

Establish Gray Snapper Status Determination Criteria and Modify Annual Catch Limits



Draft Amendment 51 to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico

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ENVIRONMENTAL ASSESSMENT COVER SHEET

Establish Gray Snapper Status Determination Criteria and Modify Annual Catch Limits

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Type of Action

Administrative Legislative
 Draft Final

Summary/Abstract

ABBREVIATIONS USED IN THIS DOCUMENT

ABC	acceptable biological catch
ACL	Annual Catch Limit
ACT	Annual Catch Target
AM	accountability measures
Council	Gulf of Mexico Fishery Management Council
F	fishing mortality rate
FMP	Fishery Management Plan
FMU	fishery management unit
Gulf	Gulf of Mexico
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MFMT	maximum fishing mortality threshold
mp	million pounds
MRIP	Marine Recreational Information Program
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service
NS1	National Standard 1
OFL	overfishing limit
OY	optimum yield
SDC	status determination criteria
SEFSC	Southeast Fisheries Science Center
SFA	Generic Sustainable Fisheries Act
SSB	spawning stock biomass
SSBR	spawning stock biomass per recruit
SSC	Scientific and Statistical Committee
SPR	spawning potential ratio
TL	total length
ww	whole weight

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CHAPTER 1. INTRODUCTION

1.1 Background

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires the National Marine Fisheries Service (NMFS) and the Regional Fishery Management Councils to end overfishing, rebuild overfished stocks, and achieve, on a continuing basis, the optimum yield (OY) from federally managed fish stocks. These mandates are intended to ensure fishery resources are managed for the greatest overall benefit to the nation, particularly with respect to providing food production, recreational opportunities, and protecting marine ecosystems.

Gulf of Mexico Fishery Management Council

- Responsible for conservation and management of fish stocks
- Consist of 17 voting members: 11 appointed by the Secretary of Commerce; 1 representative from each of the 5 Gulf states, the Southeast Regional Director of NMFS; and 4 non-voting members
- Develops fishery management plans and amendments; and recommends actions to NMFS for implementation

National Marine Fisheries Service

- Responsible for preventing overfishing while achieving optimum yield
- Approves, disapproves, or partially approves Council recommendations
- Implements regulations

Status Determination Criteria and Biological Reference Points

The National Standard 1 (NS1) guidelines require that each Fishery Management Plan (FMP) describe objective and measurable criteria to determine overfishing and overfished status, such as a minimum stock size threshold (MSST), and a maximum fishing mortality threshold (MFMT), or an overfishing limit (OFL), collectively known as status determination criteria (SDC). These thresholds represent the point at which a stock is determined to be overfished (i.e., biomass below MSST) or experiencing overfishing (i.e., fishing mortality above MFMT or annual landings exceed OFL). Consistent with the requirements of the Magnuson-Stevens Act, the NS1 guidelines also require that the FMP specify the maximum sustainable yield (MSY) (or appropriate proxy), and OY for managed stocks.

Catch Level Reference Points

MSY is a long-term average catch level corresponding to the largest average amount of fish that can be caught each year on a continuing basis without depleting the stock. OY is a long-term average catch level that is based on MSY as reduced by relevant economic, social, or ecological factors.

Stock Biomass Reference Points

Stock biomass refers to the size of the unharvested population that is capable of reproduction. It can be measured in terms of biomass (e.g., pounds left in the water), numbers of fish remaining in the water, or the expected egg production from the spawning stock biomass (SSB) of the adult stock in the water. The stock level that results from catching the MSY level is called the biomass at MSY (B_{MSY}). If the stock level falls below B_{MSY} , it can no longer sustain the MSY catch without further depletion and requires a temporary reduction in harvest to rebuild the stock. However, biomass can be expected to fluctuate over time, due to changes in environmental conditions, recruitment, or other variables. To account for these fluctuations, a stock is not considered to be overfished until it drops to some specified level below B_{MSY} , which is defined by the MSST.

The Gulf of Mexico Fishery Management Council (Council) has broad latitude in deciding how far the MSST can be set below B_{MSY} , but it cannot be less than 50% of B_{MSY} . The wider the gap between B_{MSY} and MSST, the less likely a stock is to be declared overfished, but the more difficult it may be to rebuild the stock back to B_{MSY} . The narrower the gap between B_{MSY} and MSST, the more likely a stock is to be declared overfished, but the less difficult it may be to rebuild the stock. If MSST is set too close to B_{MSY} , natural fluctuations may cause the stock to enter an overfished condition even if it is well-managed.

Minimum Stock Size Threshold (overfished)

Minimum stock size threshold (MSST) is the biomass level that a stock can decline to before being declared overfished (stock abundance is too low), requiring a rebuilding plan. MSST is usually expressed as a percentage of the biomass level at MSY or MSY proxy.

A narrower buffer is more likely to trigger an overfished determination, but if triggered, less restrictive regulations would be needed during the rebuilding plan.

Narrower buffer



$$0.75 * B_{MSY}$$

$$0.50 * B_{MSY}$$

Wider buffer

A wider buffer is less likely to trigger an overfished determination, but if triggered, more restrictive regulations would likely be required during the rebuilding plan.

Fishing Mortality Rate Reference Points

The fishing mortality rate that results in catching the MSY level on an annual basis is called F_{MSY} and is the maximum fishing mortality rate that is likely to be sustainable. The MFMT is the rate of fishing mortality above which a stock is declared to be experiencing overfishing (fish are being removed at too rapid a rate). MFMT is often set equal to F_{MSY} , but under some conditions it may be desirable to set below F_{MSY} , for example, if the stock size is below B_{MSY} . The MFMT is also the fishing mortality rate that results in catching the OFL level on an annual basis. An annual harvest that exceeds the OFL is considered overfishing as well as the case where a stock assessment shows that the current fishing mortality rate (F) exceeds the MFMT.

Gray Snapper

Gray snapper, also called mangrove snapper or “mangoes,” are found throughout the Gulf of Mexico (Gulf). Gray snapper occur in tropical, subtropical and warm temperate waters from Brazil to Bermuda, and throughout the Gulf and Caribbean Sea. Spawning occurs primarily in the summer months, between May and September. Gray snapper spend their first month of life in a larval phase, floating as plankton. As juveniles, gray snapper settle nearshore in estuaries, seagrass beds or shallow reefs, and gradually move offshore as they grow larger. Adults are often reef- or structure-associated.

Gray snapper are an important component of the reef fish fishery and are targeted inshore and offshore on natural and artificial reefs. The federal minimum size limit is 12 inches total length (TL),

the fishing season is year-round, and there are no sector allocations. Recreational anglers can keep 10 fish per person, within the 20 fish per person reef fish aggregate bag limit. Gray snapper are primarily harvested by hook-and-line gear by the recreational sector, with some spearfishing. There are no commercial trip limits for Gulf gray snapper.

Recruitment to the fishery begins at age four, and the species has a maximum age of 28. Spawning occurs year-round in south Florida and during the summer throughout the rest of the Gulf on reef and hard bottom habitats at depths from 0-180 m. Male gray snapper mature at 185 mm TL and females mature at 200 mm TL.

Gray Snapper Landings

Total annual landings of gray snapper have ranged from 0.945 million pounds (mp) whole weight (ww) in 2010 to 2.62 mp ww in 2004 (Table 1.1.1). From 2012 through 2017, landings have averaged 2.12 mp ww without trend over this time period. The landings in 2010 may have been unusually low because of reduced fishing effort from the Deepwater Horizon oil spill that occurred in 2010. The majority of landings are from the recreational sector and gray snapper are frequently harvested by anglers in both inshore and offshore waters off Florida. The other Gulf states have low landings. Since the implementation of an annual catch limit (ACL) and annual catch target (ACT) in 2012, total landings exceeded the ACT in 2014-2016 but only exceeded the ACL in 2016. When the ACL is exceeded for gray snapper, the Accountability Measures (AM)(GMFMC 2011) require in-season monitoring of the stock in the following year. If the ACL is reached or projected to be reached within the fishing year, the Assistant Administrator for Fisheries shall file a notification with the Office of the Federal Register to close the appropriate sector(s) for the remainder of the fishing year.

Table 1.1.1. Commercial and recreational landings of gray snapper by sector from 2001 through 2017. Recreational data includes all modes.

Year	Recreational Landings (lbs ww)	Commercial Landings (lbs ww)	Total Landings (lbs ww)
2001	1,364,957	198,411	1,563,368
2002	1,333,870	231,700	1,565,570
2003	2,085,558	197,496	2,283,054
2004	2,390,000	230,778	2,620,778
2005	1,659,791	234,513	1,894,304
2006	1,548,997	203,097	1,752,094
2007	1,705,143	150,456	1,855,599
2008	1,961,553	150,979	2,112,532
2009	1,714,554	179,479	1,894,033
2010	833,085	112,307	945,392
2011	1,171,117	192,906	1,364,023
2012	1,724,641	179,006	1,903,647
2013	1,781,811	143,644	1,925,455
2014	2,215,245	199,025	2,414,270
2015	2,027,096	163,321	2,190,417
2016	2,314,929	156,337	2,471,266
2017*	1,664,034	136,262	1,800,296

Source: Data Source: SEFSC Recreational ACL - MRIPassess_rec81_18wv2_08Aug18; SEFSC Commercial ACL - ACL_FILES_08222018

Note: Gulf recreational landings reported to the Marine Recreational Information Program (MRIP) exclude Monroe County

*Commercial landings for 2017 are preliminary

Gray Snapper Stock Assessment (SEDAR 51)

Despite the importance of gray snapper, the stock condition had not been evaluated in a stock assessment. In 2018, the gray snapper benchmark stock assessment was completed (SEDAR 51, 2018) and reviewed by the Gulf of Mexico Fishery Management Council's (Council) Scientific and Statistical Committee (SSC) at its May 2018 meeting. The SSC accepted the gray snapper assessment as the best scientific information available and determined that the stock is experiencing overfishing as of 2015 (Table 1.1.2).

Table 1.1.2. Status determination criteria and stock status of gray snapper based on the SEDAR 51 (2018) stock assessment.

Criteria	Definitions	SEDAR 51 Values	Status
M		0.15	
Steepness		1.0	
Virgin Recruitment	1,000s	10,683	
SSB Unfished	metric tons	22,200	
Mortality Rate Criteria			
F_{MSY} or proxy	$F_{SPR30\%}$	0.115	
MFMT	$F_{SPR30\%}$	0.115	
F_{CURRENT}	geometric mean ($F_{2013-2015}$)	0.138	
F_{CURRENT}/MFMT		1.2	Overfishing
Biomass Criteria			
SSB_{MSY} or proxy (metric tons)	$SSB_{SPR30\%}$	6,621	
MSST (metric tons) @ (1-M)	$(1-M)*SSB_{SPR30\%}$	5,627	
MSST (metric tons) @ 50%	$0.50*SSB_{SPR30\%}$	3,310	
SSB_{CURRENT} (metric tons)	SSB_{2015}	4,660	
SSB_{CURRENT}/SSB_{SPR30%}	SSB_{2015}	0.704	
SSB_{CURRENT}/MSST @ (1-M)	$MSST = (1-M)*SSB_{SPR30\%}$	0.827	Overfished
SSB_{CURRENT}/MSST @ 50%	$MSST = 0.50*SSB_{SPR30\%}$	1.408	Not Overfished

The actions in this amendment are intended to establish stock status reference points where they do not currently exist, and in some cases to consider modifying existing reference points. As part of the SSC review of the gray snapper stock assessment, the SSC also provided OFL and acceptable biological catch (ABC) recommendations for 2019 through 2021. This amendment also considers alternatives that would modify the ACLs and ACTs for gray snapper from 2019 through 2021 based on the revised ABC recommendations.

1.2 Purpose and Need

The purpose of this proposed action is to establish status determination criteria for gray snapper, including an estimate (or proxy) of MSY, MSST, and OY, as well as modify the MFMT, consistent with the current NS1 guidelines and the Reef Fish FMP. In addition, the purpose is to modify the gray snapper ACL and ACT consistent with a recent stock assessment and SSC ABC recommendations.

The need is to have biological reference points that can be used for setting gray snapper management targets and for determining overfished and overfishing status, to adjust gray

snapper ACL and ACT consistent with the best available science, and to achieve OY consistent with the requirements of the Magnuson-Stevens Act.

1.3 History of Management

The following summary describes management actions that affect the gray snapper component of the reef fish fishery in the Gulf. More information on the Reef Fish FMP and other Council FMPs can be obtained from the Council website.¹

Fishery management unit: Gray snapper were included in the 33 species (15 snappers, 15 groupers, and 3 sea basses) that comprised the original fishery management unit (FMU) of the Reef Fish FMP (GMFMC 1981). Species have been added and subtracted through **Amendments 1 and 15** (GMFMC 1989, 1997) and the **Generic ACL/AM Amendment²** (GMFMC 2011). These changes did not affect gray snapper, which have always been in the FMU.

Stock status determination criteria: **Amendment 1** (GMFMC 1989) established an OY goal for all reef fish of 20% spawning stock biomass per recruit (SSBR) relative to the SSBR that would occur with no fishing, and an overfished stock was defined as a stock biomass below 20% SSBR. Overfishing was defined, for a stock that is not overfished, as fishing at a rate that would not allow harvest of OY on a continuing basis, and for a stock that is overfished, as fishing at a rate that is not consistent with rebuilding the stock to 20% SSBR. The SSBR terminology was later replaced with spawning potential ratio (SPR). The **Generic Sustainable Fisheries Act Amendment** (GMFMC 1999), partially approved and measures implemented in November 1999, set MFMT for gray snapper at $F_{30\% SPR}$. Estimates of MSY, MSST, and OY were disapproved because they were based on SPR proxies rather than biomass-based estimates. The **Generic ACL/AM Amendment** (GMFMC 2011), established a gray snapper OFL of 2.88 mp ww, ACL of 2.42 mp ww, ACT of 2.08 mp ww, and AMs.

Other management measures: A 12-inch total length minimum size limit was established for gray snapper in **Amendment 1** (GMFMC 1989) for the commercial and recreational sectors. Gray snapper were also included in the 10-snapper recreational aggregate bag limit established through that amendment.

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

² Generic Annual Catch Limits/Accountability Measures Amendment for the Gulf of Mexico Fishery Management Council's Red Drum, Reef Fish, Shrimp, Coral and Coral Reefs Fishery Management Plans

CHAPTER 2. MANAGEMENT ALTERNATIVES

2.1 Action 1 – Maximum Sustainable Yield Proxy for Gulf of Mexico Gray Snapper

Alternative 1. No action. Do not establish a maximum sustainable yield proxy for gray snapper.

Alternative 2. For gray snapper, the maximum sustainable yield proxy is the yield when fishing at 30% spawning potential ratio ($F_{30\% SPR}$).

Alternative 3. For gray snapper, the maximum sustainable yield proxy is the yield when fishing at 40% spawning potential ratio ($F_{40\% SPR}$).

Alternative 4. For future assessments of gray snapper, the maximum sustainable yield (MSY) proxy equals the yield produced by F_{MSY} or PROXY recommended by the Gulf of Mexico Fishery Management Council's (Council) Scientific and Statistical Committee (SSC), and subject to approval by the Council through in a plan amendment.

Note: Alternative 4 can be selected with **Alternative 2** or **Alternative 3** as the preferred.

Discussion:

Stocks require an estimate of MSY and the fishing mortality rate (F) associated with catching MSY (F_{MSY}) in order to determine whether a stock is undergoing overfishing. The actual MSY can rarely be estimated with certainty and could not be estimated for gray snapper in SEDAR 51 (2018) because a stock-recruitment relationship could not be identified, given the available data. Proxies that are easier to measure are usually used for species in the Gulf of Mexico (Gulf) including gray snapper. The MSY proxies are often, but not always, based on some percentage of spawning potential ratio (SPR), and are expressed as the yield when fishing at F associated with the SPR proxy. The SPR is a ratio equal to the production of eggs in a fished population divided by the production of eggs in an unfished population. Under the Magnuson-Stevens Fishery Conservation and Management Act, it is the responsibility of the SSC to provide ongoing scientific advice, including recommendations for MSY. It is the responsibility of the Council to specify MSY for each managed stock in the Fishery Management Plan (FMP).

After reviewing the SEDAR 51 assessment, the SSC recommended that the MSY proxy be set at the yield when fishing at $F_{30\% SPR}$, which is consistent with the current gray snapper maximum fishing mortality threshold (MFMT). However, the Council questioned if the yield when fishing at $F_{30\% SPR}$, is the correct proxy, noting that the red snapper proxy is set at $F_{26\% SPR}$ which allows for a larger yield at a given stock size. The Council requested that the Southeast Fisheries Science Center (SEFSC) provide an analysis of MSY proxies ranging from the yield at $F_{23\% SPR}$ (corresponding to SPR at maximum yield per recruit) to the yield at $F_{40\% SPR}$ (the SPR level

recommended by Harford et al. (personnel communication)³ for gonochoristic [do not change sex] stocks). Generally, fish species with a lower SPR such as 20-25% typically have a high resilience to fishing mortality whereas a species with an SPR of 40-50% have a low resilience to fishing mortality (Mace and Sissenwine 1993). The SEFSC analyses were presented at the SSC's August 2018 meeting. The SSC was unable to reach a consensus on a recommendation for a specific MSY proxy; however, all SSC members agreed that the proxy should not be any lower than $F_{30\% SPR}$. Therefore, no proxies below $F_{30\% SPR}$ are considered in this action.

Alternative 1 would leave the gray snapper stock without an MSY or MSY proxy. This is inconsistent with the requirements of the Magnuson-Stevens Act and National Standard 1 (NS1) Guidelines.

Alternative 2 proposes to adopt the MSY proxy of the yield when fishing at $F_{30\% SPR}$ that was recommended by the SSC. This MSY proxy is consistent with the current MFMT.

Alternative 3 proposes to adopt the MSY proxy of the yield when fishing at $F_{40\% SPR}$. This proxy was recommended by Harford et al. (in review)⁴ for species that do not change sex because it has a lower risk of driving the stock below the true stock biomass level capable of producing an equilibrium yield of MSY (B_{MSY}). Because the SPR value here is greater than the SPR used in **Alternative 2**, the MSY proxy yield value would be lower.

Alternative 4 can be adopted along with either **Alternative 2** or **Alternative 3**. It provides a streamlined process for modifying the gray snapper MSY. Sometimes, the SSC changes its recommendation of an MSY proxy based on new scientific information. This alternative would allow the Council to adopt the SSC recommendation for a new MSY proxy by noting the change in a plan amendment rather than by analyzing the recommendation along with several alternatives that the SSC did not consider appropriate. If the SSC identifies more than one possible proxy, or as occurred here, identified the lowest proxy it determined to be acceptable, a plan amendment action with alternatives would be required.

³ Harford, W.J., S.R. Sagarese, and M. Karnauskas. (In Review). Selecting proxy fishing mortality reference points for grouper-snapper fisheries under uncertainty about stock-recruitment steepness. Cooperative Institute for Marine and Atmospheric Studies, University of Miami, and NOAA Southeast Fisheries Science Center, Sustainable Fisheries Division, Miami, FL. 21 p.

⁴ Harford, W.J., S.R. Sagarese, and M. Karnauskas. (In Review). Selecting proxy fishing mortality reference points for grouper-snapper fisheries under uncertainty about stock-recruitment steepness. Cooperative Institute for Marine and Atmospheric Studies, University of Miami, and NOAA Southeast Fisheries Science Center, Sustainable Fisheries Division, Miami, FL. 21 p.

2.2 Action 2 - Maximum Fishing Mortality Threshold

Alternative 1. No action. The current definition for the gray snapper maximum fishing mortality threshold will be retained and is equal to $F_{30\% SPR}$

Alternative 2. The definition for the gray snapper MFMT equal to $F_{40\% SPR}$.

Discussion:

The Generic Annual Catch Limit/Accountability Measure Amendment (GMFMC 2011) established two methods for determining if overfishing is occurring.

1. The MFMT in years where there is a stock assessment: The NS1 guidelines define MFMT as the level of fishing mortality above which overfishing is occurring. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate), or as a function of spawning biomass or other measure of reproductive potential. Overfishing is occurring if the stock assessment's estimate of the current fishing mortality rate is above MFMT.
2. The overfishing limit (OFL) in years when there is not a stock assessment, or for stocks that do not have assessments that provide estimates of fishing mortality: The OFL is a yield that corresponds to fishing at MFMT. Overfishing is occurring if the annual harvest exceeds the OFL.

To date, landings have not been exceeded the OFL of 2.88 million pounds (mp) since it was implemented in 2012 (Table 1.1.1).

Alternative 1 (No Action) would leave MFMT unchanged. The Generic Sustainable Fisheries Act (SFA) Amendment (GMFMC 1999) set MFMT equal to $F_{30\% SPR}$ for reef fish species with the exception of red snapper, Nassau grouper, and goliath grouper. Thus, the current MFMT for gray snapper is $F_{30\% SPR}$.

Alternative 2 would set MFMT equal to the fishing mortality rate based an SPR of 40% and would be consistent with **Alternative 3** of Action 1. This would result in a lower F value that would more likely result in an overfishing determination in future assessments when compared to **Alternative 1**. The stock is currently experiencing overfishing based on the definition in both alternatives.

2.3 Action 3 – Establish a Minimum Stock Size Threshold for Gray Snapper

Alternative 1. No action. Do not establish a minimum stock size threshold for gray snapper.

Alternative 2. The minimum stock size threshold for gray snapper = $(1-M) * B_{MSY}$ (or proxy) where M is the natural mortality rate.

Alternative 3. The minimum stock size threshold for gray snapper = $0.75 * B_{MSY}$ (or proxy).

Alternative 4. The minimum stock size threshold for gray snapper = $0.50 * B_{MSY}$ (or proxy).

Discussion:

The minimum stock size threshold (MSST) is a stock biomass level set at or below the biomass level capable of producing MSY or the MSY proxy. It is used to determine when a stock is overfished. Currently, gray snapper does not have a defined MSST, which has led to an indeterminate finding of whether the stock is overfished or not.

The NS1 guidelines allow MSST to be set at a level below B_{MSY} (or proxy) but not lower than $0.50 * B_{MSY}$ (or proxy). If the fishing mortality can be kept below the overfishing threshold in non-assessment years, stock biomass is unlikely to drop below the overfished level (MSST). However, stock biomass can fluctuate due to environmental variability, or due to management being unsuccessful in constraining fishing mortality. In such cases, there are concerns with setting MSST either too close to or too far from B_{MSY} (or proxy).

Under **Alternative 1** (No Action), MSST is undefined and is inconsistent with the requirements of the Magnuson-Stevens Act and the NS1 guidelines, which require that managed stocks have objective and measurable criteria for determining when those stocks are overfished.

Alternative 2 sets MSST at $(1-M) * B_{MSY}$ (or proxy) for gray snapper. Natural mortality (M) includes dying from old age, diseases, and predation. The stock assessments typically calculate an M for stocks using the age classes that have fully recruited to the fishery (meaning that can be caught and kept). When MSST is defined as equal to $(1-M) * B_{MSY}$ (or proxy), stocks with a low M can end up with an MSST that is only slightly below the B_{MSY} (or proxy) spawning stock biomass level. In such situations it can be difficult to determine if a stock is actually below MSST due to imprecision and accuracy of the data. In addition, natural fluctuations in stock biomass levels around the B_{MSY} level may temporarily drop the spawning stock biomass below MSST, although analysis from the SEFSC suggests that this is unlikely, except at very low natural mortality rates. Given M for gray snapper is currently estimated at 0.15, this alternative's MSST would be equal to $0.85 * B_{MSY}$ and would be the more conservative than **Alternatives 3** and **4**.

Alternative 3 sets the gray snapper MSST at $0.75 * B_{MSY}$ (or proxy). Setting a wider buffer between B_{MSY} (or proxy) and MSST can avoid false declarations of overfished status due to

natural fluctuations in the stock biomass. In addition, setting a wider buffer can allow a greater opportunity for management to end a decline in a stock that is approaching an overfished condition, without the constraints imposed by a rebuilding plan that is required if the stock drops below MSST and is declared overfished. However, if a stock does drop below MSST and is declared overfished, a more restrictive rebuilding plan may be needed than if there were a narrower buffer between B_{MSY} and MSST. This alternative does not require an estimate of M because it sets the MSST at a fixed percentage of the B_{MSY} (or proxy). For gray snapper, it is intermediate to MSST values of **Alternatives 2 and 4**.

Alternative 4 sets gray snapper MSST as $0.50 * B_{MSY}$ (or proxy) for all reef fish stocks. Reef Fish Amendment 44 (GMFMC 2017) recently revised the MSST for seven reef fish stocks where it was previously defined (gag, red grouper, red snapper, vermilion snapper, gray triggerfish, greater amberjack, and hogfish). For these seven stocks, Amendment 44 set MSST equal to $0.50 * B_{MSY}$ (or proxy). Therefore, this alternative would match the MSST level established for those seven stocks. This is the widest buffer allowed under the NS1 guidelines and is the least conservative alternative.

2.4 Action 4 – Establish Optimum Yield for Gray Snapper

Alternative 1. No action. Do not establish an optimum yield for gray snapper.

Alternative 2. Set an optimum yield (OY for gray snapper that is the long-term yield that implicitly accounts for relevant economic, social, or ecological factors by fishing at:

Option 2a. 50% of $F_{MSY Proxy}$.

Option 2b. 75% of $F_{MSY Proxy}$.

Option 2c. 90% of $F_{MSY Proxy}$.

Discussion:

The Magnuson-Stevens Fishery and NS1 guidelines state that optimum yield (OY) should be based on MSY as reduced by relevant economic, social, or ecological factors. The NS1 guidelines provide additional detail in considering such factors. The NS1 guidelines also state that OY should include some consideration of uncertainty. The guidelines state that if the estimates of MFMT and current biomass are known with a high level of certainty and management controls can accurately limit catch, then OY could be set very close to MSY, assuming no other reductions are necessary for social, economic, or ecological factors. To the degree that such MSY estimates and management controls are lacking or unavailable, OY should be set farther from MSY.

Alternative 1 (No Action) would leave OY undefined for gray snapper. Leaving stocks with OY undefined is inconsistent with the NS1 guidelines.

Alternative 2 would specify a long-term OY based on fixed percentages fishing at the yield between 50% and 90% of $F_{MSY Proxy}$. The long-term OY is an equilibrium yield around which the yield may fluctuate. Under this alternative, OY is considered to implicitly account for relevant economic, social, or ecological factors when specifying OY. Setting OY as the yield of fishing at 50% of $F_{MSY Proxy}$ (**Option 2a**) is the most conservative of the options as the yield would be the furthest below MSY of the alternative being considered. This option would provide the greatest protection to the stock; however, setting it this low may have negative social and economic costs from fewer gray snapper being available to the reef fish fishery. Fishing at 90% of $F_{MSY Proxy}$ (**Option 2c**) would be the least conservative as OY would be closest to MSY. This option would provide the least protection to the stock, but would provide more fish to the fishery and likely have greater social and economic benefits. **Option 2b** (75% of $F_{MSY Proxy}$) is intermediate to **Options 2a** and **2b** and is consistent with OYs set for other reef fish stocks (Table 2.4.1).

Table 2.4.1. Current OY definitions as implemented in plan amendments

Stock	OY	Source
Gag	Yield at 75% of F_{MAX}	Amendment 30B (GMFMC 2008a)
Red grouper	Yield at 75% of F_{MSY}	Secretarial Amendment 1 (GMFMC 2004a)
Red snapper	Yield at 75% of F_{MSY}	Amendment 22 (GMFMC 2004b)
Vermilion snapper	Yield at 75% of $F_{MSY proxy}$	Amendment 47 (GMFMC 2017b)
Gray triggerfish	Yield at 75% of $F_{MSY proxy}$	Amendment 30A (GMFMC 2008b)
Greater amberjack	Yield at $F_{40\% SPR}$	Secretarial Amendment 2 (GMFMC 2002)

2.5 Action 5 – Modify the Gray Snapper Overfishing Limit (OFL), Acceptable Biological Catch (ABC), Annual Catch Limit (ACL), and Annual Catch Target (ACT)

Alternative 1: No Action. The ACL for gray snapper will remain at 2.42 million pounds million pounds (mp) whole weight (ww) and the ACT will remain at 2.08 mp ww (86.0% of ACL).

Alternative 2: The ACL for gray snapper for the years 2019 through 2021 and beyond will be equal to the ABC yield stream using the MSY proxy of $F_{30\%SPR}$ selected in Action 1. Do not set an ACT.

Year	OFL (mp ww)	ABC (mp ww)	ACL (mp ww)
2019	2.31	2.27	2.27
2020	2.33	2.29	2.29
2021+	2.36	2.32	2.32

Alternative 3: The ACL for gray snapper for the years 2019 through 2021 and beyond will be equal to the ABC yield stream using the MSY proxy $F_{40\%SPR}$ selected in Action 1. Do not set an ACT.

Year	OFL (mp ww)	ABC (mp ww)	ACL (mp ww)
2019	1.83	1.80	1.80
2020	1.90	1.86	1.86
2021+	1.95	1.92	1.92

Alternative 4: The ACL for gray snapper for the years 2019 through 2021 and beyond will be equal to the ABC yield stream using the MSY proxy $F_{30\%SPR}$ selected in Action 1. Apply the ACL/ACT Control Rule (landings from 2014 through 2017) to establish an 11% buffer between the ACL and the ACT.

Year	OFL (mp ww)	ABC (mp ww)	ACL (mp ww)	ACT (mp ww)
2019	2.31	2.27	2.27	2.03
2020	2.33	2.29	2.29	2.04
2021+	2.36	2.32	2.32	2.07

Alternative 5: The ACL for gray snapper for the years 2019 through 2021 and beyond will be equal to the ABC yield stream using the MSY proxy $F_{40\%SPR}$ selected in Action 1. Apply the ACL/ACT Control Rule (landings from 2014 through 2017) to establish an 11% buffer between the ACL and the ACT.

Year	OFL (mp ww)	ABC (mp ww)	ACL (mp ww)	ACT (mp ww)
2019	1.83	1.80	1.80	1.61
2020	1.90	1.86	1.86	1.66
2021+	1.95	1.92	1.92	1.71

Discussion:

Action 2 includes alternatives to modify the OFL, ABC, ACL, and ACT for gray snapper based on the results of the SEDAR 51 (2018) stock assessment and subsequent SSC review and recommendations. Gray snapper are currently managed to an ACT; however, the accountability measures are associated with the ACL (GMFMC 2011). Therefore, the ACT does not serve any management purpose.

The current OFL (2.88 mp ww) and ABC (2.42 mp ww) for gray snapper were established in the Generic ACL/AM Amendment (GMFMC 2011) using tier 3a of the ABC control rule. Using the control rule, OFL is equal to the mean plus two standard deviations of the annual landings between 1998 through 2008. The ABC is equal to the mean plus 1.0 standard deviations of the annual landings from 1998 through 2008. The ACL was set equal to the ABC and the ACT was established using the ACL/ACT control rule where the ACT was reduced 14% from the ACL and equal to 2.08 mp ww.

At its May 2018 meeting, the SSC determined that the gray snapper was experiencing overfishing as of 2015, the terminal year of data in the assessment. The SSC did not determine if the stock is overfished, as this is dependent upon the definition of MSY proxy (Action 1) and MSST (Action 3). However, the SSC determined that the stock assessment represented the best scientific information available and was suitable as the basis for management advice. Based on this determination, the SSC provided OFLs and ABCs for the years 2019 through 2021. If the SSC does not provide an updated ABC recommendation for 2022 and beyond, the ABC will remain at the level established for 2021. As the MSY proxy may be modified in Action 1, the SSC provided OFL and ABC recommendations based on using either $F_{30\%SPR}$ or $F_{40\%SPR}$. In general, yields are higher at lower MSY proxy values. Higher MSY proxy values are biologically conservative, have less risk of stock depletion, but may result in forgone yield.

Alternative 1 (No Action) would retain the current OFL (2.88 mp ww), ABC (2.42 mp ww), ACL (2.42 mp ww), and ACT (2.08 mp ww) that were established in the Generic ACL/AM Amendment (GMFMC 2011) using tier 3a from the ABC control rule. This would preserve the status quo and offers yields greater than the alternatives based on the most recent stock assessment. However, the current ACL exceeds the SSC's ABC recommendation for 2019 through 2021 and does not use the best scientific information available as the basis as management.

Alternative 2 establishes an ACL equal to the annual ABC for each year from 2019 through 2021, which in turn is based on the annual yield projections recommended by the SSC when fishing at a constant fishing mortality rate. **Alternative 2** would set the ACL based on yield when fishing at $F_{30\%SPR}$. **Alternative 3** would set the ACL based on the yield when fishing at $F_{40\%SPR}$. In all years, the allowable harvest for **Alternative 2** exceeds **Alternative 3** because it is based on a higher fishing mortality rate, however the allowable harvest for both alternatives is a modest reduction as compared to **Alternative 1**. For **Alternatives 2** and **3**, the ACT would not be established because it currently serves no management purpose. A similar action was taken for hogfish in Amendment 43 (GMFMC, 2016).

Alternative 4 also establishes an ACL based on the annual ABC for each year from 2019 through 2021, which in turn is based on the annual yield projections recommended by the SSC when fishing at a constant fishing mortality rate ($F_{30\%SPR}$). **Alternative 5** is identical to **Alternative 4**, but is at a constant fishing mortality rate at $F_{40\%SPR}$. The ACLs in **Alternative 4** are equivalent to those in **Alternative 2** and the ACLs in **Alternative 5** are equivalent to those in **Alternative 3**. The difference between **Alternatives 2-3** and **Alternatives 4-5** is the inclusion of ACTs. ACTs are intended to provide a buffer to account for uncertainty in the response to management advice. However, the accountability measures associated with the ACT do not serve any purpose in the management. **Alternative 4-5** apply the ACL/ACT Control Rule (landings from 2014 through 2017) to establish an 11% buffer between the ACL and the ACT for both **Options 4** and **5**.

As mentioned above, the ABC and ACL recommendations are identical for **Alternative 2** and **Alternative 4** and **Alternative 3** and **Alternative 5**. These are modest reductions in harvest when compared to **Alternative 1**. Based on the SSC recommendation, the ABC increases modestly each year (~ 0.03 mp ww) from 2019 to 2021 and would remain at the 2021 levels until a new ABC recommendation is provided from the SSC. This occurs because the stock biomass is expected to increase each year and is expected to be at or above the B_{MSY} by 2024.

CHAPTER 3. REFERENCES

- GMFMC. 1981. Environmental impact statement and fishery management plan for the reef fish resources of the Gulf of Mexico and environmental impact statement. Gulf of Mexico Fishery Management Council, Tampa, Florida.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/RF%20FMP%20and%20EIS%201981-08.pdf>
- GMFMC. 1989. Amendment number 1 to the reef fish fishery management plan including environmental assessment, regulatory impact review, and regulatory flexibility analysis. Gulf of Mexico Fishery Management Council. Tampa, Florida.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/RF%20Amend-01%20Final%201989-08-rescan.pdf>
- GMFMC. 1997. Amendment 15 to the fishery management plan for the reef fish resources of the Gulf of Mexico, includes regulatory impact review, initial regulatory flexibility analysis, and environmental assessment. Gulf of Mexico Fishery Management Council. Tampa, Florida.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/AMEND15.pdf>
- GMFMC. 1999. Generic sustainable fisheries act amendment, includes environmental assessment, regulatory impact review, and initial regulatory flexibility analysis. Gulf of Mexico Fishery Management Council, Tampa, Florida. 318 pp.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Generic%20SFA%20amendment%201999.pdf>
- GMFMC. 2002. Secretarial Amendment 2 to the Reef Fish Fishery Management Plan to set greater amberjack sustainable fisheries act targets and thresholds and to set a rebuilding plan includes environmental assessment and regulatory impact review. Gulf of Mexico Fishery Management Council. Tampa, Florida. 105 pp.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Secretarial-Amendment-2-RF.pdf>
- GMFMC. 2004a. Secretarial Amendment 1 to the reef fish management plan to set a 10-year rebuilding plan for red grouper, with associated impacts on gag and other groupers includes environmental assessment, regulatory impact review and final regulatory flexibility analyses. Gulf of Mexico Fishery Management Council. Tampa, Florida. 367 pp.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Secretarial-Amendment-1-RF.pdf>
- GMFMC. 2004b. Amendment 22 to the fishery management plan for the reef fish fishery of the Gulf of Mexico, U.S. waters, with supplemental environmental impact statement, regulatory impact review, initial regulatory flexibility analysis, and social impact assessment. Gulf of Mexico Fishery Management Council. Tampa, Florida. 291 pp.
<http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Amend%2022%20Final%20070204.pdf>

GMFMC. 2008a. Final Amendment 30B: gag – end overfishing and set management thresholds and targets. Red grouper – set optimum yield, TAC, and management measures, time/area closures, and federal regulatory compliance including environmental impact statement, regulatory impact review, and regulatory flexibility act analysis. Gulf of Mexico Fishery Management Council, Tampa, Florida. 427 pp.

http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20Amendment%2030B%2010_10_08.pdf

GMFMC. 2008b. Final reef fish amendment 30A: greater amberjack – revised rebuilding plan, accountability measures; gray triggerfish – establish rebuilding plan, end overfishing, accountability measures, regional management, management thresholds and benchmarks including supplemental environmental impact statement, regulatory impact review, and regulatory flexibility act analysis. Gulf of Mexico Fishery Management Council. Tampa, Florida. 346 pp.

<http://www.gulfcouncil.org/docs/amendments/Amend-30A-Final%202008.pdf>

GMFMC. 2011. Final generic annual catch limits/accountability measures amendment for the Gulf of Mexico fishery management council's red drum, reef fish, shrimp, coral and coral reefs fishery management plans, including environmental impact statement, regulatory impact review, regulatory flexibility analysis, and fishery impact statement. Gulf of Mexico Fishery Management Council. Tampa, Florida.

http://www.gulfcouncil.org/docs/amendments/Final%20Generic%20ACL_AM_Amendment-September%209%202011%20v.pdf

GMFMC. 2016. Final Amendment 43 to the fishery management plan for the reef fish resources of the Gulf of Mexico, includes regulatory impact review, initial regulatory flexibility analysis, and environmental assessment Gulf of Mexico Fishery Management Council. Tampa, Florida.

http://archive.gulfcouncil.org/docs//amendments/Final%20Amendment%2043%20-%20Hogfish_10-11-2016.pdf

GMFMC. 2017a. Final amendment 44 to the fishery management plan for the reef fish resources of the Gulf of Mexico: Minimum stock size threshold (MSST) revision for reef fish stocks with existing status determination criteria, including environmental assessment and fishery impact statement. Gulf of Mexico Fishery Management Council. Tampa, Florida. 121 pp.

<http://gulfcouncil.org/wp-content/uploads/B-4a-Public-Hearing-Draft-Amendment-44-MSST-GOM-Reef-Fish.pdf>

GMFMC. 2017b. Final amendment 47 to the reef fish fishery management plan: establish a vermilion snapper MSY proxy and adjust the stock annual catch limit, including environmental assessment, fishery impact statement, regulatory impact review, and regulatory flexibility act analysis. Gulf of Mexico Fishery Management Council. Tampa, Florida. 146 pp.

<http://gulfcouncil.org/wp-content/uploads/Final-Amendment-47-Vermilion-snapper-ACL-and-MSY-proxy.pdf>

Mace, P.M. and M. P. Sissenwine. 1993. How much spawning per recruit is enough? *in* S.J. Smith, J. J. Hunt and D. Rivard [eds.] Risk evaluation and biological reference points for fisheries management. Canadian Special Publications in Fisheries and Aquatic Sciences 120:101-118.

SEDAR 51. 2018. Stock assessment report for Gulf of Mexico gray snapper. Southeast Data, Assessment, and Review. North Charleston, SC. 174 pp + attachments.
http://sedarweb.org/docs/sar/S51_FINAL_SAR_0.pdf