also provided a constant catch ABC recommendation of 7.27 mp ww (in the MRIP-FES data currency) for 2021 through 2025 based on the yield when fishing at 75% of the $F_{SPR30\%}$ proxy, the same yield level used to define OY.

1.2 Purpose and Need

The purpose of the proposed action is to modify the OFL, ABC, and ACL, consistent with the most recent stock assessment for Gulf vermilion snapper, and SSC and Reef Fish AP recommendations.

The need for the proposed action is to establish catch limits consistent with the best scientific information available for vermilion snapper, and continue to achieve OY consistent with the requirements of the Magnuson-Stevens Fishery Conservation and Management Act, while preventing overfishing.

1.3 History of Management

This history of management covers events pertinent to the management of vermilion snapper in the Gulf. A complete history of management for the Reef Fish FMP is available on the Council's website[1]. The original Reef Fish FMP [with its associated Environmental Impact Statement (EIS)] (GMFMC 1981) was implemented November 8, 1984.

1.3.1 Vermilion Snapper

Amendment 1 [with its associated environmental assessment (EA), regulatory impact review (RIR), and regulatory flexibility analysis (RFA)] to the Reef Fish FMP, implemented in 1990, established a minimum size limit of 8 inches TL for vermilion snapper.

[1] http://gulfcouncil.org/fishery-management/implemented-plans/reef-fish/

Amendment 12 (with its associated EA and RIR), implemented in January 1997, created an aggregate bag limit of 20 reef fish for all reef fish species not having a bag limit (including vermilion snapper).
Amendment 15 (with its associated EA, RIR, and RFA), implemented in January 1998, increased the vermilion snapper minimum size limit from 8-inches TL to 10-inches TL.

Amendment 23 [with its associated supplemental environmental impact statement ((EIS), RIR, and RFA))], implemented in July 2005, established a rebuilding plan for vermilion snapper, increasing the minimum size limit to 11-inches TL, implementing a 10-fish vermilion snapper bag limit within the 20-reef fish aggregate bag limit, and established an April 22 through May 31 closed season for the commercial sector. Furthermore, it established MSY for vermilion snapper as the yield associated with F_{MSY} when the stock is at equilibrium. It also established a maximum fishing mortality threshold (MFMT) where MFMT = F_{MSY}, and a MSST, where MSST = (1-M)*B_{MSY} or B_{MSY} proxy.

A **February 2007 Framework Action** (with its associated EA, RIR, and RFA), revised management measures for vermilion snapper to those prior to implementation of Reef Fish Amendment 23 by reducing the minimum size limit from 11-inches TL to 10-inches TL; eliminating the 10-fish bag limit for vermilion snapper, but retaining the 20-fish aggregate bag limit for those reef fish species without a species-specific bag limit, and eliminating the April 22 through May 31 commercial closed season.

The **Generic ACL/AM Amendment** (with its associated EIS, RIR, and RFA), implemented in January 2012, established an OFL and ACL; an ACT is not used for management purposes. It also established an in-season closure authority for when vermilion snapper landings reach or are projected to reach the ACL.

A **September 2013 Framework Action** (with its associated EA, RIR, and RFA) re-established a 10-vermilion snapper recreational bag limit within the 20-reef fish aggregate bag limit.

Amendment 44 (with its associated EA), implemented in 2017, re-defined MSST for seven reef fish species including vermilion snapper. MSST was re-defined to be 50% of the BMSY proxy.

Amendment 47 (with its associated EA, RIR, and RFA), implemented in 2018, decreased the ABC and ACL as a constant catch. An ACT was not set. MSY was updated to be the yield when fishing at $F_{30\%\ SPR.}$

CHAPTER 2. MANAGEMENT ALTERNATIVES

2.1 Action 1 – Modify the Gulf of Mexico (Gulf) Vermilion Snapper Overfishing Limit (OFL), Acceptable Biological Catch (ABC), and Annual Catch Limit (ACL).

Alternative 1: No Action. Retain the OFL, ABC, and ACL for the vermilion snapper stock as implemented in 2018 by Reef Fish Amendment 47.

Year	OFL	ABC	ACL
2021+ (MRIP-CHTS)	3,580,000	3,110,000	3,110,000

Note: Values are in pounds whole weight.

Preferred Alternative 2: Modify the OFL, ABC, and ACL for vermilion snapper based on the recommendation of the Scientific and Statistical Committee (SSC) for a constant catch yield for 2021 to 2025, and then maintain the ACL at the 2025 level for subsequent fishing years or until changed by management. The stock ABC equals 75% of $F_{SPR30\%}$ and the ACL equals the ABC.

Year	OFL	ABC	ACL
2021-2025+ (MRIP-FES)	8,600,000	7,270,000	7,270,000

Note: Values are in pounds whole weight.

Alternative 3: Modify the OFL and ABC for vermilion snapper based on the recommendation of the Scientific and Statistical Committee (SSC) for a constant catch yield for 2021 to 2025. The stock ABC equals 75% of $F_{SPR30\%}$. Set an ACL for 2021 to 2025 using the Gulf of Mexico Fishery Management Council's (Council) ABC/ACL/ACT Control Rule, which would result in a 9% buffer between the ABC and ACL. The ACL will be maintained at the 2025 level for subsequent fishing years until changed by management.

Year	OFL	ABC	ACL
2021-2025+ (MRIP-FES)	8,600,000	7,270,000	6,615,700

Note: Values are in pounds whole weight.

Discussion

Alternative 1 (No Action) retains the existing OFL, ABC, and ACL that were based on the previous vermilion snapper stock assessment (SEDAR 45 2016). The ACL is equal to the ABC implemented in 2018 under Amendment 47 (GMFMC 2017c) to the Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico (Reef Fish FMP), which set the ACL for vermilion snapper for the years 2017 – 2021+ ("+" denotes: "and subsequent years") as the constant catch average of the 5-year annual ACLs when fishing at 75% of the maximum sustainable yield (MSY) proxy of fishing mortality at 30% spawning potential ratio ($F_{SPR30\%}$). The OFL, ABC and ACL in **Alternative 1** are presented in the Marine Recreational Information

Program's Coastal Household Telephone Survey (MRIP-CHTS) data currency, which no longer represents best scientific information available based on the recommendations given by the SSC from the most recent SEDAR 67 (2020) stock assessment. Furthermore, one of the major changes between the SEDAR 45 (2016) and SEDAR 67 base models is the incorporation of the MRIP Fishing Effort Survey (FES) adjustments to the recreational catch and effort estimates, which are generally twice as large as those generated by MRIP-CHTS. SEDAR 67 used MRIP-FES for yield projections; due to this transition in data currency, retaining the OFL, ABC and ACL in MRIP-CHTS units as presented in **Alternative 1** would require recreational landings monitored in MRIP-FES units to be converted to MRIP-CHTS units.

As part of the SEDAR 67 stock assessment of Gulf of Mexico vermilion snapper, the previously accepted assessment model (SEDAR 45) was updated using FES-based recreational statistics and used to approximate the overfishing limit (OFL) recommendations SEDAR 45 might have produced had FES statistics been available. For this analysis, the recreational landings and the private/charter index of abundance in the SEDAR 45 model were replaced with the FES-based versions of these statistics produced during SEDAR 67. The SEDAR 45 assessment model did not include recreational discards so there was no need to update these data as part of the analysis. It is important to note that catch and index statistics often change as additional years of data are added. Therefore, it is likely that the data used from SEDAR 67 is similar to, but not exactly equal to, what would have been available to the analysts at the time SEDAR 45 was completed. Projections using the FES-based versions of the recreational landings and the private/charter index statistics were carried out following the same approach used in SEDAR 45 in an attempt to make the forecasted OFLs as comparable as possible. During SEDAR 45, the SSC recommended, and the Council adopted, a constant catch OFL based on the 5-year (2017 – 2021) average of the forecasted values. Applying the same formula to SEDAR 45 projections with the FES-based statistics results in an OFL estimate of 6.76 million pounds. It is important to note that this OFL estimate is provided for comparison purposes only to approximate how much of the proposed increase is due to the transition from MRIP-CHTS to MRIP-FES. The 6.76 mp OFL estimate, however, cannot be used to compute differences between the management alternatives considered in this action. Because the catch limits in **Alternative 1** do not represent the best scientific information available, **Alternative 1** is not a viable alternative under National Standard 2 of the Magnuson-Stevens Fishery Conservation and Management Act.

The SEDAR 67 stock assessment determined that vermilion snapper was neither overfished nor experiencing overfishing. The SSC determined SEDAR 67 to be the best scientific information available and, based on the assessment, recommended an OFL and ABC yield stream for 2021 – 2025 and beyond. The SSC thought it more appropriate to recommend average (constant catch) yields as opposed to annual yields, as constant catch may help account for year-to-year variability while also providing consistency for stakeholders. A buffer between the OFL and the ABC would remain in place to account for scientific uncertainty

Preferred Alternative 2 sets a constant catch ACL, which is equal to the ABC, for 2021 – 2025, and then maintains the ACL at the 2025 level for subsequent years until changed by future management action. The ABC, which equals 75% of $F_{SPR30\%}$, is currently equal to the ACL. The ABC in this alternative is set lower than the OFL to account for scientific uncertainty. The catch limits proposed in **Preferred Alternative 2** also differ from **Alternative 1** because of the recreational survey data currency used to generate the catch limits. Catch limits for **Preferred Alternative 2** are calculated using the MRIP-FES data currency; landings data for vermilion snapper are currently collected in MRIP-FES and then must be back-calibrated to MRIP-CHTS for quota monitoring purposes under **Alternative 1**. Table 2.1.1 was generated within the most recent stock assessment (SEDAR 67 2020) to show the effect of the MRIP-FES data on the equilibrium yield. The increase in projected biomass is due largely to the transition from MRIP-CHTS to MRIP-FES, and partly due to exceptional recruitment in 2015 and 2016.

Table 2.1.1. Summary of projections at $F_{SPR30\%}$ completed using the original SEDAR 45 base model, the SEDAR 45 base model with the recreational data updated to the FES values, and the SEDAR 67 base model in FES.

Model	Terminal Year	SSB	$F_{SPR30\%}$	SSB_0	$SSB_{FSPR30\%}$	Equilibrium Yield
SEDAR 45 (CHTS)	2014	1.91E+14	0.103	6.56E+14	1.97E+14	3.35
SEDAR 45 (if in FES)	2014	2.28E+14	0.14	6.51E+14	1.96E+14	5.19
SEDAR 67 (FES)	2017	2.22E+14	0.135	6.73E+14	2.02E+14	5.91

Note: Equilibrium yield is shown in millions of pounds whole weight.

Alternative 3 would set the same OFL and ABC as **Preferred Alternative 2**. However, **Alternative 3** would set an ACL for 2021 to 2025 determined by using the Gulf of Mexico Fishery Management Council's (Council) ABC/ACL/ACT Control Rule, which would result in a 9% buffer between the ABC and ACL. Therefore, the resulting ACL under **Alternative 3** equals 6,615,700 lbs ww. The ACL will be maintained at the 2025 level for subsequent fishing years until changed by management. **Alternative 3** is slightly more conservative than **Preferred Alternative 2** and could potentially provide added protection to the vermilion snapper stock in the future.

CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Description of the Fishery

Vermillion snapper is one of 31 stocks managed in the reef fish fishery. From 2012 through 2017, the stock annual catch limit (ACL) for vermillion snapper was 3,420,000 pounds (mp) whole weight (ww). In 2018, the ACL was decreased to 3,110,000 based on the result of the SEDAR 45 stock assessment. Total landings (recreational and commercial) were exceeded in 2018, by 2.8% of the ACL (Table 1.1.1). In 2020, an assessment for vermilion snapper was completed (SEDAR 67 2020) using data through the 2017 fishing year. This assessment considers new data sources, including recreational catch and effort data in the FES data currency, and reconsidered previous decisions regarding discards and shrimp bycatch estimates. Based on results from SEDAR 67, the stock is not overfished and not experiencing overfishing. When reviewing SEDAR 67, the Council's SSC determined that the results of the model represented the best scientific information available for vermilion snapper and were suitable for management advice. An OFL recommendation of 8.6 mp ww was made based on the yield at $F_{30\%\ SPR}$. The SSC also provided a constant catch ABC recommendation of 7.27 mp ww for 2021 through 2025 based on the yield when fishing at 75% of $F_{30\%\ SPR,}$ which is the same yield used by the Council to define OY for vermillion snapper.

There is no sector allocation for vermillion snapper. When the combined commercial and recreational catch reaches the stock ACL, or is projected to reach the stock ACL, the season is closed for both sectors for the remainder of the year. There is no post-season accountability measure (AM), such as an overage adjustment, for vermilion snapper. The recreational size limit for vermillion snapper is 10 inches, and daily recreational bag limit is 10 fish per angler within the 20-fish aggregate bag limit. Additional information on the reef fish fishery can be found in previous amendments, including the Generic ACL/AM Amendment (GMFMC 2011a), which can be found on the Gulf of Mexico Fishery Management Council's (Council) website.[2]

3.1.1. Recreational Sector

Permits

Anglers on privately owned or leased vessels do not need a federal permit to harvest reef fish in federal waters. However, anglers aboard these vessels must either be federally registered or licensed in states that have a system to provide complete information on the states' saltwater anglers to the national registry.

Any for-hire fishing vessel that takes anglers to harvest any species in the reef fish fishery from federal waters must have a charter/headboat permit for reef fish, which is a limited access permit specifically assigned to that vessel (1,279 as of 2018). Limited access permits may be renewed or transferred, but no additional permits may be issued. From 2012 through 2018, the number of

[2] http://gulfcouncil.org/fishery-management/implemented-plans/reef-fish/

vessels with the permit declined, in part due to the moratorium on the issuance of new permits since 2003. Table 3.1.1.1 provides the number of vessels with a charter/headboat permit for reef fish by state and year.

Table 3.1.1.1. Number of vessels with charter/headboat permit for reef fish by homeport state of vessel, 2012-2018.

Number of Vessels with Charter/Headboat Reef Fish Permit									
Year	**AL**	**FL**	**LA**	**MS**	**TX**	**Gulf**	**Other**	**Total**	**% Gulf**
2012	153	790	116	46	214	1,319	17	1,336	98.7%
2013	155	782	113	45	213	1,308	15	1,323	98.9%
2014	149	768	111	40	226	1,294	16	1,310	98.8%
2015	138	761	115	36	228	1,278	16	1,294	98.8%
2016	130	759	113	33	228	1,263	19	1,282	98.5%
2017	137	773	112	31	210	1,263	17	1,280	98.7%
2018	134	788	115	30	202	1,269	10	1,279	99.2%

Source: NMFS SERO.

The distribution of charter/headboat permits for reef fish by hailing port state changed little from 2012 through 2018 (Table 3.1.1.2). The largest relative change was an increase in Florida's share, which rose from 58.9% to 61.6%.

Vermillion Snapper Recreational Landings

From 2015 through 2019, recreational anglers landed approximately 60% of total (recreational and commercial) landings (Table 1.1.2). The majority of vermillion snapper landings are by recreational anglers aboard privately owned and leased vessels. From 2015 through 2019, they accounted for an average of about 55% of annual recreational landings (Table 1.1.2).

The fishing season for vermillion snapper runs from January 1 through December 31. Vermillion snapper aggregates offshore during spring and summer months, but vermillion snapper landings are common throughout the year.

Vermillion Snapper Recreational Discards

Discarded live fish are reported by the anglers interviewed by the Marine Recreational Information Program (MRIP). Consequently, neither the identity nor the quantities reported are verified. MRIP estimates of live released fish (b2) were adjusted in the same manner as the landings (i.e., using charter boat calibration factors, MRIP adjustment, substitutions, etc. described in Chapter 2). Southeast Region Headboat Survey (SRHS) discards are available from 2004 to the present. In 2013 the SRHS ceased recording the condition of released fish (live vs dead). Starting that year all releases are recorded as "Estimated alive". For consistency, all discards from 2004 to 2012 are categorized as b2 fish (released alive). Texas Parks and Wildlife Division (TPWD) survey does not estimate discards. The Louisiana (LA) Creel survey began estimating discards for a small number of species in 2016. No information is available on released vermilion snapper from LA Creel. Discards for Texas and Louisiana (2014+) are assumed to be negligible based on negligible TPWD landings and sporadic Louisiana MRIP discards prior to 2014. Three management changes to the recreational Gulf of Mexico (Gulf) vermilion snapper fishery are believed to have impacted discarding rate: (1) minimum size was increased in 1998 from 8 inches total length (182 mm fork length) to 10 inches total length (227 mm fork length), (2) minimum size was subsequently increased in 2005 to 11 inches total length (250 mm fork length), and (3) minimum size was again reduced in 2008 to 10 inches total length (227 mm fork length). The overall magnitude of the recreational discards relative to the landings was generally small but did have some strong peaks (greater than 20% of landings) in the mid-1990s and since the late 2000s. Discards have been increasing rapidly in recent years in conjunction with the precipitous rise in recreational landings since around 2005. Given the number of uncertainties in calculating recreational discard data for vermilion snapper, a number of approaches for fitting the data were examined in the model by using varying weighting factors. As was the case with commercial discards, recreational discards were not fit directly in the final assessment model.

3.1.2 Commercial Sector

Permits

Any vessel representative that sells Gulf reef fish in or from the Gulf Exclusive Economic Zone must have been issued a federal commercial permit and must have it on board the vessel. Between 2012 and 2020, commercial fishing for vermilion snapper has represented between 40% to 60% of the vermilion snapper landed in the Gulf. The vast majority of Gulf commercial landings of vermillion snapper reported by dealers occur in Florida. From 2015 to 2019, an annual average of 79% of commercially harvested vermillion snapper were landed in Florida (SEFSC Commercial ACL Data provided from the SEFSC on September 2021). The number of gulf reef fish permits declined sizably from 2012 (917) to 2018 (842). During that same time period, the number of reef fish permits with longline endorsements stayed steady at 62.

Vermillion Snapper Commercial Landings

The primary commercial gear used for Gulf of Mexico vermilion snapper is hand line (vertical lines, bandit rigs, rod and reel, etc.). Vermilion snapper are occasionally captured on long line gear and in the trap fishery. In most years, the take from the trap and long line fisheries were a small fraction of the total landings. The data collected from these fisheries included landings, discards, catch-per-unit effort, and age composition. Commercial data were tabulated for two geographical regions loosely separated by the Mississippi River and was updated for SEDAR 67 through 2017 for both regions (landings are provided in SEDAR67-WP-14, Table 4;).

During the SEDAR 45 assessment, only hand line landings were used as inputs for the assessment model. As previously stated, the contribution of the longline and trap catches was small in most years such that the difference between total landings and hand line landings was insignificant in most years and SEDAR 67 maintained the SEDAR 45 approach. A QA/QC issue was rectified from the SEDAR 45 assessment, which resulted in the 2014 data point for the commercial landings being revised upwards slightly for both regions. After a strong downward trend in both areas from 2009 to 2013, landings have fluctuated without trend over the last four years. Higher landings are normally observed from the eastern region compared to the western region. Total landings for the commercial fishery were input into the assessment model for SEDAR 67 in metric tons. Estimates of commercial landings were available since 1963 for the hand-line fishery, 1980 for the longline fishery, and 1985 for the trap fishery. Landings prior to 1963 were linearly interpolated to virgin conditions (no catch) in 1950 and fit as observed landings in the model.

Vermillion Snapper Commercial Discards

Commercial Discards Estimates for commercial discards of vermilion snapper were developed using the catch-per-unit-effort (CPUE) expansion method outlined in SEDAR67-WP-12. The general approach for estimating discards for the commercial reef fish fleet in the Gulf utilizes CPUE from the coastal reef fish observer program and total fishing effort from the commercial reef logbook program to estimate total catch: Total Discards = CPUE Discards x Total Effort. For discard estimation, CPUE is computed for total discards, including fish released alive, released dead, and released in unknown condition. The primary metric for the coastal observer program is CPUE by species and gear. Catch per unit effort was determined from the coastal reef fish observer program in which scientific observers on commercial fishing vessels recorded detailed information on catch and effort for a subset of trips. Catch by species was recorded according to disposition category: kept (landed), released alive, released dead, released undetermined, and used for bait. Length and weight were recorded for a subsample of individual fish. The coastal reef fish observer program began in July 2006; for Gulf vermilion snapper discard estimation, complete calendars years 2007-2017 were used. Time periods for the methodology can be defined in terms of the observer program, with the pre-observer time period representing years prior to 2007, and the observer time period representing years 2007 to 2017. Total effort was determined from the commercial coastal logbook program in which fishers reported basic information on effort and catch by species for every trip. The reef logbook program began in 1990 for a subset of vessels in the Gulf, and expanded to all vessels in 1993; for Gulf vermilion snapper discard estimation, complete calendar years 1993-2017 were used. Two management changes to the commercial Gulf vermilion snapper fishery were accounted for in this analysis: (1) minimum size was increased in July 2005 from 8 inches total length (182 mm fork length) to 11 inches total length (250 mm fork length), and (2) minimum size was subsequently reduced in February 2008 to 10 inches total length (227 mm fork length). Calculated discards are provided in SEDAR67-WP-14, Table 7. The overall magnitude of the commercial discards relative to the landings was small (ranging from 0 - 17%). Discards peaked in the mid- 2000s with the implementation of the 11-inch minimum size limit in 2005 and have decreased and stabilized around 2.42 to 3.3 mp lbs ww (11 – 15mt ww) in the east and 0.3 mp lbs ww (1.5mt ww) in the west over the last five years. A majority of discards are from the eastern region. The discard estimation procedure has been much improved since the SEDAR 45 assessment, but a number of uncertainties still exist. For example, vermilion snapper with disposition ‘used for bait’ were not included in the discard estimates. Although the extent of vermilion snapper used for bait is not known precisely, the exclusion of this disposition in the analysis is likely to lead to the calculated discards being underestimated. The SEDAR 67 panel determined that the best approach for handling discard observations in the model was to treat the data as uncertain and to examine a number of approaches for fitting the data by using varying data weighting factors. Ultimately, due to modeling issues that developed when trying to fit the observed discards, the SEDAR 67 panel determined that the discard data should not be fit directly. The predicted discards were calculated based on a retention function with no weighting emphasis given to the observed discard values.

3.2 Description of the Physical Environment

The Gulf has a total area of approximately 600,000 square miles (1.5 million km^2), including state waters (Gore 1992). It is a semi-enclosed, oceanic basin connected to the Atlantic Ocean by the Straits of Florida and to the Caribbean Sea by the Yucatan Channel (Figure 3.2.1). Oceanographic conditions are affected by the Loop Current, discharge of freshwater into the northern Gulf, and a semi-permanent, anti-cyclonic gyre in the western Gulf. The Gulf includes both temperate and tropical waters (McEachran and Fechhelm 2005). Gulf surface water temperatures range from 54º F to 84º F (12º C to 29º C) depending on time of year and depth of water. Mean annual sea surface temperatures ranged from 73º F through 83º F (23-28º C) including bays and bayous (Figure 3.2.1) between 1982 and 2009, according to satellite-derived measurements.[3] In general, mean sea surface temperature increases from north to south with large seasonal variations in shallow waters.

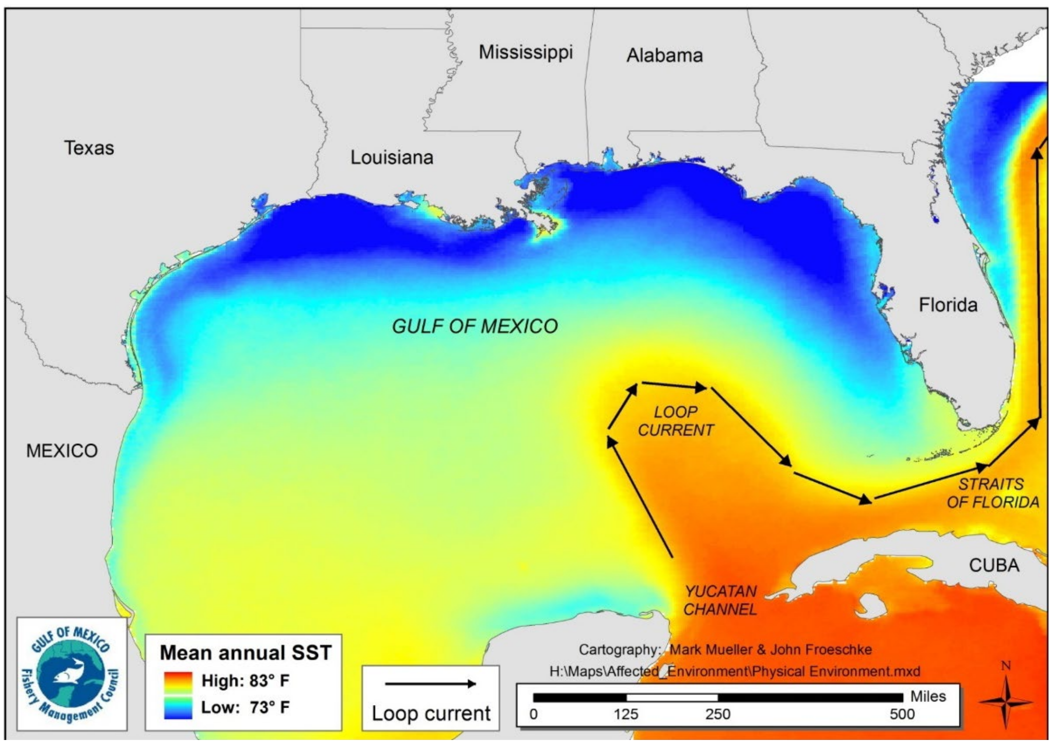

Figure 3.2.1. Physical environment of the Gulf including major feature names and mean annual sea surface temperature as derived from the Advanced Very High Resolution Radiometer Pathfinder Version 5 sea surface temperature data set (http://accession.nodc.noaa.gov/0072888).

[3] NODC 2012: http://accession.nodc.noaa.gov/0072888

The physical environment for Gulf reef fish, including vermillion snapper, is also detailed in the Generic EFH Amendment, the Generic ACL/AM Amendment, and Reef Fish Amendment 40 (GMFMC 2004a; GMFMC 2011a; GMFMC 2014, respectively), and is incorporated by reference and further summarized below. In general, reef fish are widely distributed in the Gulf, occupying both pelagic and benthic habitats during their life cycle. A planktonic larval stage lives in the water column and feeds on zooplankton and phytoplankton (GMFMC 2004a). Juvenile and adult reef fish are typically demersal and usually associated with bottom topographies on the continental shelf (less than 100 m) which have high relief, i.e., coral reefs, artificial reefs, rocky hard bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings.

Information describing Gulf area closures and marine reserves is provided in Amendment 32 (GMFMC 2011b), and is incorporated herein by reference. There are environmental sites of special interest that are discussed in the Generic Essential Fish Habitat (EFH) Amendment (GMFMC 2004a) that are relevant to vermillion snapper management. These include the longline/buoy area closure, the Edges Marine Reserve, Tortugas North and South Marine Reserves, individual reef areas and bank habitat areas of particular concern (HAPC) of the northwestern Gulf, the Florida Middle Grounds HAPC, the Pulley Ridge HAPC, and Alabama Special Management Zone. These areas are managed with gear restrictions to protect habitat and specific reef fish species. These restrictions are detailed in the Generic EFH Amendment (GMFMC 2004a), and is incorporated herein by reference.

With respect to the National Register of Historic Places, there is one site listed in the Gulf. This is the wreck of the *U.S.S. Hatteras*, located in federal waters off Texas. Historical research indicates that over 2,000 ships sunk on the Federal Outer Continental Shelf between 1625 and 1951, and thousands more sunk closer to shore in state waters during the same period. Only a handful of these have been scientifically excavated for archeological benefit.[4]

Northern Gulf of Mexico Hypoxic Zone

Every summer in the northern Gulf, a large hypoxic zone forms. It is the result of allochthonous materials and runoff from agricultural lands by rivers to the Gulf, increasing nutrient inputs from the Mississippi River, and a seasonal layering of waters in the Gulf. The layering of the water is temperature and salinity dependent and prevents the mixing of higher oxygen content surface water with oxygen-poor bottom water. For 2019, the extent of the hypoxic area was estimated to be 6,952 square miles and ranks as the eighth largest event over the past 33 years the area has been mapped.[5] The hypoxic conditions in the northern Gulf directly affect less mobile benthic macroinvertebrates (e.g., polychaetes) by influencing density, species richness, and community composition (Baustian and Rabalais 2009). However, more mobile macroinvertebrates and demersal fishes (e.g., gray snapper) are able to detect lower dissolved oxygen levels and move away from hypoxic conditions. Therefore, although not directly affected, these organisms are indirectly affected by limited prey availability and constrained available habitat (Baustian and

[4] Further information can be found at http://www.boem.gov/Environmental-Stewardship/Archaeology/Shipwrecks.aspx.

[5] http://gulfhypoxia.net

Rabalais 2009; Craig 2012). As mentioned above in Chapter 3.1.2, vermillion snapper is primarily distributed in the eastern Gulf and so is not generally affected by this hypoxic zone; however, some localized hypoxic conditions do arise (Alcock 2007; Gravinese et al. 2020). For example, red tide blooms in the eastern Gulf may cause fish kills and the decomposing biomass can result in the rapid depletion of dissolved oxygen in coastal and estuarine waters.

Greenhouse Gases

The Intergovernmental Panel on Climate Change has indicated greenhouse gas emissions are one of the most important drivers of recent changes in climate. Wilson et al. (2014) inventoried the sources of greenhouse gases in the Gulf from sources associated with oil platforms and those associated with other activities such as fishing. A summary of the results of the inventory are shown in Table 3.2.1 with respect to total emissions and from fishing. Commercial fishing and recreational vessels make up a small percentage of the total estimated greenhouse gas emissions from the Gulf (2.04% and 1.67%, respectively).

Table 3.2.1. Total Gulf greenhouse gas emissions estimates (tons per year) from oil platform and non-oil platform sources, commercial fishing, and percent greenhouse gas emissions from commercial fishing vessels of the total emissions*. Data are for 2011 only.

Emission source	CO_2	Greenhouse CH_4	Gas N_2O	Total CO_{2e}**
Oil platform	5,940,330	225,667	98	11,611,272
Non-platform	14,017,962	1,999	2,646	14,856,307
Total	**19,958,292**	**227,665**	**2,743**	**26,467,578**
Commercial fishing	531,190	3	25	538,842
Recreational fishing	435,327	3	21	441,559
Percent commercial fishing	2.66%	>0.01%	0.91%	2.04%
Percent recreational fishing	2.18%	>0.01%	0.77%	1.67%

*Compiled from Tables 6-11, 6-12, and 6-13 in Wilson et al. (2014). **The CO_2 equivalent (CO_2e) emission estimates represent the number of tons of CO_2 emissions with the same global warming potential as one ton of another greenhouse gas (e.g., CH_4 and N_2O). Conversion factors to CO_{2e} are 21 for CH_4 and 310 for N_2O

3.2.2 Description of the Biological/Ecological Environment

The biological/ecological environment of the Gulf, including that of vermillion snapper, is described in detail in the final environmental impact statement for the Generic EFH Amendment (GMFMC 2004a) and is incorporated herein by reference.

3.2.2.1 Vermillion Snapper

Life History and Biology

Distribution

The vermilion snapper, Rhomboplites aurorubens, is a small, subtropical snapper that occurs from North Carolina to Rio de Janeiro, but is most abundant off the southeastern United States and in the Gulf of Campeche (Swartz and Bert, 2003). In the Gulf of Mexico, juvenile and adult vermilion snapper are usually found near hard bottom areas off the west-central Florida coast, the Florida Middle Ground, and the Texas Flower Gardens (Smith et al., 1975; Smith, 1976; Nelson, 1988). Eggs and larvae are pelagic. Faunal surveys in the South Atlantic Bight (SAB) indicate vermilion snapper are most common over inshore live-bottom habitats and over shelf-edge, rocky-rubble and rock outcrop habitats (Grimes et al., 1977, 1982; Barans and Henry, 1984; Chester et al., 1984; Sedberry and Van Dolah, 1984).

Diet

Vermilion snapper prey on fishes, shrimps, crabs, polychaetes, and other benthic invertebrates, cephalopods and planktonic organisms (Grimes, 1979; Allen, 1985, in Froese and Pauly, 2004). In the Northern Gulf, vermilion snapper prey on other fishes as well as benthic and pelagic invertebrates (Nelson, 1988). Sedberry and Cuellar (1993) reported that off the Southeastern U.S., small crustaceans, primarily copepods and decapods (especially planktonic species and larval stages) dominated the diet of small vermilion snapper (<= 50 mm or 2 inches SL). Larger vermilion snapper shifted their diet to larger amphipods, decapods and teleost fishes.

Age/Growth

Hood and Johnson (1999) found vermilion snapper sampled from the eastern Gulf were smaller than those collected during the 1980s from the western Gulf. They discounted sampling biases, depth, and movement for accounting for these differences. While they suggested that geographical differences in growth could be responsible for these differences, they also felt increases in fishing pressure may have reduced the average size of fish caught by the fishery. SEDAR 9 (2006) indicated vermilion snapper from the western Gulf were significantly older than vermilion snapper collected from the eastern Gulf. Schirripa (1996) reported the average size of fish in the Gulf commercial fishery decreased from a high of 371 mm TL in 1984 to a low of 320 mm TL in 1993. Over this same time period, landings increased from 1.72 mp in 1984 to 3.89 mp in 1993 (Schirripa, 1996). Vermilion snapper are considered long-lived, slow-growing fish (Manooch, 1987). The oldest individual aged from the Gulf was 26 years old (SEDAR 9, 2006). Initial growth of vermilion snapper is rapid, reaching an average of about 210 mm TL (8.3 inches) by age 1 (Zastrow, 1984; Nelson, 1988; Hood and Johnson, 1999; Allman et al., 2001). Vermilion snapper are commonly as large as 350 mm TL (about 14 inches) and can grow to a maximum size of 600 mm TL (23.6 inches). Most fish caught in the fishery are between 4- and 6-years old (Hood and Johnson, 1999; Allman et al., 2001). Hood and Johnson (1999) and Allman et al. (2001) reported size-at-age is highly variable, making it difficult to estimate age from length. No significant difference in growth rates between males and females have been detected (Hood and Johnson, 1999).

Reproduction

Information on the reproductive biology of vermilion snapper in the Gulf is limited. Sex ratio appears to be dependent on location. Most studies reporting sex ratios from the Gulf and Puerto Rico are approximately 1:1 (Boardman and Weiler, 1979; Zastrow, 1984; Hood and Johnson, 1999) although Nelson (1988) reported males outnumbered females 1.2:1 and reported females outnumbered males 1.48 to 1 (SEDAR9-DW3, 2005). In the SAB, females consistently outnumbered males, and sex ratios ranged from 1.6:1 to 1.7:1 (Grimes and Huntsman, 1980; Collins and Pinckney, 1988; Cuellar et al., 1996; Zhao et al., 1997). Hood and Johnson (1999) found that most females were sexually mature by 200 mm TL (7.9 inches; age 1). They also did not observe any immature males. The smallest male they sampled was 199 mm TL (7.9 inches). Compared to the findings of Nelson (1988), the size at maturity for females was smaller for Hood and Johnson (1999). They suggested that this decrease in size at maturity could be a result of increased fishing pressure on the stock. SEDAR9-DW3 (2005) found female and male vermilion snapper were mature at lengths ranging from 153 to 555 mm. Of 1,384 female vermilion snapper sampled, only one female was immature. During the spawning season, no females with undeveloped ovaries and no males with undeveloped testes were sampled (SEDAR9-DW3, 2005). Vermilion snapper are thought to spawn in aggregations. Boardman and Weiler (1979) and Grimes 15 and Huntsman (1980) found large numbers of fish in the same reproductive state in single collections. Spawning in the Gulf occurs from the late spring to early fall (Nelson, 1988; Hood and Johnson, 1999; and SEDAR9-DW3, 2005). Vermilion snapper are batch spawners and batch fecundity has been found to have a positive relationship with fish size (Grimes and Huntsman, 1980; Nelson, 1988; Cuellar et al., 1996; Hood and Johnson, 1999; SEDAR9-DW3, 2005). Age is not an effective predictor of batch fecundity (SEDAR9-DW3, 2005). Annual fecundities are estimated to range from 0.7 to 35 million eggs depending on fish size (SEDAR9-DW3, 2005). Vermilion snapper have been estimated to spawn 87 times annually (SEDAR9-DW3, 2005).

Natural Mortality

In SEDAR 45, an age-specific natural mortality rate was implemented using a Lorenzen (1996) curve scaled to an average M equal to 0.25. Age-0 natural mortality was adjusted to account for the true midyear birthdate (i.e., age-0 fish only underwent a half-year of mortality). The final base vector of natural mortality rate at age used in SEDAR 67 is shown in Table 3 and Figure 4 of the assessment.

Release Mortality

The SEDAR 67 base model incorporated fishery discards to better address mortality due to undersized vermilion snapper being caught and released. Dead discards were the fraction of total discards that were assumed to not survive the release process based on an assumed release mortality rate of 0.15. The assumed discard mortality rate was based on studies conducted on vermilion snapper in the South Atlantic, because no comprehensive studies across gear types were available from the Gulf of Mexico. South Atlantic studies indicated that release mortality was low, on the order of 15%, for shallow caught fish (Guccione, 2005); however, the magnitude of mortality likely increases substantially for deeper caught fish and fish that are hooked in locations other than the jaw (Rudershausen et al., 2007). However, a Gulf of Mexico release mortality study was presented to the SEDAR 67 panel late in the assessment process (i.e., during the final assessment webinar), which indicated that immediate release mortality of vermilion snapper from the commercial sector was likely around 50% (Pulver, 2017). However, observer data in the recreational fisheries in Florida (SEDAR67-WP-07) suggested that immediate release mortality in that sector was below 1%. Given the discrepancy in discard mortality rates presented and the lack of information across all sectors and regions, the panel decided to maintain the SEDAR 45 discard mortality rate of 15%. However, a sensitivity run with the SEDAR 67 base model was developed to explore the impact of assuming a 50% discard mortality rate across all sectors.

Status of the Vermillion Snapper Stock
In 2020, an assessment for vermilion snapper was completed (SEDAR 67 2020) using data through the 2017 fishing year. This assessment considers new data sources, including recreational catch and effort data in the FES data currency, and reconsidered previous decisions regarding discards and shrimp bycatch estimates. Based on results from SEDAR 67, the stock is not overfished and not experiencing overfishing. When reviewing SEDAR 67, the Council's SSC determined that the results of the model represented the best scientific information available for vermilion snapper and were suitable for management advice. An OFL recommendation of 8.6 mp ww was made based on the yield at $F_{30\%\ SPR}$. The SSC also provided a constant catch ABC recommendation of 7.27 mp ww for 2021 through 2025 based on the yield when fishing at 75% of $F_{30\%\ SPR}$, the same yield level used to define OY.

3.2.2.2 General Information on Reef Fish Species

The National Ocean Service collaborated with the National Marine Fisheries Service (NMFS) and the Council to develop distributions of reef fish (and other species) in the Gulf (SEA 1998). Reef fish are widely distributed in the Gulf, occupying both pelagic and benthic habitats during their life cycle. In general, both eggs and larval stages are planktonic. Larval fish feed on zooplankton and phytoplankton. Gray triggerfish are exceptions to this generalization as they lay their eggs in nests on the sandy bottom (Simmons and Szedlmayer 2012), and gray snapper whose larvae are found around submerged aquatic vegetation.

Status of Reef Fish Stocks

The Fishery Management Plan for Reef Fish Resources in the Gulf of Mexico (Reef Fish FMP) currently encompasses 31 species (Table 3.3.1). The NMFS Office of Sustainable Fisheries updates its Status of U.S. Fisheries Report to Congress[6] on a quarterly basis. Stock assessments and status determinations have been conducted and designated for many reef fish stocks and can be found on the Council[7] and the SEDAR[8] websites.

Of the stocks for which stock assessments have been conducted, the last quarterly report of the 2021 Status of U.S. Fisheries classifies only one as overfished and undergoing over-fishing (greater amberjack), and three stocks as undergoing overfishing (cobia, lane snapper, Jacks Complex).

The status of both assessed and unassessed stocks, as of the most recent version of the Status of U.S. Fisheries Report, is provided in Table 3.2.2.1. Reef Fish Amendment 44 (GMFMC 2017), was implemented December 2017, and modified the minimum stock size threshold (MSST) for

[6] https://www.fisheries.noaa.gov/national/population-assessments/fishery-stock-status-updates

[7] www.gulfcouncil.org

[8] www.sedarweb.org

seven species in the Reef Fish FMP to 50% of B_{MSY}. Red snapper and gray triggerfish are now listed as not overfished but rebuilding, because the biomass for the stock is currently estimated to be greater than 50% of B_{MSY}, but below B_{MSY}.

A stock assessment was conducted for Atlantic goliath grouper (SEDAR 47 2016). The Council's Science and Statistical Committee (SSC) accepted the assessment's general findings that the stock was not overfished nor experiencing overfishing. Although the SSC determined Atlantic goliath grouper to not be experiencing overfishing, the SSC deemed the assessment not suitable for stock status determination and management advice.

Stock assessments were conducted for seven reef fish stocks (including vermillion snapper) using the Data Limited Methods Toolkit (DLMToolkit; SEDAR 49 2016). This method allows the setting of the overfishing limit (OFL) and acceptable biological catch (ABC) based on limited data and life history information, but does not provide assessment-based status determinations. Several stocks did not have enough information available to complete an assessment even using the DLMToolkit.

The remaining species within the Reef Fish FMP have not been assessed at this time. Therefore, their overfished status is unknown (Table 3.2.2.1). For those species that are listed as not undergoing overfishing, that determination has been made based on the annual harvest remaining below the OFL. No other unassessed species are scheduled for a stock assessment at this time.

Table 3.2.2.1. Status of species in the Reef Fish FMP grouped by family.

Common Name	Scientific Name	Stock Status		Most recent assessment or SSC workshop
		Overfishing	Overfished	
Family Balistidae – Triggerfishes				
gray triggerfish	*Balistes capriscus*	N	N	SEDAR 43 2015
Family Carangidae – Jacks				
greater amberjack	*Seriola dumerili*	N	Y	SEDAR 70 2020
lesser amberjack	*Seriola fasciata*	Y	Unknown	SEDAR 49 2016
almaco jack	*Seriola rivoliana*	Y	Unknown	SEDAR 49 2016
banded rudderfish	*Seriola zonata*	Y	Unknown	
Family Labridae – Wrasses				
hogfish	*Lachnolaimus maximus*	N	N	SEDAR 37 2014
Family Malacanthidae – Tilefishes				
tilefish (golden)	*Lopholatilus chamaeleonticeps*	N	N	SEDAR 22 2011a
blueline tilefish	*Caulolatilus microps*	N	Unknown	
goldface tilefish	*Caulolatilus chrysops*	N	Unknown	
Family Serranidae – Groupers				
gag	*Mycteroperca microlepis*	N	N	SEDAR 33 Update 2016b
red grouper	*Epinephelus morio*	N	N	SEDAR 61 2019
Scamp	*Mycteroperca phenax*	Unknown	Unknown	
black grouper	*Mycteroperca bonaci*	N	N	SEDAR 19 2010
yellowedge grouper	*Hyporthodus flavolimbatus*	N	N	SEDAR 22 2011b
snowy grouper	*Hyporthodus niveatus*	N	Unknown	SEDAR 49 2016
speckled hind	*Epinephelus drummondhayi*	N	Unknown	SEDAR 49 2016
yellowmouth grouper	*Mycteroperca interstitialis*	Unknown	Unknown	SEDAR 49 2016

Common Name	Scientific Name	Stock Status		Most recent assessment or SSC workshop
		Overfishing	Overfished	
yellowfin grouper	*Mycteroperca venenosa*	Unknown	Unknown	
warsaw grouper	*Hyporthodus nigritus*	N	Unknown	
*Atlantic goliath grouper	*Epinephelus itajara*	N	Unknown	SEDAR 47 2016
Family Lutjanidae – Snappers				
queen snapper	*Etelis oculatus*	N	Unknown	
mutton snapper	*Lutjanus analis*	N	N	SEDAR 15A Update 2015
blackfin snapper	*Lutjanus buccanella*	N	Unknown	
red snapper	*Lutjanus campechanus*	N	N	SEDAR 52 2018
cubera snapper	*Lutjanus cyanopterus*	N	Unknown	
gray snapper	*Lutjanus griseus*	N	N	
lane snapper	*Lutjanus synagris*	Y	Unknown	SEDAR 49 Update 2019
silk snapper	*Lutjanus vivanus*	N	Unknown	
yellowtail snapper	*Ocyurus chrysurus*	N	N	SEDAR 64 2020
vermilion snapper	*Rhomboplites aurorubens*	N	N	SEDAR 67 2020
wenchman	*Pristipomoides aquilonaris*	N	Unknown	SEDAR 49 2016

Note: *Atlantic goliath grouper is a protected grouper (i.e., ACL is set at zero) and benchmarks do not reflect appropriate stock dynamics. Species status based on the NOAA Quarter 4 2020 FSSI report. The most recent stock assessment is provided for reference, and the stock status determination may reflect more current information than reported in the latest stock assessment. †The greater amberjack assessment (SEDAR 70) which determined the stock was overfished and undergoing overfishing was accepted by the SSC in January 2021. However, the Quarter 4 2020 FSSI report does not include this update for greater amberjack.

Bycatch

Many of the reef fish species co-occur with each other and can be incidentally caught when fishermen target certain species. In some cases, these fish may be discarded for regulatory reasons and thus are considered bycatch. Bycatch practicability analyses have been completed for red snapper (GMFMC 2004b, GMFMC 2007, GMFMC 2014, GMFMC 2015a), grouper (GMFMC 2008a, GMFMC 2010b, GMFMC 2011a, GMFMC 2011b, GMFMC 2012a), vermilion snapper (GMFMC 2004d, GMFMC 2017a), greater amberjack (GMFMC 2008c, GMFMC 2012b, GMFMC 2015b), gray triggerfish (GMFMC 2012c), hogfish (GMFMC 2016a) and most recently in red grouper Amendment 53 (GMFMC 2021). These analyses examined the effects of fishing on these species.

Protected Species

NMFS manages marine protected species in the Southeast region under the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). A very brief summary of these two laws and more information is available on NMFS Office of Protected Resources website[9]. There are 21 ESA-listed species of marine mammals, sea turtles, fish, and corals that may occur in the exclusive economic zone (EEZ) of the Gulf. There are 91 stocks of marine mammals managed within the Southeast region, plus the addition of the stocks such as North Atlantic right

[9] https://www.fisheries.noaa.gov/topic/laws-policies#endangered-species-act

whales, humpback, sei, fin, minke, and blue whales, that regularly or sometimes occur in Southeast region managed waters for a portion of the year (Hayes et al. 2018). All marine mammals in U.S. waters are protected under the MMPA.

Of the four whales species that may be present in the Gulf (sperm, sei, fin, and Rice's[10]), the sperm, sei, and Rice's whale are listed as endangered under the ESA. Rice's whales are the only resident baleen whales in the Gulf. Manatees, listed as threatened under the ESA, also occur in the Gulf and are the only marine mammal species in this area managed by the U.S. Fish and Wildlife Service.

The gear used by the Gulf reef fish fishery is classified in the MMPA 2022 Proposed List of Fisheries as a Category III fishery (86 FR 43491). This classification indicates the annual mortality and serious injury of a marine mammal stock resulting from any fishery is less than or equal to 1% of the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. Dolphins are the only species documented as interacting with the reef fish fishery. Bottlenose dolphins prey upon bait, catch, and/or released discards of fish from the reef fish fishery. They are also a common predator around reef fish vessels, feeding on the discards. Marine Mammal Stock Assessment Reports and additional information are available on the NMFS Office of Protected Species website.[11]

Sea turtles, fish, and corals that are listed as threatened or endangered under the ESA occur in the Gulf. These include the following: five species (six distinct population segments (DPS)) of sea turtles (Kemp's ridley, loggerhead (Northwest Atlantic Ocean DPS), green (North Atlantic and South Atlantic DPSs), leatherback, and hawksbill); five species of fish (Gulf sturgeon, smalltooth sawfish, Nassau grouper, oceanic whitetip shark and giant manta ray); and six species of coral (elkhorn, staghorn, lobed star, mountainous star, boulder star, and rough cactus). Critical habitat designated under the ESA for smalltooth sawfish, Gulf sturgeon, and the Northwest Atlantic Ocean DPS of loggerhead sea turtles occur in the Gulf, though only loggerhead critical habitat occurs in federal waters.

The most recent biological opinion (BiOp) for the FMP was completed on September 30, 2011. The BiOp determined the operation of the Gulf reef fish fishery managed under the Reef Fish FMP is not likely to adversely affect ESA-listed marine mammals or coral, and was not likely to jeopardize the continued existence of sea turtles (loggerhead, Kemp's ridley, green, hawksbill, and leatherback) or smalltooth sawfish. Since issuing the opinion, in memoranda dated September 16, 2014, and October 7, 2014, NMFS concluded that the activities associated with the Reef Fish FMP are not likely to adversely affect critical habitat for the Northwest Atlantic Ocean loggerhead sea turtle DPS and four species of corals (lobed star, mountainous star, boulder star, and rough cactus). On September 29, 2016, NMFS requested re-initiation of

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[10] The Gulf of Mexico Bryde's whale has recently been identified as morphologically and genetically distinct from other whales under the Bryde's whale complex, warranting classification as a new species of baleen whale living in the Gulf of Mexico, now known as *Balaenoptera ricei* or Rice's whale. NMFS revised the Enumeration of endangered marine and anadromous species for Bryde's Whale—Gulf subspecies, to revise the common name to Rice's whale, and the description of the listed entity to entire species (86 *Fed. Reg.* 47022 (Aug. 23, 2021)).

[11] https://www.fisheries.noaa.gov/topic/marine-mammal-protection

Section 7 consultation on the operation of reef fish fishing managed by the Reef Fish FMP because new species (i.e., Nassau grouper [81 FR 42268] and green sea turtle North Atlantic and South Atlantic DPSs [81 FR 20057]) were listed under the ESA that may be affected by the proposed action. NMFS documented a determination that the operation of the fishery to continue during the re-initiation period is not likely to adversely affect these species.

On January 22, 2018, NMFS published a final rule (83 FR 2916) listing the giant manta ray as threatened under the ESA. On January 30, 2018, NMFS published a final rule (83 FR 4153) listing the oceanic whitetip shark as threatened under the ESA. In a memorandum dated March 6, 2018, NMFS revised the request for re-initiation of consultation on the Reef Fish FMP to address the listings of the giant manta and oceanic whitetip. In that memorandum, NMFS also determined that fishing under the Reef Fish FMP during the extended re-initiation period will not jeopardize the continued existence of the giant manta ray, oceanic whitetip shark, Nassau grouper, or the North Atlantic and South Atlantic DPSs of green sea turtles.

NMFS published a final rule on April 15, 2019, listing the Gulf Bryde's whale (which is now named Rice's whale) as endangered. In a memorandum dated June 20, 2019, NMFS revised the re-initiation request to include the Gulf Bryde's whale and determined that fishing under the Reef Fish FMP during the re-initiation period will not jeopardize the continued existence of any of the newly listed species discussed above.[12]

Red Tide

Red tide is a common name for harmful algal blooms (HAB) caused by species of dinoflagellates and other organisms that cause the water to appear to be red. Red tide blooms occur in the Gulf almost every year, generally in late summer or early fall. They are most common off the central and southwestern coasts of Florida between Clearwater and Sanibel Island, but may occur anywhere in the Gulf. More than 50 species capable of causing red tides occur in the Gulf, but one of the best-known species is *Karenia brevis*. This organism produces toxins capable of killing fish, birds and marine animals.[13] The factors causing red tide blooms are complex (Alcock 2007). Blooms are thought to begin to develop offshore at depth. When oceanic or wind currents push the bloom to the coast where nutrient levels increase, blooms are able to increase in size. The source of the coastal nutrients can come from natural or man-made sources. Optimum water temperature for *K. brevis* growth occurs between 72˚F and 82˚F (22˚C and 28˚C) and optimal salinities occur between 31 and 37 ppt. Although climate change has been predicted to increase likelihood of blooms of other HABs, the effects on *K. brevis* are less known. On one hand, increasing water temperatures may increase above the optimal range, hindering growth, but increased temperatures in conjunction with higher levels of CO_2 may promote growth causing higher concentrations of *K. brevis* in blooms (Errera et al. 2014).

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[12] The change to the taxonomic classification and nomenclature to Rice's whale has no effect on NMFS's conclusion that the activities associated with the Reef Fish FMP will not jeopardize the continued existence of the species during the reinitiation period.

[13] http://myfwc.com/research/redtide/general/about/

The effects of red tide on fish stocks have been well established. After *K. brevis* cells die, they release brevetoxins. When these are absorbed through the gills or ingested, they affect the nervous and respiratory functions of fish and cause mortality. It is unknown whether mortality occurs via absorption of the brevetoxins across gill membranes (Abbott et al. 1975, Baden 1988), ingestion of toxic biota (Landsberg 2002), or from some indirect effect of red tide such as hypoxia (Walter et al. 2013). During severe *K. brevis* blooms, large fish kills can occur (e.g, Flaherty and Landsberg 2011, Smith 1975, Steidinger and Ingle 1972). This can add to fish mortality as the decaying biomass from the blooms create hypoxic conditions. In 2005, a severe red tide event occurred in the Gulf along with an associated large decline in multiple abundance indices for red grouper, gag, red drum, and other species thought to be susceptible to mortality from *K. brevis* bloom events. In 2018, a severe red tide event occurred off the southwest coast of Florida from Monroe County to Sarasota County that persisted for more than 10 months; the impacts on fish stocks will likely be considered in future stock assessments.

Climate Change

Climate change projections predict increases in sea-surface temperature and sea level; decreases in sea-ice cover; and changes in salinity, wave climate, and ocean circulation.[14] These changes are likely to affect plankton biomass and fish larvae abundance that could adversely affect fish, marine mammals, seabirds, and ocean biodiversity. Kennedy et al. (2002) and Osgood (2008) have suggested global climate change could affect temperature changes in coastal and marine ecosystems that can influence organism metabolism and alter ecological processes such as productivity and species interactions, change precipitation patterns and cause a rise in sea level. This could change the water balance of coastal ecosystems; altering patterns of wind and water circulation in the ocean environment; and influence the productivity of critical coastal ecosystems such as wetlands, estuaries, and coral reefs. The National Oceanic and Atmospheric Association (NOAA) Climate Change Web Portal[15] predicts the average sea surface temperature in the Gulf will increase by 1-3ºC for 2010-2070 compared to the average over the years 1950-2010. For reef fishes, Burton (2008) speculated climate change could cause shifts in spawning seasons, changes in migration patterns, and changes to basic life history parameters such as growth rates. The smooth puffer and common snook are examples of species for which there has been a distributional trend to the north in the Gulf. For other species, such as red snapper and the dwarf sand perch, there has been a distributional trend towards deeper waters. For other fish species, such as the dwarf goatfish, there has been a distributional trend both to the north and to deeper waters. These changes in distributions have been hypothesized as a response to environmental factors, such as increases in temperature.

The distribution of native and exotic species may change with increased water temperature, as may the prevalence of disease in keystone animals such as corals and the occurrence and intensity of toxic algae blooms. Hollowed et al. (2013) provided a review of projected effects of climate change on the marine fisheries and dependent communities. Integrating the potential effects of climate change into the fisheries assessment is currently difficult due to the time scale

[14] http://www.ipcc.ch/

[15] https://www.esrl.noaa.gov/psd/ipcc/

differences (Hollowed et al. 2013). The fisheries stock assessments rarely project through a time span that would include detectable climate change effects. However, some stocks have shown increases in abundance in the northern Gulf (Fodrie et al. 2010) and Texas estuaries (Tolan and Fisher 2009) during the interval between 1979 and 2006. This may be a result of increasing water temperatures in coastal environments.

***Deepwater Horizon* MC252 Oil Spill**

The Deepwater Horizon oil spill occurred on April 20, 2010 and released large amounts of crude oil into the Gulf. Crude oil contains polycyclic aromatic hydrocarbons (PAH), which are highly toxic chemicals that tend to persist in the environment for long periods of time, in marine environments can have detrimental impacts on marine finfish, especially during the more vulnerable larval stage of development (Whitehead et al. 2012). When exposed to realistic, yet toxic levels of PAHs (1–15 µg/L), greater amberjack larvae develop cardiac abnormalities and physiological defects (Incardona et al. 2014). The future reproductive success of long-lived species, including red drum and many reef fish species may be negatively affected by episodic events resulting in high-mortality years or low recruitment. These episodic events could leave gaps in the age structure of the population, thereby affecting future reproductive output (Mendelssohn et al. 2012). Other studies have described the vulnerabilities of various marine finfish species, with morphological and/or life history characteristics similar to species found in the Gulf, to oil spills and dispersants (Hose et al. 1996; Carls et al. 1999; Heintz et al. 1999; Short 2003).

Increases in histopathological lesions were found in red snapper in the area affected by the oil, but Murawski et al. (2014) found that the incidence of lesions had declined between 2011 and 2012. The occurrence of such lesions in marine fish is not uncommon (Sindermann 1979; Haensly et al. 1982; Solangi and Overstreet 1982; Khan and Kiceniuk 1984, 1988; Kiceniuk and Khan 1987; Khan 1990). Red snapper diet was also affected after the spill. A decrease in zooplankton consumed, especially by adults (greater than 400 mm total length) over natural and artificial substrates may have contributed to an increase in the consumption of fish and invertebrate prey – more so at artificial reefs than natural reefs (Tarnecki and Patterson 2015).

In addition to the crude oil, over a million gallons of the dispersant, Corexit 9500A®, was applied to the ocean surface and an additional hundreds of thousands of gallons of dispersant was pumped to the mile-deep wellhead (National Commission 2010). No large-scale applications of dispersants in deep water had been conducted until the *Deepwater Horizon* MC252 oil spill. Thus, no data exist on the environmental fate of dispersants in deep water. The effect of oil, dispersants, and the combination of oil and dispersants on fishes of the Gulf remains an area of concern.

3.3 Description of the Economic Environment

Economic information pertaining to Gulf vermilion snapper can be found in Amendment 47 (GMFMC 2017) and is incorporated herein by reference. The following section contains select updated information on the economic environment of the vermilion snapper portion of the reef fish fishery, broken down by sector. Inflation adjusted revenues and prices are reported in 2020 dollars using the annual, non-seasonally adjusted Gross Domestic Product (GDP) implicit price deflator provided by the U.S. Bureau of Economic Analysis (BEA).

3.3.1 Commercial Sector

Permits

Any fishing vessel that harvests and sells any of the reef fish species managed under the Reef Fish FMP from the Gulf exclusive economic zone (EEZ) must have a valid Gulf reef fish permit. As of December 21, 2021, there were 747 limited access valid or renewable[16] reef fish permits. Commercial harvest of reef fish in the EEZ may only be sold to dealers with a federal dealer permit. As of December 21, 2021, there were 341 entities with a federal Gulf and South Atlantic Dealers (GSAD) permit.

Vessels, Landings, and Dockside Revenue

The following summaries of landings, revenue, and effort (Tables 3.3.1.1 and 3.3.1.2) are based on logbook information and the National Marine Fisheries Service (NMFS) Accumulated Landings System (ALS) for prices. Therefore, the values contained in this section may not match exactly with landings and revenue values presented elsewhere in this document that used ACL monitoring data. In addition, the landings are presented in gutted weight (gw) rather than in ww. Landings for all species in the SEFSC Social Science Research Group's (SEFSC-SSRG) Socioeconomic Panel data are expressed in gw to provide one unit for all species. This is because data summarizations, as presented in Tables 3.3.1.1 and 3.3.1.2 below, generally involve a multitude of species. It is also important to note that federally-permitted vessels that are required to submit logbooks generally report their harvest of most species regardless of whether the fish were caught in state or federal waters.

The number of federally permitted commercial vessels that harvested vermilion snapper in the Gulf was mostly stable from 2015 through 2019 with a peak in participation in 2017 (Table 3.3.1.1). Vermilion snapper ex-vessel revenue increased from 2015 to 2016 but then steadily decreased through 2019 (Tables 3.3.1.2). The average price per lb gw for vermilion snapper during this time period was $3.23 (2020 dollars). On average (2015 through 2019), vessels that landed vermilion snapper did so on approximately half of their Gulf trips and vermilion snapper comprised approximately 7% of their annual revenue from all species (Tables 3.3.1.1 and 3.3.1.2). Average annual revenue per vessel for all species harvested by these vessels experienced a downward trend from 2015 through 2018 but then increased modestly in 2019 (Table 3.3.1.2).

Estimates of net revenue specific to the vessels affected by this amendment are not readily available; however, it is assumed there is an overlap between these vessels and vessels that participate in the commercial Gulf reef fish fishery in general. According to Overstreet and Liese (2018), annual net revenue from operations for commercial vessels in the reef fish fishery

[16] A renewable permit is an expired limited access permit that cannot be actively fished, but can be renewed for up to one year after expiration.

was approximately 34% of their average annual gross revenue from 2014 through 2016. Applying this percentage to the results provided in Table 3.3.1.2 would result in an estimated per vessel average annual net revenue from operations of $52,944 (2020 dollars) per year.

Table 3.3.1.1. Number of vessels, number of trips, and landings (lbs gw) by year for vermilion snapper.

Year	# of vessels that caught vermilion snapper (> 0 lbs gw)	# of trips that caught vermilion snapper	vermilion snapper landings (lbs gw)	Other species' landings jointly caught w/ vermilion snapper (lbs gw)	# of Gulf trips that only caught other species	Other species' landings on Gulf trips w/o vermilion snapper (lbs gw)	All species landings on South Atlantic trips (lbs gw)
2015	364	2,703	1,248,886	7,179,971	2,952	6,141,689	132,306
2016	366	2,908	1,387,559	7,527,283	2,914	5,426,652	104,221
2017	389	3,180	1,445,764	7,318,480	2,850	4,741,163	60,527
2018	364	2,742	1,231,854	6,624,705	2,204	3,888,126	62,001
2019	362	2,669	1,125,671	6,386,333	2,562	4,792,229	84,310
Average	369	2,840	1,287,947	7,007,354	2,696	4,997,972	88,673

Source: SEFSC-SSRG Socioeconomic Panel (July 2021 version).

Table 3.3.1.2. Number of vessels and ex-vessel revenues by year (2020 dollars) for vermilion snapper.

Year	# of vessels that caught vermilion snapper (> 0 lbs gw)	Dockside revenue from vermilion snapper	Dockside revenue from 'other species' jointly caught w/ vermilion snapper	Dockside revenue from 'other species' caught on Gulf trips w/o vermilion snapper	Dockside revenue from 'all species' caught on South Atlantic trips	Total dockside revenue	Average total dockside revenue per vessel
2015	364	$4,230,950	$31,679,787	$25,341,108	$462,123	$61,713,968	$169,544
2016	366	$4,616,844	$33,302,902	$22,496,003	$332,849	$60,748,597	$165,980
2017	389	$4,383,899	$32,685,512	$19,627,574	$191,572	$56,888,557	$146,243
2018	364	$3,844,293	$30,878,187	$16,922,148	$255,182	$51,899,810	$142,582
2019	362	$3,698,758	$30,394,428	$21,428,261	$313,924	$55,835,370	$154,241
Average	369	$4,154,949	$31,788,163	$21,163,019	$311,130	$57,417,261	$155,718

Source: SEFSC-SSRG Socioeconomic Panel (July 2021 version).

Imports

Imports of seafood products compete in the domestic seafood market and have in fact dominated many segments of the seafood market. Imports affect the price for domestic seafood products and tend to set the price in the market segments in which they dominate. Seafood imports have downstream effects on the local fish market. At the harvest level for snapper species, imports affect the returns to fishermen through the ex-vessel prices they receive for their landings. As substitutes to the domestic production of snapper species, imports tend to cushion the adverse economic effects on consumers resulting from a reduction in domestic landings. The following describes the imports of fish products that directly compete with the domestic harvest of snapper species. Imports data for vermilion snapper, in particular, are not available.

Imports[17] of fresh snapper increased from 26.1 million lbs product weight (pw) in 2015 to 32.8 million lbs pw in 2019. During this time, total revenue from fresh snapper imports ranged from approximately $85.7 million (2020 dollars[18]) to $110.8 million. Imports of fresh snappers primarily originated in Mexico or Central America and entered the U.S. through the port of Miami, Florida. Imports of fresh snapper were highest on average (2015 through 2019) during the months of March through July. Imports of frozen snapper increased from 12.3 million lbs pw in 2015 to 14.4 million lbs pw in 2016, then decreased steadily to 11.4 million lbs pw in 2019. The annual value of these imports ranged from approximately $35.2 million (2020 dollars) to $40.8 million, with a peak in 2016. Imports of frozen snapper primarily originated in South America (especially Brazil), Indonesia, Mexico, and Central America. The majority of frozen snapper imports entered the U.S. through the ports of Miami, Florida, New York, New York, and San Juan, Puerto Rico. Imports of frozen snappers tended to be lowest during March through May when fresh snapper imports were high.

Business Activity

The commercial harvest and subsequent sales and consumption of fish generate business activity as fishermen expend funds to harvest the fish and consumers spend money on goods and services, such as vermilion snapper purchased at a local fish market and served during restaurant visits. These expenditures spur additional business activity in the region(s) where the harvest and purchases are made, such as jobs in local fish markets, grocers, restaurants, and fishing supply establishments. In the absence of the availability of a given species for purchase, consumers would spend their money on substitute goods, such as other finfish or seafood products, and services, such as visits to different food service establishments. As a result, the analysis presented below represents a distributional analysis only; that is, it only shows how

[17] NOAA Fisheries Service purchases fisheries trade data from the Foreign Trade Division of the U.S. Census Bureau. Data are available for download at https://www.fisheries.noaa.gov/national/sustainable-fisheries/foreign-fishery-trade-data

[18] Converted to 2020 dollars using the annual, not seasonally adjusted GDP implicit price deflator provided by the U.S. Bureau of Economic Analysis.

economic effects may be distributed through regional markets and should not be interpreted to represent the impacts if this species is not available for harvest or purchase.

Estimates of the U.S. average annual business activity associated with the commercial harvest of vermilion snapper in the Gulf were derived using the model developed for and applied in NMFS (2021) and are provided in Table 3.3.1.3.[19] This business activity is characterized as jobs (full- and part-time), output impacts (gross business sales), income impacts (wages, salaries, and self-employed income), and value-added impacts, which represent the contribution made to the U.S. GDP. These impacts should not be added together because this would result in double counting. It should be noted that the results provided should be interpreted with caution and demonstrate the limitations of these types of assessments. These results are based on average relationships developed through the analysis of many fishing operations that harvest many different species. Separate models to address individual species are not available. For example, the results provided here apply to a general "reef fish" category rather than just vermilion snapper, and a harvester job is "generated" for approximately every $33,800 (2020 dollars) in ex-vessel revenue. These results contrast with the number of harvesters (vessels) with recorded landings of vermilion snapper presented in Table 3.3.1.1.

Table 3.3.1.3. Average annual business activity (2015 through 2019) associated with the commercial harvest of vermilion snapper in the Gulf. All monetary estimates are in 2020 dollars.

Species	Average Ex-vessel Value ($ thousands)	Total Jobs	Harvester Jobs	Output (Sales) Impacts ($ thousands)	Income Impacts ($ thousands)	Value Added ($ thousands)
Vermilion Snapper	$4,155	517	123	$41,204	$15,131	$21,379

Source: Calculated by NMFS Southeast Regional Office (SERO) using the model developed for and applied in NMFS (2021).

3.3.2 Recreational Sector

The recreational sector is comprised of the private and for-hire modes. The private mode includes anglers fishing from shore (all land-based structures) and private/rental boats. The for-hire mode is composed of charter boats and headboats. Charter boats generally carry fewer passengers and charge a fee on an entire vessel basis, whereas headboats carry more passengers and payment is per person. The type of service, from a vessel- or passenger-size perspective, affects the flexibility to search different fishing locations during the course of a trip and target different species because larger concentrations of fish are required to satisfy larger groups of anglers.

[19]A detailed description of the input/output model is provided in NMFS (2011).

Permits

For-hire vessels are required to have a Gulf charter/headboat permit for reef fish (for-hire permit) to fish for or possess reef fish species in the Gulf EEZ. These are limited access permits. On December 21, 2021, there were 1,172 vessels with a valid (non-expired) or renewable[20] for-hire reef fish permit (including historical captain permits). Although the for-hire permit application collects information on the primary method of operation, the permit itself does not identify the permitted vessel as either a headboat or a charter vessel, and vessels may operate in both capacities. However, only federally permitted headboats are required to submit harvest and effort information to the NMFS Southeast Region Headboat Survey (SRHS).[21] Participation in the SRHS is based on determination by the SEFSC that the vessel primarily operates as a headboat. As of March 9, 2021, 69 Gulf headboats were registered in the SRHS (K. Fitzpatrick, NMFS SEFSC, pers. comm. 2021). The majority of these headboats were located in Florida (39), followed by Texas (16), Alabama (9), and Mississippi/Louisiana (5).

Information on Gulf charter vessel and headboat operating characteristics is included in Savolainen et al. (2012) and is incorporated herein by reference.

There are no specific federal permitting requirements for recreational anglers to fish for or harvest reef fish species, including vermilion snapper. Instead, anglers are required to possess either a state recreational fishing permit that authorizes saltwater fishing in general, or be registered in the federal National Saltwater Angler Registry system, subject to appropriate exemptions. As a result, it is not possible to identify with available data how many individual anglers would be expected to be affected by this action.

Angler Effort

Recreational effort derived from the Marine Recreational Information Program (MRIP) database can be characterized in terms of the number of trips as follows:

- Target effort - The number of individual angler trips, regardless of duration, where the intercepted angler indicated that the species or a species in the species group was targeted as either the first or the second primary target for the trip. The species did not have to be caught.

[20] A renewable permit is an expired permit that may not be actively fished, but is renewable for up to one year after expiration.

[21] All federal charter/headboat permit holders, including charter vessel owners or operators, are required to comply with the new Southeast For-Hire Electronic Reporting Program as of January 5, 2021, except for the Vessel Monitoring System requirements, which become effective as of March 1, 2022. Under this program, all such permit holders must declare trips prior to departure and submit electronic fishing reports prior to offloading fish, or within 30 minutes after the end of a trip, if no fish are landed. Those vessels selected to report to the SRHS (i.e., federally permitted headboats) will continue to submit their reports under the new requirements directly to the SRHS program. For more information, see: https://www.fisheries.noaa.gov/southeast/recreational-fishing-data/southeast-hire-electronic-reporting-program?utm_medium=email&utm_source=govdelivery

- Catch effort - The number of individual angler trips, regardless of duration and target intent, where the individual species or a species in the species group was caught. The fish did not have to be kept.
- Total recreational trips - The total estimated number of recreational trips in the Gulf, regardless of target intent or catch success.

A target trip may be considered an angler's revealed preference for a certain species, and thus may carry more relevant information when assessing the economic effects of regulations on the subject species than the other two measures of recreational effort. Given the subject nature of this action, the following discussion focuses on target trips for vermilion snapper in the Gulf. Data from MRIP and the Louisiana Department of Wildlife and Fisheries (LDWF) were used to estimate these trips. It is important to note that in 2018, MRIP transitioned from the old Coastal Household Telephone Survey (CHTS) to a new mail-based fishing effort survey (FES). The MRIP-based estimates presented for FL, AL, and MS in Table 3.3.2.1 are calibrated to the FES and may be greater than estimates that are non-calibrated.[22] In addition, effort estimates for Louisiana from the LDWF LA Creel survey are not calibrated to MRIP and are therefore not directly comparable to the MRIP-based estimates.

Target trips for vermilion snapper in the Gulf increased substantially from 2015 through 2019 (Table 3.3.2.1). Florida and Alabama recorded the most target trips for vermilion snapper during this time period and the dominant mode of fishing on these trips was the private/rental mode (Table 3.3.2.1).

Table 3.3.2.1. Gulf vermilion snapper recreational target trips, by mode and state, 2015-2019.

	Alabama	**Florida**	**Louisiana***	**Mississippi**
	Shore Mode			
2015	0	0	N/A	0
2016	0	0	0	0
2017	0	0	0	0
2018	0	0	0	0
2019	0	0	0	0
Average	0	0	0	0
	Charter Mode			
2015	1468	2941	N/A	0
2016	5,705	5,991	0	0
2017	4466	10,810	0	0

[22] As of August 2018, all directed trip estimate information provided by MRIP (public use survey data and directed trip query results) for the entire time series were updated to account for both the Access Point Angler Intercept Survey (APAIS) design change in 2013, as well as the transition from the CHTS to the FES in 2018. Back-calibrated estimates of directed effort are not available. For more information, see: https://www.fisheries.noaa.gov/recreational-fishing-data/recreational-fishing-estimate-updates

	Alabama	Florida	Louisiana*	Mississippi
2018	3,972	13,124	35	0
2019	5,246	12,779	0	0
Average	4,171	9,129	9	0
	Private/Rental Mode			
2015	5,848	65,153	N/A	0
2016	6,131	23,394	53	3721
2017	8,275	63,393	234	0
2018	19,182	93,832	12	0
2019	63,931	91,443	1,087	0
Average	20,673	67,443	347	744
	All Modes			
2015	7,317	68,095	N/A	0
2016	11,836	29,385	53	3721
2017	12,740	74,203	234	0
2018	23,154	106,956	47	0
2019	69,177	104,221	1,087	0
Average	24,845	76,572	355	744

Source: MRIP database, SERO, NMFS (December, 2021) for AL, FL and MS. LA Creel for LA (January, 2022).
*MRIP estimates for Louisiana are not available after 2013. Estimates shown are provided by the Louisiana Department of Wildlife and Fisheries, which began collecting target effort data beginning in 2016. These data are not currently calibrated with the MRIP data and are therefore not directly comparable to the MRIP-based estimates.
Note: Texas and headboat information is unavailable.

Similar analysis of recreational effort is not possible for the headboat mode because headboat data are not collected at the angler level. Estimates of effort by the headboat mode are provided in terms of angler days, or the total number of standardized full-day angler trips.[23] Headboat angler days were fairly stable across the Gulf states from 2015 through 2019 (Table 3.3.2.2). There was, however, a downward trend in reported angler days in Florida from 2016 on. On average (2015 through 2019), Florida accounted for the majority of headboat angler days reported, followed by Texas and Alabama; whereas, Mississippi and Louisiana combined accounted for only a small percentage (Table 3.3.2.2). Headboat effort in terms of angler days for the entire Gulf tended to be concentrated most heavily during the summer months of June through August (Table 3.3.2.3).

Table 3.3.2.2. Gulf headboat angler days and percent distribution by state (2015 - 2019).

[23] Headboat trip categories include half-, three-quarter-, full-, and 2-day trips. A full-day trip equals one angler day, a half-day trip equals .5 angler days, etc. Angler days are not standardized to an hourly measure of effort and actual trip durations may vary within each category.

	Angler Days				Percent Distribution			
	FL	AL	MS-LA*	TX	FL	AL	MS-LA	TX
2015	176,375	18,008	3,587	55,135	69.7%	7.1%	1.4%	21.8%
2016	183,147	16,831	2,955	54,083	71.3%	6.5%	1.1%	21.0%
2017	178,816	17,841	3,189	51,575	71.1%	7.1%	1.3%	20.5%
2018	171,996	19,851	3,235	52,160	69.6%	8.0%	1.3%	21.1%
2019	161,564	18,607	2,632	52,456	68.7%	7.9%	1.1%	22.3%
Average	174,380	18,228	3,120	53,082	70.1%	7.3%	1.3%	21.3%

Source: NMFS SRHS (February, 2020).
*Headboat data from Mississippi and Louisiana are combined for confidentiality purposes.

Table 3.3.2.3. Gulf headboat angler days and percent distribution by month (2015 - 2019).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Headboat Angler Days											
2015	9,444	10,594	22,827	20,684	20,973	44,731	45,192	26,637	15,114	17,246	9,757	9,906
2016	7,954	13,233	21,829	18,691	21,693	50,333	49,881	21,775	13,596	15,827	11,823	10,381
2017	8,998	14,007	21,032	19,383	19,186	47,673	54,028	22,984	10,289	11,054	11,299	11,488
2018	5,524	13,694	20,762	17,584	16,876	54,251	53,304	24,819	13,235	10,633	8,183	8,377
2019	2,330	12,819	21,796	16,299	18,271	46,046	47,594	24,212	11,369	13,687	10,389	10,447
Avg	6,850	12,869	21,649	18,528	19,400	48,607	50,000	24,085	12,721	13,689	10,290	10,120
	Percent Distribution											
2015	3.7%	4.2%	9.0%	8.2%	8.3%	17.7%	17.9%	10.5%	6.0%	6.8%	3.9%	3.9%
2016	3.1%	5.1%	8.5%	7.3%	8.4%	19.6%	19.4%	8.5%	5.3%	6.2%	4.6%	4.0%
2017	3.6%	5.6%	8.4%	7.7%	7.6%	19.0%	21.5%	9.1%	4.1%	4.4%	4.5%	4.6%
2018	2.2%	5.5%	8.4%	7.1%	6.8%	21.9%	21.6%	10.0%	5.4%	4.3%	3.3%	3.4%
2019	1.0%	5.4%	9.3%	6.9%	7.8%	19.6%	20.2%	10.3%	4.8%	5.8%	4.4%	4.4%
Avg	2.7%	5.2%	8.7%	7.4%	7.8%	19.5%	20.1%	9.7%	5.1%	5.5%	4.1%	4.1%

Source: NMFS SRHS (February 2020).

Economic Value

Participation, effort, and harvest are indicators of the value of saltwater recreational fishing. However, a more specific indicator of value is the satisfaction that anglers experience over and above their costs of fishing. The monetary value of this satisfaction is referred to as consumer surplus (CS). The value or benefit derived from the recreational experience is dependent on several quality determinants, which include fish size, catch success rate, and the number of fish kept. These variables help determine the value of a fishing trip and influence total demand for recreational fishing trips.

Direct estimates of the CS for vermilion snapper are not currently available. There are, however, estimates for snapper and grouper species in general. Haab et al. (2012) estimated the CS (willingness to pay [WTP] for one additional fish caught and kept) for snappers and groupers in the Southeastern U.S. using four separate econometric modeling techniques. The finite mixture model, which takes into account variation in the preferences of fishermen, had the best prediction rates of the four models and, therefore, was selected for presentation here. The WTP for an additional snapper (excluding red snapper) estimated by this model was $13.11 (2020 dollars).[24] Although this estimate is not specific to vermilion snapper, the study did include vermilion snapper as part of the snapper group. This value may seem low and may be strongly influenced by the pooling effect inherent to the model in which it was estimated. The WTP for an additional red snapper, in comparison, was estimated to be $148.57 (2020 dollars). The WTP for an additional grouper was estimated to be $142.74 (2020 dollars).

The foregoing estimates of economic value should not be confused with economic impacts associated with recreational fishing expenditures. Although expenditures for a specific good or service may represent a proxy or lower bound of value (a person would not logically pay more for something than it was worth to them), they do not represent the net value (benefits minus cost), nor the change in value associated with a change in the fishing experience.

With regard to for-hire businesses, economic value can be measured by producer surplus (PS) per passenger trip (the amount of money that a vessel owner earns in excess of the cost of providing the trip). Estimates of the PS per for-hire passenger trip are not available. Instead, trip net revenue (TNR), which is the return used to pay all labor wages, returns to capital, and owner profits, is used as a proxy for PS. When TNR is divided by the number of anglers on a trip, it represents cash flow per angler (CFpA). The estimated CFpA value for an average Gulf charter angler trip is $237 (2020 dollars) and the estimated CFpA value for an average Gulf headboat angler trip is $99 (Souza and Liese 2019). Estimates of CFpA for a vermilion snapper target trip are not available.

According to Savolainen et al. (2012), the average charter vessel operating in the Gulf is estimated to receive approximately $91,000 (2020 dollars) in gross revenue and $27,000 in net income (gross revenue minus variable and fixed costs) annually. The average headboat is estimated to receive approximately $275,000 (2020 dollars) in gross revenue and $80,000 in net income annually.

Business Activity

The desire for recreational fishing generates economic activity as consumers spend their income on various goods and services needed for recreational fishing. This spurs economic activity in the region where recreational fishing occurs. It should be clearly noted that, in the absence of the opportunity to fish, the income would presumably be spent on other goods and services, and these expenditures would similarly generate economic activity in the region where the expenditures occur. As such, the analysis below represents a distributional analysis only.

Estimates of the business activity (economic impacts) associated with recreational angling for vermilion snapper in the Gulf were calculated using average trip-level impact coefficients

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[24] Converted to 2020 dollars using the annual, not seasonally adjusted GDP implicit price deflator provided by the U.S. Bureau of Economic Analysis (BEA).

derived from the 2017 Fisheries Economics of the U.S. report (NMFS 2021) and underlying data provided by the NOAA Office of Science and Technology. Economic impact estimates in 2017 dollars were adjusted to 2020 dollars using the annual, not seasonally adjusted GDP implicit price deflator provided by the U.S. Bureau of Economic Analysis.

Business activity (economic impacts) for the recreational sector is characterized in the form of jobs (full- and part-time), income impacts (wages, salaries, and self-employed income), output impacts (gross business sales), and value-added impacts (contribution to the GDP in a state or region). Estimates of the average annual economic impacts (2015-2019) resulting from Gulf vermilion snapper target trips are provided in Table 3.3.2.4. The average impact coefficients, or multipliers, used in the model are invariant to the "type" of effort (e.g., target or catch) and can therefore be directly used to measure the impact of other effort measures such as vermilion snapper catch trips. To calculate the multipliers from Table 3.3.2.4, simply divide the desired impact measure (sales impact, value-added impact, income impact, or employment) associated with a given state and mode by the number of target trips for that state and mode.

The estimates provided in Table 3.3.2.4 only apply at the state-level. Addition of the state-level estimates to produce a regional (or national) total may underestimate the actual amount of total business activity, because state-level impact multipliers do not account for interstate and interregional trading. It is also important to note that these economic impacts estimates are based on trip expenditures only and do not account for durable expenditures. Durable expenditures cannot be reasonably apportioned to individual species. As such, the estimates provided in Table 3.3.2.4 may be considered a lower bound on the economic activity associated with those trips that targeted vermilion snapper.

Estimates of the business activity associated with headboat effort are not available. Headboat vessels are not covered in MRIP in the Southeast, so, in addition to the absence of estimates of target effort, estimation of the appropriate business activity coefficients for headboat effort has not been conducted.

Table 3.3.2.4. Estimated annual average economic impacts (2015-2019) from recreational trips that targeted Gulf vermilion snapper, by state and mode, using state-level multipliers. All monetary estimates are in 2020 dollars in thousands.

	FL	**AL**	**MS**	**LA**
	Charter Mode			
Target Trips	9,129	4,171	0	9
Value Added Impacts	$3,194	$1,737	$0	$4
Sales Impacts	$5,363	$3,160	$0	$8
Income Impacts	$1,866	$991	$0	$2
Employment (Jobs)	49	34	0	0
	Private/Rental Mode			
Target Trips	67,443	20,673	744	347
Value Added Impacts	$2,431	$935	$16	$52
Sales Impacts	$3,768	$1,446	$27	$89
Income Impacts	$1,276	$364	$9	$28

	FL	AL	MS	LA
Employment (Jobs)	34	13	0	1
	All Modes			
Target Trips	76,572	24,845	744	355
Value Added Impacts	$5,625	$2,672	$16	$56
Sales Impacts	$9,132	$4,606	$27	$96
Income Impacts	$3,142	$1,355	$9	$30
Employment (Jobs)	84	48	0	1

Source: Effort data from MRIP and LDWF LA Creel; economic impacts results calculated by NMFS SERO using NMFS (2021) and underlying data provided by the NOAA Office of Science and Technology.
Note: Texas and headboat information is unavailable.

3.4 Description of the Social Environment

This framework action affects commercial and recreational management of vermilion snapper in the Gulf. A description of the permits related to commercial and recreational reef fish fishing is included by state in order to provide a geographic distribution of fishing involvement. Top communities based on the number of permits are presented. Commercial and recreational landings by state are included to provide information on the geographic distribution of fishing involvement. Descriptions of the top communities involved in commercial vermilion snapper are included as well as the top recreational fishing communities based on recreational engagement. Additional detailed information about communities in the following analysis can be found on SERO's Community Snapshots website.[25] Community level data are presented in order to meet the requirements of National Standard 8 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), which requires the consideration of the importance of fishery resources to human communities when changes to fishing regulations are considered. Lastly, social vulnerability data are presented to assess the potential for environmental justice concerns.

3.4.1 Commercial Sector

Permits

Gulf reef fish permits are issued to individuals in Florida (80% of Gulf reef fish vessels), Texas (8.2%), Alabama (4.6%), Louisiana (4.1%), and Mississippi (1%, SERO permit office, December 21, 2020). Residents of nine other states also hold commercial reef fish permits, but these states represent a smaller percentage of the total number of issued permits.

Gulf reef fish permits are held by individuals with mailing addresses in 230 communities (SERO permit office, December 21, 2020). Communities with the most commercial reef fish permits are located in Florida and Texas (Table 3.4.1.1). The communities with the most reef fish permits

[25] https://www.fisheries.noaa.gov/southeast/socioeconomics/snapshots-human-communities-and-fisheries-gulf-mexico-and-south-atlantic

are Panama City, Florida (8.3% of reef fish permits), Key West, Florida (4.6%), and St. Petersburg, Florida (3.2%).

Table 3.4.1.1. Top communities by number of commercial reef fish permits.

State	Community	Reef Fish Permits (RR)
FL	Panama City	69
FL	Key West	38
FL	St. Petersburg	27
FL	Largo	24
FL	Destin	22
TX	Galveston	22
FL	Pensacola	20
FL	Cortez	18
FL	Seminole	18
FL	Clearwater	17
FL	Tampa	15
FL	Naples	13
FL	Winter Springs	13
FL	Fort Walton Beach	11
FL	Tarpon Springs	11
FL	Lecanto	10
TX	Houston	10
FL	Apalachicola	9
FL	Hudson	9
FL	Lynn Haven	9
FL	Palm Harbor	9
FL	Steinhatchee	9

Source: SERO permit office, December 21, 2020.

Landings

Table 3.4.1.2 provides the commercial landings by state for 2014-2020. The majority of commercial landings of vermilion snapper are made in Florida (78% average over the time series). A smaller proportion of the total commercial vermilion snapper catch is landed in the other Gulf states, with an average 7% of landings in Alabama, 3% in Mississippi and Louisiana, combined; and 12% in Texas).

Table 3.4.1.2. Commercial landings of vermilion snapper by state for 2014-2020, in pounds whole weight.

Year	AL	FL	LA/MS	TX	Total
2014	123,666	1,399,774	17,891	203,891	1,745,222
2015	74,207	941,296	28,185	309,246	1,352,934
2016	75,697	1,246,940	50,767	191,960	1,565,364
2017	79,989	1,350,776	31,956	150,137	1,612,859
2018	83,462	1,167,964	38,813	108,206	1,398,445
2019	146,090	995,360	50,661	112,943	1,305,052
2020	74,120	614,969	78,960	92,564	860,613

Source: M. Larkin, NMFS-SERO. Landings from Mississippi and Louisiana have been combined for confidentiality.

The regional quotient (RQ) is the proportion of landings and value out of the total landings and value of that species for that region, and is a relative measure. These communities would be most likely to experience the effects of the proposed action (Section 4.1.4). If a community is identified as a vermilion snapper community based on the RQ, this does not necessarily mean that the community would experience significant impacts due to changes in the fishery if a different species or number of species were also important to the local community and economy. Vermilion snapper makes up a relatively small proportion of the finfish landed in each of these communities.

The top vermilion snapper fishing communities are located in the Florida Panhandle (Figure 3.4.1.1). About 30% of vermilion snapper is landed in the top community of Panama City, representing 29% of Gulf-wide ex-vessel value for the species. Pensacola ranks second for pounds RQ (23%) and value RQ (22%) of vermilion snapper, and Destin ranks third (15% for pounds RQ and value RQ).

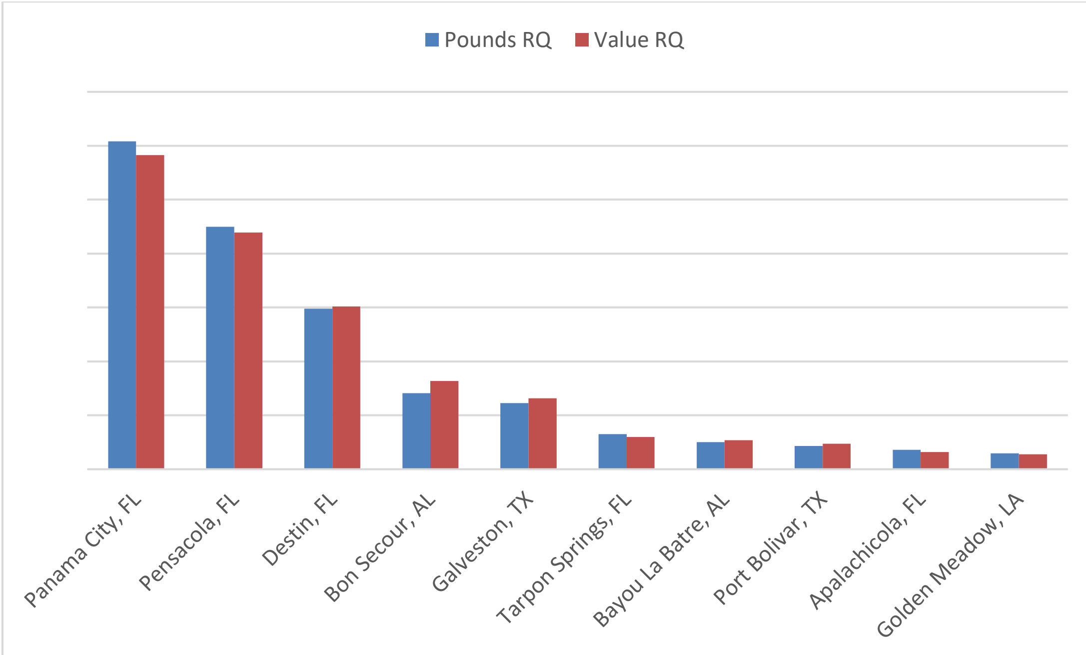

Figure 3.4.1.1. Top 10 Gulf communities ranked by pounds and value RQ for vermilion snapper. The actual RQ values (y-axis) are omitted from the figure to maintain confidentiality.
Source: SERO, Community ALS 2019.

3.4.2 Recreational Sector

Permits

Charter/headboat reef fish permits are issued to individuals in Florida (59.7% of charter/headboat reef fish vessels), Texas (15.8%), Alabama (10%), Louisiana (7.7%), and Mississippi (2.9%, SERO permit office, December 21, 2020). Residents of 18 other states also hold a small percentage of the total number of issued charter/headboat permits.

Charter/headboat reef fish permits are held by individuals with mailing addresses in 339 communities (SERO permit office, December 21, 2020). Communities with the most charter/headboat for reef fish permits are located in Florida, Alabama, and Texas (Table 3.4.2.1). The communities with the most charter/headboat permits are Destin, Florida (4.9% of charter/headboat permits), Panama City, Florida (4.4%), and Naples, Florida (3.7%).

Table 3.4.2.1. Top communities by number of Gulf charter/headboat for reef fish permits.

State	Community	Charter/Headboat for Reef Fish Permits (RCG)
FL	Destin	63
FL	Panama City	57
FL	Naples	47
AL	Orange Beach	45
FL	Key West	37
FL	Pensacola	28
TX	Galveston	21
FL	Panama City Beach	20
FL	Sarasota	20
FL	St. Petersburg	19
FL	Clearwater	17
FL	Cape Coral	16
TX	Corpus Christi	16
FL	Fort Myers	14
FL	Gulf Breeze	14

Source: SERO permit office, December 21, 2020.

Landings

Table 3.4.2.2 provides total recreational landings in MRIP-FES units by state for 2014-2020, including those from charter vessels, headboats, and privately-owned boats. The majority of recreational landings of vermilion snapper are from waters adjacent to Florida (average of 73.4% from 2014-2020), followed by Alabama (20.2%), and the remaining states representing small percentages of the recreational landings (Texas 3.6%; Louisiana and Mississippi 2.7%; Table 3.4.2.2).

Table 3.4.2.2. Recreational landings in MRIP-FES units (pounds whole weight) by state (2014-2020), including for-hire (charter/headboat) and privately-owned vessels.

Year	AL	FL	LA/MS	TX	Total
2014	441,085	1,236,427	3,908	62,635	1,744,056
2015	323,329	1,133,002	10,041	75,800	1,542,173
2016	173,367	1,119,890	178,606	55,278	1,527,140
2017	639,526	1,716,197	19,899	70,817	2,446,438
2018	534,896	2,306,633	32,371	66,311	2,940,211
2019	406,439	1,717,236	62,161	75,944	2,261,779
2020	335,508	1,112,255	30,184	69,523	1,547,470

Source: M. Larkin, NMFS-SERO. Landings from Mississippi and Louisiana have been combined.

Engagement and Reliance Indicators

Landings for the recreational sector are not available by species at the community level, making it difficult to identify communities as dependent on recreational fishing for vermilion snapper. Because limited data are available concerning how recreational fishing communities are engaged and reliant on specific species, indices were created using secondary data from permit and infrastructure information for the southeast recreational fishing sector at the community level (Jepson and Colburn 2013, Jacob et al. 2013). Recreational fishing engagement is represented by the number of recreational permits and vessels designated as "recreational" by homeport and owners address. Fishing reliance includes the same variables as fishing engagement, divided by population. Factor scores of both engagement and reliance were plotted by community.

Figure 3.4.2.1 identifies the top Gulf communities that are engaged and reliant upon recreational fishing in general. Two thresholds of one and one-half standard deviation above the mean were plotted to help determine a threshold for significance. Communities are presented in ranked order by fishing engagement and all 20 included communities demonstrate high levels of recreational engagement, although this is not specific to fishing for vermilion snapper. Because the analysis used discrete geo-political boundaries, Panama City and Panama City Beach had separate values for the associated variables. Calculated independently, each still ranked high enough to appear in the top 20 list suggesting a greater importance for recreational fishing in that area.

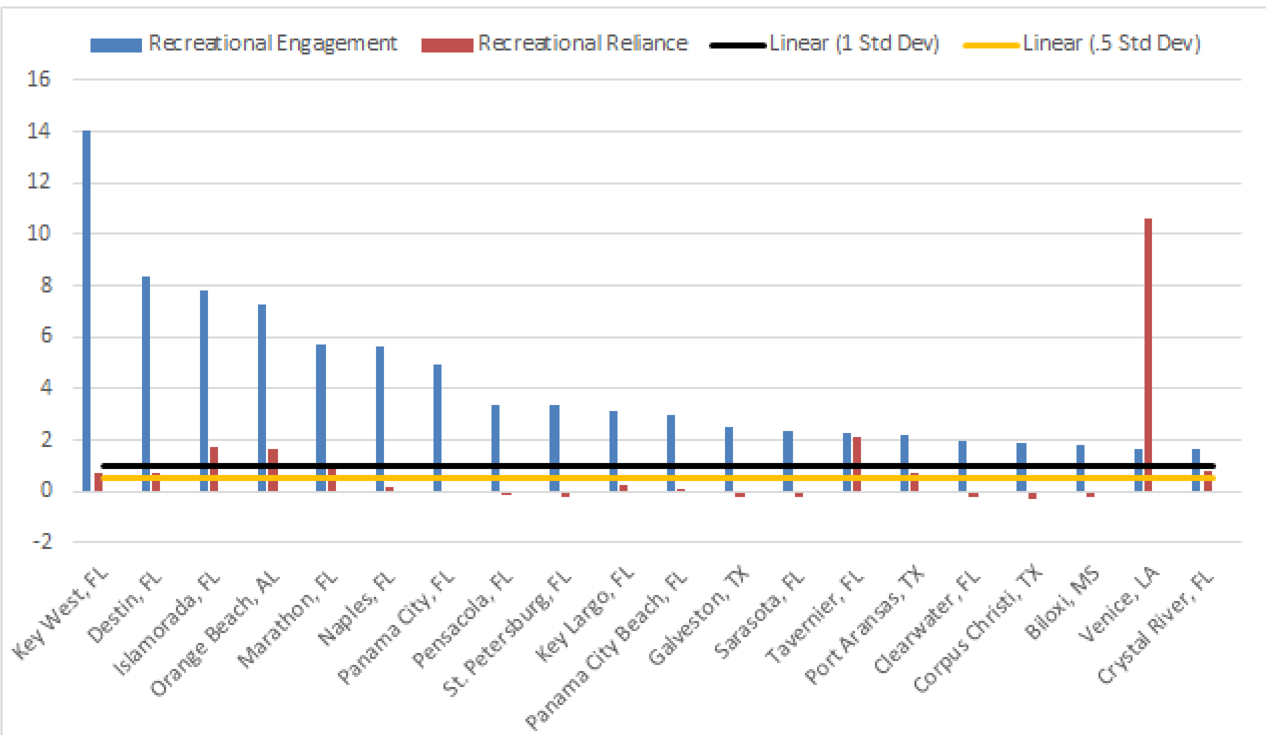

Figure 3.4.2.1. Top 20 recreational fishing communities' engagement and reliance.
Source: SERO, Community Social Vulnerability Indicators Database 2019.

3.4.3 Environmental Justice

Executive Order (E.O.) 12898 requires federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. The main focus of E.O. 12898 is to consider "the disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories…" This E.O. is generally referred to as environmental justice (EJ).

Information is available concerning communities overall status with regard to underserved populations including minorities and those living in poverty (e.g., census data). To help assess whether any EJ concerns may be present within regional communities, a suite of indices was created to examine the social vulnerability of coastal communities. The three indices are poverty, population composition, and personal disruptions. The variables included in each of these indices have been identified through the literature as being important components that contribute to a community's vulnerability. Indicators such as increased poverty rates for different groups, more single female-headed households and households with children under the age of five, disruptions such as higher separation rates, higher crime rates, and unemployment all are signs of populations experiencing vulnerabilities. Again, for those communities that exceed the threshold it would be expected that they would exhibit vulnerabilities to sudden changes or social disruption that might accrue from regulatory change.

Figure 3.4.3.1 provides the social vulnerability of the top vermilion snapper fishing communities. Included are the top 10 commercial communities based on volume and value of vermilion snapper landings (Figure 3.4.1.1), and the top 10 recreational communities for engagement and reliance with recreational fishing in general (Figure 3.4.2.1). Panama City, Pensacola, and Destin, Florida rank among the top ten for both sectors. Supporting information for Port Bolivar, Texas is not available as a discrete community, and is likely included with Galveston, Texas. One community exceeds the threshold of one standard deviation above the mean for all three indices, Bayou La Batre, Alabama, and would be the most likely to exhibit vulnerabilities to social or economic disruption due to regulatory change.

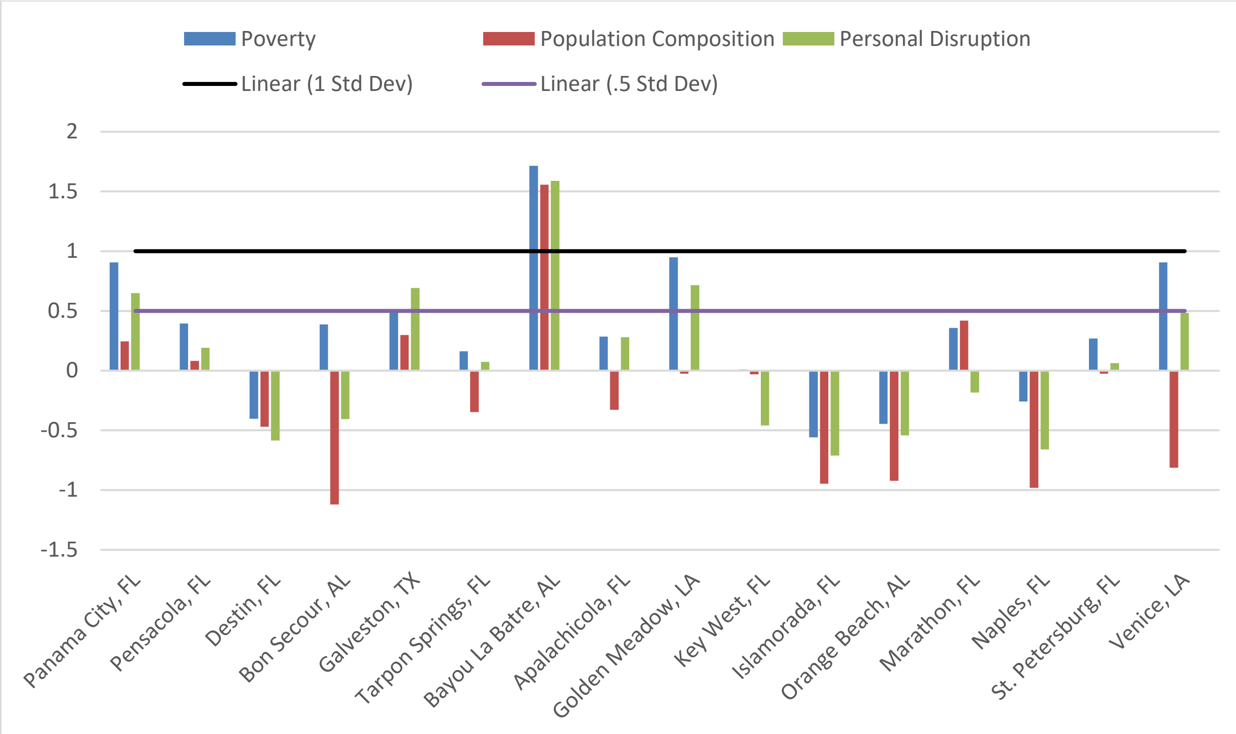

Figure 3.4.3.1. Social vulnerability indices for top commercial and recreational communities for vermilion snapper and reef fish fishing.
Source: SERO, Community Social Vulnerability Indicators Database 2018.

People in these communities may be affected by fishing regulations in two ways: participation and employment. Although these communities may have the greatest potential for EJ concerns, complete data are not available on the race and income status for those involved in the local fishing industry (employment), or for their dependence on vermilion snapper specifically (participation). Although no EJ issues have been identified, the absence of potential EJ concerns cannot be assumed.

3.5 Description of the Administrative Environment

3.5.1 Federal Fishery Management

Federal fishery management is conducted under the authority of the Magnuson-Stevens Act (16 U.S.C. 1801 *et seq*.), originally enacted in 1976 as the Fishery Conservation and Management Act. The Magnuson-Stevens Act claims sovereign rights and exclusive fishery management authority over most fishery resources within the EEZ. The EEZ is defined as an area extending 200 nautical miles from the seaward boundary of each of the coastal states. The Magnuson-Stevens Act also claims authority over U.S. anadromous species and continental shelf resources that occur beyond the EEZ.

Responsibility for federal fishery management decision-making is divided between the Secretary of Commerce (Secretary) and eight regional fishery management councils that represent the expertise and interests of constituent states. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring management measures are consistent with the Magnuson-Stevens Act and with other applicable laws summarized in Appendix C. In most cases, the Secretary has delegated this authority to NMFS.

The Gulf Council is responsible for fishery resources in federal waters of the Gulf. For reef fish, these waters extend 200 nautical miles offshore from the seaward boundaries of Alabama, Florida, Louisiana, Mississippi, and Texas, as those boundaries have been defined by law. The length of the Gulf coastline is approximately 1,631 miles. Florida has the longest coastline extending 770 miles along its Gulf coast, followed by Louisiana (397 miles), Texas (361 miles), Alabama (53 miles), and Mississippi (44 miles).

The Gulf Council consists of seventeen voting members: 11 public members appointed by the Secretary; one each from the fishery agencies of Texas, Louisiana, Mississippi, Alabama, and Florida; and one from NMFS. The public is also involved in the fishery management process.

3.5.2 State Fishery Management

The purpose of state representation at the Council level is to ensure state participation in federal fishery management decision-making and to promote the development of compatible regulations in state and federal waters. The state governments of Texas, Louisiana, Mississippi, Alabama, and Florida have the authority to manage their respective state fisheries. Each of the five Gulf states exercises legislative and regulatory authority over their states' natural resources through discrete administrative units. Although each agency is the primary administrative body with respect to the states' natural resources, all states cooperate with numerous state and federal regulatory agencies when managing marine resources. Descriptions of individual state management and data collection programs can be found at the Web Pages shown in Table 3.6.2.1.

Table 3.5.2.1. Gulf state marine resource agencies and web pages.

State Marine Resource Agency	Web Page
Alabama Marine Resources Division	http://www.outdooralabama.com/
Florida Fish and Wildlife Conservation Commission	http://myfwc.com/
Louisiana Department of Wildlife and Fisheries	http://www.wlf.louisiana.gov/
Mississippi Department of Marine Resources	http://www.dmr.ms.gov/
Texas Parks and Wildlife Department	http://tpwd.texas.gov/

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

4.1 Direct and Indirect Effects Analysis

4.1.1 Direct and Indirect Effects on the Physical Environment

The alternatives in this action would modify the catch limits for vermillion snapper: overfishing limit (OFL), acceptable biological catch (ABC), and the annual catch limit (ACL). While this action would not directly affect the physical environment, catch levels that allow for more or less harvest may change fishing activity, which could indirectly affect this environment. Any effects from this action are not expected to be significant, as this action is not expected to change how the reef fish fishery is prosecuted overall because it is a multi-species fishery targeting many species. This action would only affect the portion of the fishery targeting vermillion snapper.

Participants in the commercial sector of the reef fish fishery primarily use vertical lines (i.e., electric reel, bandit rig, hook-and-line, and trolling) and longlines. On average (from 1999 through 2019) approximately 45% of vermillion snapper is landed by the commercial sector (Table 1.1.2). Participants in the recreational sector (headboat, charter, and private modes) primarily use vertical line gear (hook-and-line). Bottom longline gear is deployed over hard bottom habitats using weights to keep the gear in direct contact with the bottom. The potential for this gear to adversely impact the bottom depends on the type of habitat it is set on, the presence or absence of currents and the behavior of fish after being hooked. In addition, this gear, upon retrieval, can abrade, snag, and dislodge smaller rocks, corals, and sessile invertebrates (Hamilton 2000; Barnette 2001).

Direct underwater observations of longline gear in the Pacific halibut fishery by High (1998) noted that the gear could sweep across the bottom. A study that directly observed deployed longline gear (Atlantic tilefish fishery) found no evidence that the gear shifted significantly, even when set in currents (Grimes et al. 1982). A lack of gear shifting, even in strong currents, was attributed to setting anchors at either end of the longline to prevent movement, which is the standard in the longline component of the commercial sector of the reef fish fishery. Based on direct observations, it is logical to assume that bottom longline gear would have a minor impact on sandy or muddy habitat areas. However, due to the vertical relief that hard bottom and coral reef habitats provide, it would be expected that bottom longline gear may become entangled, resulting in potential negative effects to habitat (Barnette 2001).

Concentrations of many managed reef fish species are higher on hard bottom areas than on sand or mud bottoms, thus vertical line gear fishing generally occurs over hard bottom areas (GMFMC 2004a). Vertical lines include multi-hook lines known as bandit gear, handlines, and rod-and-reels. Vertical line gear is less likely to contact the bottom than longlines, but still has the potential to snag and entangle bottom structures and cause attached organisms, such as soft corals and sponges, to tear off or be abraded (Barnette 2001).

In using bandit gear, a weighted line is lowered to the bottom, and then the weighted line is raised slightly off the bottom (Siebenaler and Brady 1952). The gear is in direct contact with the bottom for only a short period of time. Barnette (2001) suggested that physical impacts may include entanglement and minor degradation of benthic species from line abrasion and the use of weights (sinkers). Anchor damage is also associated with vertical line fishing vessels, particularly by the recreational sector, where anglers may repeatedly visit well-marked or known fishing locations. Hamilton (2000) pointed out that "favorite" fishing areas such as reefs are targeted and revisited multiple times, particularly with the advent of GPS technology.

The cumulative effects of repeated anchoring could damage the hard bottom areas where reef fish fishing occurs, as well as repeated drops of weighted fishing rigs onto the reef. Recreational and commercial vessels that use vertical line gear are typically known to anchor more frequently over the reef sites. Spears are used by both the recreational and commercial sector to harvest reef fish, but represent a relatively minor component of both. Barnette (2001) summarized a previous study that concluded spearfishing on reef habitat might result in some coral breakage. In addition, there could be some impacts from divers touching coral with their hands or from re-suspension of sediment by fins (Barnette 2001).

Alternative 1 (No Action) would maintain the current catch limits. Under **Alternative 1**, fishing effort and effects on the physical environment would be similar to what has been experienced in recent years (2012-2019). Landings would still be limited as the stock is managed under the ACL. Both **Preferred Alternative 2** and **Alternative 3** would increase the catch limits for vermillion snapper based on results from the SEDAR 67 stock assessment update and conversion of recreational landings to the Marine Recreation Information Program's Fishing Effort Survey (MRIP-FES). Higher catch limits may allow for additional fishing effort resulting in increased adverse effects on the physical environment relative to **Alternative 1**. **Preferred Alternative 2** update the ABC to 7,270,000 lbs ww, and increase the ACL from 3,110,000 lbs ww to the updated ABC of 7,270,000 lbs ww. **Alternative 3** would update the ABC to 7,270,000 lbs ww and set an ACL using the Gulf of Mexico Fishery Management Council's (Council) ACL/ACT Control Rule, which would result in a 9% buffer between the ABC and the ACL (6,615,700 lbs ww). The National Marine Fisheries Service (NMFS) will close the fishing season for vermilion snapper when the ACL is met or estimated to be met. Since the ACL in **Alternative 3** is less than the Preferred Alternative 2 ACL, it could result in decreased fishing effort relative to **Preferred Alternative 2**. However, because it is only a 9% difference between the two ACLs, it is possible that any difference in the adverse effects on the physical environment between **Preferred Alternative 2** and **Alternative 3** may be negligible.

4.1.2. Direct and Indirect Effects on the Biological Environment

Direct and indirect effects from fishery management actions have been discussed in detail for a variety of reef fish species in past Reef Fish FMP Amendments (e.g., GMFMC 2004b, 2007, 2008a, 2008b, 2008c, 2009, 2011b, 2012a, 2012b, 2015, 2016, 2017b) and are incorporated herein by reference. Management actions that affect the biological and ecological environment mostly relate to the impacts of fishing on a species' population size, life history, and the role of the species within its habitat. Removal of fish from the population through fishing reduces the overall population size. Fishing gears have different selectivity patterns that refer to a fishing method's ability to target and capture organisms by size and species. This would include the number of discards, which are expected to be mostly sublegal fish or fish caught during seasonal closures, and the mortality associated with releasing these fish. Fishing can affect life history characteristics of reef fish such as growth and maturation rates. For example, Fischer et al. (2004) and Nieland et al. (2007) found that the average size-at-age of red snapper had declined and associated this trend with fishing pressure. Woods (2003) found that the size at maturity for Gulf red snapper had declined and speculated this change may also have been due to increases in fishing effort. Lombardi-Carlson et al. (2006) found that the mean size of gag at age was larger pre-1990 than in post-1990 years, and suggested this change was also due to fishing. Bycatch does occur within the reef fish fishery. If fish are released due to catch limits, seasons, or other regulatory measures, these fish are considered bycatch. Bycatch practicability analyses have been completed for red snapper (GMFMC 2004, GMFMC 2007, GMFMC 2014 GMFMC 2015), grouper (GMFMC 2008a, GMFMC 2009, GMFMC 2011b, GMFMC 2012a), vermilion snapper (GMFMC 2004b, GMGMC 2017a), greater amberjack (GMFMC 2008b, GMFMC 2012b), gray triggerfish (GMFMC 2012c), and hogfish (GMFMC 2016). In general, these analyses have found that reducing bycatch provides biological benefits to managed species, as well as benefits to the fishery through less waste, higher yields, and less forgone yield. Some management measures can increase bycatch through regulatory discards such as increased minimum sizes and closed seasons. However, these measures are implemented in situations where the biological benefit to the managed species outweighs any increases in discards. For this action, any effects on bycatch are likely to be negligible because the action is not expected to change how the reef fish fishery is prosecuted.

Fishing for species in the reef fish fishery can also affect species outside the reef fish complex. For example, sea turtles have been observed to be directly affected by the bottom longline component of the Gulf reef fish fishery. These effects occur when sea turtles interact with fishing gear and result in an incidental capture injury or mortality and are summarized in GMFMC (2009) and NMFS (2011). However, as described in Section 3.3, the reef fish fishery is not likely to jeopardize the continued existence of any endangered species and has a remote likelihood of, or no known incidental mortality or serious injury of, marine mammal species. Modifying the catch levels through this action is not expected change how the reef fish fishery is prosecuted or result in any impacts beyond those described in Section 3.3.

Alternative 1 (No Action) would maintain the current catch limits. Under **Alternative 1**, fishing effort and effects on the biological environment would be similar to what has been experienced in recent years (2012-2019). Landings would still be limited as the stock is managed under the ACL. Both **Preferred Alternative 2** and **Alternative 3** would increase the catch limits for vermillion snapper based on results from the SEDAR 67 stock assessment update and conversion of recreational landings to the MRIP-FES. Higher catch limits may increase fishing effort resulting in increased adverse effects on the biological environment relative to **Alternative 1**. **Preferred Alternative 2** would update the ABC to 7,270,000 and increase the ACL from 3,110,000 lbs ww to the updated ABC of 7,270,000 lbs ww. **Alternative 3** would update the ABC to 7,270,000 lbs ww and set an ACL using the Gulf of Mexico Fishery Management Council's (Council) ACL/ACT Control Rule, which would result in a 9% buffer between the ABC and the ACL (6,615,700 lbs ww). NMFS will close the fishing season for vermilion snapper when the ACL is met or estimated to be met. Since the ACL in **Alternative 3** is less than the Preferred Alternative 2 ACL, it could result in decreased fishing effort relative to **Preferred Alternative 2**. However, because it is only 9% difference between the two ACLs, it is possible that any difference in the adverse effects on the biological environment between **Preferred Alternative 2** and **Alternative 3** may be negligible.

4.1.3. Direct and Indirect Effects on the Economic Environment

Alternative 1 (No Action) would maintain the current reference points (OFL and ABC) and the stock ACL for vermilion snapper. Therefore, **Alternative 1** would not be expected to change fishing practices or recreational and commercial harvests of vermilion snapper and would not be expected to result in economic effects. However, **Alternative 1** would not be consistent with the SSC's latest recommendations and would not constitute a viable alternative because the reference points and ACL are based on MRIP-CHTS units.

Preferred Alternative 2 and **Alternative 3** would modify the OFL, ABC and stock ACL for vermilion snapper based on the SSCs' recommendations following its review of the latest vermilion snapper stock assessment (SEDAR 67, 2020). The proposed vermilion snapper stock reference points and ACL considered in **Preferred Alternative 2** and **Alternative 3** are based on MRIP-FES data. **Preferred Alternative 2** and **Alternative 3** would set higher reference points and stock ACL for vermilion snapper relative to **Alternative 1**. From 2021 to 2025, and for subsequent fishing years or until amended by the Council, **Preferred Alternative 2** and **Alternative 3** would set the OFL and ABC for vermilion snapper at 8.60 million and 7.27 million lbs ww. **Preferred Alternative 2** would set a stock ACL equal to the ABC. **Alternative 3** would set a 9% buffer between the ABC and stock ACL based on the Council's control rule, resulting in a stock ACL of 6.62 million lbs ww.

It is not possible to distinguish the portion of the increases to the vermilion snapper reference points and ACL due to the conversion from MRIP-CHTS to MRIP-FES units from the portion due to direct increases attributable to the health of the vermilion snapper stock. Therefore, economic effects that would be expected to result from **Preferred Alternative 2** and **Alternative 3** cannot be quantified. It can be inferred that, relative to status quo, higher stock ACLs for vermilion snapper would be expected to afford additional fishing opportunities to the recreational and commercial sectors, thereby potentially resulting in positive economic effects to both sectors. These expected economic benefits would be commensurate with the increased landings relative to status quo. However, economic benefits that could result from ACL increases would only materialize to each sector (recreational or commercial) if that sector's vermilion snapper landings following the implementation of this action exceed its status quo landings. Because **Preferred Alternative 2** would set a higher stock ACL than **Alternative 3**, it is expected that potential economic benefits that would result from **Preferred Alternative 2** would be greater than the benefits expected from **Alternative 3**.

4.1.4. Direct and Indirect Effects on the Social Environment

The social effects that could arise from this action would relate to the change in catch levels and whether fishing activity is affected. If the vermilion snapper ACL is met or projected to be met, the fishing season is closed. This has not occurred since ACLs were put in place, and the ACL has only been exceeded one time (by 2.8% in 2018). No additional effects would be expected under **Alternative 1** (No Action) and the catch levels would remain at their current levels.

Preferred Alternative 2 and **Alternative 3** would revise the catch levels based on the most recent stock assessment and the recommendation of the SSC, which includes the adoption of MRIP-FES units for the recreational sector. Compared to **Alternative 1**, the catch levels are understood to be an increase from which positive effects would be expected, while the transition from MRIP-CHTS to MRIP-FES units is a conversion and should not result in effects. However, the amount of the increase that is attributed to the stock assessment is unclear due to the change in recreational data units at the same time, making it difficult to determine the extent of the expected effects. Because of this uncertainty, **Alternative 3** provides an ACL that is reduced from the ABC, whereas **Preferred Alternative 2** sets the ACL equal to the ABC. It would be less likely for an in-season closure to occur under **Preferred Alternative 2** than under **Alternative 3**; in-season closures are disruptive and negative short-term effects would be expected. On the other hand, given the uncertainty with the new catch levels, **Alternative 3** takes a more precautionary approach, which could contribute to long-term goals for stock sustainability.

4.1.5. Direct and Indirect Effects on the Administrative Environment

Implementation of this action would not directly affect the administrative environment. This action would increase the ACL and would provide a benefit to the vessels to continue fishing operations without an operating VMS, however, vessels would be required to submit the request for the electronic exemption.

Alternative 1 (No Action) would maintain the current catch limits. Under **Alternative 1**, fishing effort and effects on the biological environment would be similar to what has been experienced in recent years (2012-2019). Landings would still be limited as the stock is managed under the ACL. Both **Preferred Alternative 2** and **Alternative 3** would increase the catch limits for vermillion snapper based on results from the SEDAR 67 stock assessment update and conversion of recreational landings to the Marine Recreation Information Program's Fishing Effort Survey (MRIP-FES). NMFS will close the fishing season for vermilion snapper when the ACL is met or estimated to be met. Since **Alternative 3** decreases the ACL, it could result in decreased fishing effort relative to **Preferred Alternative 2**. The likelihood of a closure would be greater under **Alternative 3** because of the lower ACL. However, since the buffer between the ACL is only 9% it is possible that any difference in the adverse effects on the administrative environment between **Preferred Alternative 2** and **Alternative 3** may be negligible.

4.2. Cumulative Effects Analysis

While this environmental assessment (EA) is being prepared using the 2020 Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) Regulations, the cumulative effects discussed in this section meet the two-part standard for "reasonable foreseeability" and "reasonably close causal connection" required by the new definition of effects or impacts. Below is our five-step cumulative effects analysis that identifies criteria to be considered in an EA.

1. **The area in which the effects of the proposed action will occur.**
   The affected area of this proposed action to modify the catch limits for vermillion snapper: overfishing limit (OFL), acceptable biological catch (ABC), and the annual catch limit (ACL), encompasses the state and federal waters of the Gulf, as well as Gulf communities that are dependent on reef fish fishing. Most relevant to this proposed action is reef fish and those who fish for them. For more information about the area in which the effects of this proposed action will occur, please see Chapter 3, Affected Environment that describes these important resources as well as other relevant features of the human environment.

2. **The impacts that are expected in that area from the proposed action.**
   The proposed action would modify the catch limits for vermillion snapper: overfishing limit (OFL), acceptable biological catch (ABC), and the annual catch limit (ACL). The direct and indirect environmental consequences of the proposed action are analyzed in detail in Section 4.1. This action is not expected to have significant beneficial or adverse cumulative effects on the physical and biological/ecological environments because the action is not expected to alter the manner in which the reef fish fishery as a whole is prosecuted (Sections 4.1.1 and 4.1.2). These actions would likely have some positive direct and indirect effects on the social and economic environments, due to the harvest level increases (Sections 4.1.3 and 4.1.4). The action is also not expected to have substantial adverse or beneficial effects on the administrative environment (Section 4.1.5).

3. **Other past, present and RFFAs that have or are expected to have impacts in the area.**

   The Council and the South Atlantic Fishery Management Council (South Atlantic Council) implemented ACLs and AMs to prevent and correct ACL overages for all federally managed species. Improvements in federally permitted for-hire vessel reporting requirements are needed to improve in-season monitoring of the ACLs, and to facilitate the expeditious implementation of AMs for federally managed species when needed. More effective in-season monitoring efforts for Gulf reef fish species are likely to reduce the risk of future overfishing in those fisheries and foster sustainable fishing practices.

   Other fishery related actions – The cumulative effects relative to reef fish management have been analyzed in the Environmental Impact Statements (EIS) for Amendments 22 (GMFMC 2004c, 26 (GMFMC 2006), and 27/14 (GMFMC 2007), Amendments 29

(GMFMC 2008a), Amendment 30A (GMFMC 2008b), Amendments 30B (GMFMC 2008c), 31 (GMFMC 2009), 40 (GMFMC 2014), 28 (GMFMC (2015), and 50A (GMFMC 2019). These cumulative effects Modification to Vermillion Snapper Catch Limits and AMs. Environmental Consequences analyses are incorporated here by reference. Other past actions are summarized in the history of management (Section 1.3). Currently, there are multiple present actions and RFFAs that are being developed by the Council or considered for implementation by NMFS that could affect reef fish stocks. These include: Amendment 53, which would revise red grouper allocations and catch levels; Amendment 36B, which would revise the red snapper and grouper-tilefish commercial individual fishing quota programs; Amendment 52, which would modify red snapper allocation; a generic framework, which would modify the Council's ABC Control Rule; Amendment 48, which would establish status determination criteria for many reef fish stocks; a generic framework that would modify fishing access in Eastern Gulf Marine protected areas, some actions to address red snapper recreational data calibration and catch limits; and a framework that would modify lane snapper catch limits and accountability measures. Descriptions of these actions can be found on the Council's web page.

Non-fishery related actions - Forces affecting the reef fish fishery have been described in previous cumulative effect analyses (e.g., Amendment 40 [GMFMC 2014b]). Three important examples include impacts of the *Deepwater Horizon* MC252 oil spill, the Northern Gulf Hypoxic Zone, and climate change (See Sections 3.1 and 3.2). Reef fish and CMP species are mobile and are able to avoid hypoxic conditions, so any effects from the Northern Gulf Hypoxic Zone on these species are likely minimal regardless of this action. Impacts from the *Deepwater Horizon* MC252 oil spill are still being examined; however, as indicated in Section 3.2, the oil spill had some adverse effects on fish species.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Intergovernmental Panel on Climate Change has numerous reports addressing their assessments of climate change. Global climate changes could affect the Gulf fisheries as discussed in Section 3.2. However, the extent of these effects cannot be quantified at this time. The proposed action is not expected to significantly contribute to climate change through the increase or decrease in the carbon footprint from fishing, as these actions should not change how the fishery is prosecuted. As described in Section 3.1, the contribution to greenhouse gas emissions from fishing is minor compared to other emission sources (e.g., oil platforms).

4. **The impacts or expected impacts from these other actions.**
The cumulative effects from managing the reef fish fishery have been analyzed in other actions as listed in part three of this section. They include detailed analysis of the reef fish fishery, cumulative effects on non-target species, protected species, and habitats in the Gulf. In general, the effects of these actions are positive as they ultimately act to

restore/maintain the stocks at a level that will allow the maximum benefits in yield and recreational fishing opportunities to be achieved.

5. **The overall impact that can be expected if the individual impacts are allowed to accumulate.**
   This action, combined with other past actions, present actions, and RFFAs, is not expected to have significant beneficial or adverse effects on the physical and biological/ecological environments because this action would only minimally affect current fishing practices (Sections 4.1.1 and 4.1.2). For the social and economic environments, effects should be positive (Sections 4.1.3 and 4.1.4). Most effects are likely minimal as the proposed action, along with other past actions, present actions, and RFFAs, are not expected to alter the manner in which the reef fish fishery is prosecuted. Because it is unlikely there would be any changes in how the fisheries are prosecuted, this action, combined with past actions, present actions, and RFFAs, is not expected to have significant adverse effects on public health or safety.

6. **Summary**
   The proposed action is not expected to have individual significant effects to the biological, physical, social, or economic environment. Any effects of the proposed action, when combined with other past actions, present actions, and RFFAs are not expected to be significant. The effects of the proposed action are, and will continue to be, monitored through collection of landings data by NMFS, stock assessments and stock assessment updates, life history studies, economic and social analyses, and other scientific observations. Landings data for the recreational sector in the Gulf are collected through MRIP, the Southeast Region Headboat Survey, the Texas Marine Recreational Fishing Survey, and the Louisiana Department of Wildlife and Fisheries Creel Survey. In addition, the Alabama Department of Conservation and Natural Resources, Mississippi Department of Marine Resources, and Florida Fish and Wildlife Conservation Commission have instituted programs to collect information on reef fish species, and in particular, recreational landings information. Although not affected by this action, commercial data are collected through trip ticket programs, port samplers, and logbook programs, as well as dealer reporting through the IFQ program.

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APPENDIX A. CHANGES TO RECREATIONAL DATA COLLECTION

Changes to the Recreational Data Collection Survey

The Marine Recreational Fisheries Statistics Survey (MRFSS) was created in 1979 by NMFS. In the Gulf, MRFSS collected data on catch and effort in recreational fisheries, including vermilion snapper and gray triggerfish; the first recreational fishing estimates became available in 1981. The program included the Access Point Angler Intercept Survey (APAIS), which consisted of onsite interviews at marinas and other points where recreational anglers fish, to determine catch. MRFSS also included the coastal household telephone survey (CHTS), which used random-digit dialing of homes in coastal counties to contact anglers to determine fishing effort. In 2000, the For-Hire Survey (FHS) was implemented to incorporate for-hire effort due to lack of coverage of charter boat anglers by the CHTS. The FHS used a directory of all known charter boats and a weekly telephone sample of the charter boat operators to obtain effort information.

MRFSS included both offsite telephone surveys and onsite interviews at marinas and other points where recreational anglers fish. In 2008, the Marine Recreational Information Program (MRIP) was established to replace MRFSS to meet increasing demand for more precise, accurate, and timely recreational catch estimates. After the National Academies of Sciences identified potential sources of bias in the sampling process, catch survey protocols were revised. This led to a new design for the APAIS that was certified and subsequently implemented in 2013 to measure recreational catch on the Atlantic and Gulf coasts. This significantly improved how intercepts were conducted. This new design addressed concerns regarding the validity of the survey approach, specifically that trips recorded during a given time period were representative of trips for a full day (Foster et al. 2018). The more complete temporal coverage with the new survey design provided for consistent increases or decreases in APAIS angler catch rate statistics, which are used in stock assessments and management, for at least some species (NOAA Fisheries 2019).

MRIP is a more scientifically sound methodology for estimating catch because it reduces some sources of potential bias as compared to MRFSS resulting in more accurate catch estimates. Specifically, CHTS was improved to better estimate private angling effort. Instead of random telephone calls, MRIP-CHTS used targeted calls to anglers registered with a federal or state saltwater fishing registry. Subsequently, MRIP transitioned from the CHTS to a new mail-based Fishing Effort Survey, (FES) beginning in 2015, and in 2018, replaced the CHTS. Both survey methods collect data needed to estimate marine recreational fishing effort (number of fishing trips) by shore and private/rental boat anglers on the Atlantic and Gulf coasts. The CHTS used random-digit dialing of homes in coastal counties to contact anglers. The new mail-based FES uses angler license and registration information as one way to identify and contact anglers (supplemented with data from the U.S. Postal Service, which includes virtually all U.S. households). Because the FES and CHTS are so different, NMFS conducted side-by side testing of the two methods from 2015 to 2018 and developed calibration procedures to convert the historical catch estimates (MRFSS, MRIP-CHTS, MRIP-APAIS [collectively MRFSS]) into MRIP-FES. In general, landings estimates are higher using the MRIP-FES as compared to the

MRFSS estimates. This is because the FES is designed to more accurately measure fishing activity than the CHTS, not because there was a sudden rise in fishing effort. NMFS developed a calibration model to adjust historic effort estimates so that they can be accurately compared to new estimates from the FES. The new effort estimates alone do not lead to definitive conclusions about stock size or status in the past or currently. NMFS determined that the MRIP-FES data, when fully calibrated to ensure comparability among years and across states, produced the best available data for use in stock assessments and management (NOAA Fisheries 2019)