

Vermilion Snapper MSY Proxy and Annual Catch Limit



Options Paper for Draft Amendment 47 to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico

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ENVIRONMENTAL ASSESSMENT COVER SHEET

Name of Action

Draft Amendment 47 to the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico: Vermilion Snapper MSY Proxy and Annual Catch Limit

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Summary/Abstract

To be completed

ABBREVIATIONS USED IN THIS DOCUMENT

Council	Gulf of Mexico Fishery Management Council
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
Gulf	Gulf of Mexico
M	Instantaneous Rate of Natural Mortality
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MFMT	Maximum fishing mortality threshold
MSST	Minimum stock size threshold
MSY	Maximum sustainable yield
NMFS	National Marine Fisheries Service
NS1	National Standard 1 guidelines
OY	Optimum yield
SDC	Status determination criteria
SEDAR	Southeast Data, Assessment and Review
SPR	Spawning potential ratio

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FISHERY IMPACT STATEMENT

CHAPTER 1. INTRODUCTION

1.1 Background

The Gulf of Mexico Fishery Management Council (Council) is one of eight regional Fishery Management Council established by the Fishery Conservation and Management Act of 1976. The Council prepares fishery management plans (FMPs) which are designed to manage fishery resources within the federal waters of the Gulf of Mexico. One such FMP is the Fishery Management Plan for Reef Fish Resources of the Gulf of Mexico. Vermilion snapper are 1 of 31 species managed under the Reef Fish FMP.

The National Marine Fisheries Service, also known as NOAA Fisheries, is an office of the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce. NMFS is responsible for the stewardship of the nation's ocean resources and their habitat. NMFS collects data and conducts stock assessments in support of science-based fishery management to overfishing and rebuild fish stocks. NMFS may approve, reject, or partially approve FMPs and amendments submitted by the Council, and is responsible for implementing and enforcing management measures based on the FMPs and amendments. NMFS has five regional offices. The Gulf of Mexico falls under the jurisdiction of the Southeast Regional Office (SERO).

Maximum Sustainable Yield Proxy

The Sustainable Fisheries Act of 1996 and the subsequent revisions to the National Standard 1 (NS1) guidelines require Councils to establish definitions of overfishing (maximum fishing mortality threshold – MFMT), overfished (minimum stock size threshold –MSST), and estimates of maximum sustainable yield (MSY) or proxy for managed stocks. Collectively, these are referred to as status determination criteria. For vermilion snapper, the following status determination criteria were adopted in Amendment 23 (GMFMC 2004):

$MSY = \text{Yield at } F_{MSY} \text{ (no proxy)}$

$MFMT = F_{MSY} \text{ (no proxy)}$

$MSST = (1-M)*B_{MSY} \text{ (} M = 0.25 \text{)}$

Under the criteria in Amendment 27, there is no proxy used for MSY. The estimate generated by the assessment model is used. However, the calculation for this estimate of MSY is dependent upon the spawner-recruit relationship. For vermilion snapper, there is a high degree of variability and a narrow range of spawning biomass in the data used to calculate the spawner-recruit relationship.

Because of the poor fit of the spawner-recruit curve to the available data, the Council's Scientific and Statistical Committee (SSC) had little confidence in the resulting estimate of MSY. Instead, the SSC recommended the use of an MSY proxy. The SSC had, in some past assessments, used as an MSY proxy the yield when fishing for maximum yield-per-recruit (F_{MAX}) (Schirripa 1992, SEDAR 9 Update 2012), and provided management advice based on that proxy. In the most

recent assessment (SEDAR 45 2016), the SSC selected the yield at $F_{30\% \text{ SPR}}$ as a better proxy. The SSC's use of an MSY proxy results in the best scientific information available, but is inconsistent with the status determination criteria currently in the Reef Fish Fishery Management Plan for vermilion snapper.

Annual Catch Limit

The annual catch limit (ACL) for vermilion snapper has been at 3.42 million pounds whole weight (mp ww) since 2012 when it was set using tier 3a of the ABC control rule. Tier 3a is a data poor method that relies only on catch data. The 3.42 mp ww ACL was the average annual catch during 1999-2008 plus one standard deviation.

An update assessment conducted in 2012 (SEDAR 9 update 2012) evaluated the stock status using MSY proxies of both 30% SPR ($SSB_{30\% \text{ SPR}}$ and $F_{30\% \text{ SPR}}$) and maximum yield per recruit (SSB_{MAX} and F_{MAX}). Under both proxies the stock was determined to be neither overfished nor undergoing overfishing, but the proxy based on maximum yield per recruit did bring the stock closer to the overfishing and overfished thresholds. The SSC felt that maximum yield per recruit was a better proxy because the yield-per-recruit curve for vermilion snapper revealed that $F_{30\% \text{ SPR}}$ was greater than F_{MAX} for this stock under directed yield projections. Projections for OFL and ABC conducted under tier 1 of the ABC control rule ($P^* = 39.8\%$) resulted in ABC yields higher than the existed 4.42 mp ww ACL suggesting that the ACL could be increased. However, members of the Council's Reef Fish Advisory Panel as well as fishermen who testified to the Council felt that, based on their personal observations, the vermilion snapper stock was not in as good condition as the assessment suggested. As a result, the 3.42 mp ww ACL was maintained in the 2012 'Framework Action to Set the Annual Catch Limit & Optionally the Annual Catch Target For the Vermilion Snapper Fishery' (GMFMC 2012).

In 2016, a standard assessment for vermilion snapper was conducted (SEDAR 45 2016). Stock status was evaluated using MSY proxies of 30% SPR ($SSB_{30\% \text{ SPR}}$ and $F_{30\% \text{ SPR}}$), maximum yield per recruit (SSB_{MAX} and F_{MAX}), and under a proxy that accounted for prevailing selectivities (SSB_{CMAX} and F_{CMAX}). Under $SSB_{30\% \text{ SPR}}$ and SSB_{CMAX} the stock was not overfished (a status was not provided for SSB_{MAX}). Under all proxies, overfishing was not occurring. The SSC selected 30% SPR as the best MSY proxy for this assessment.

Projections were made for OFL and ABC. However, the SSC felt that ABCs calculated under tier 1 of the ABC control rule produced catch levels that were too close to the OFLs, and instead provided ABC projections based on the yield when fishing at 75% of $F_{30\% \text{ SPR}}$. This is the yield level that the Council usually uses to define optimum yield (OY). The resulting ABC over the five-year period 2017 – 2021 is either a declining yield stream from 3.21 mp ww to 3.03 mp ww, or a constant catch ABC of 3.11 mp ww (see Table 2.2.3 for specific OFL and ABC values). Under either method, the current ACL of 3.42 mp ww exceeds the ABC and must be adjusted.

Gulf of Mexico Fishery Management Council

- Responsible for conservation and management of fish stocks
- Consists of 17 voting members, 11 of whom are appointed by the Secretary of Commerce, the National Marine Fisheries Service Regional Administrator, and 1 representative from each of the 5 Gulf states marine resource agencies
- Responsible for developing fishery management plans and amendments, and for recommending actions to National Marine Fisheries Service for implementation

National Marine Fisheries Service

- Responsible for conservation and management of fish stocks
- Responsible for compliance with federal, state, and local laws
- Approves, disapproves, or partially approves Council recommendations
- Implements regulations

1.2 Purpose and Need

The purpose for the action is to establish a proxy for MSY and to adjust the ACL for the Gulf of Mexico vermilion snapper stock consistent with the most recent stock assessment.

The need for the proposed action is to establish and MSY proxy and associated status determination criteria that are consistent with the best scientific information available under National Standard Guideline 2, and to establish an ACL that does not exceed the ABC yields from the most recent stock assessment (SEDAR 45 2016).

1.3 History of Management

This history of management covers events pertinent to the management of vermilion snapper in the Gulf of Mexico. A complete history of management for the Fishery Management Plan (FMP) for the Reef Fish Resources of the Gulf of Mexico is available on the Council's website: http://www.gulfcouncil.org/fishery_management_plans/reef_fish_management.php. The original Reef Fish FMP (with its associated environmental impact statement [EIS]) (GMFMC 1981) was effective November 8, 1984. There were no regulations specific to vermilion snapper, but vermilion snapper were included in the reef fish management unit. Species in the management unit were subject to certain gear restrictions when fished inside defined stressed area including a prohibition on the use of fish traps, roller trawls, and powerheads for the taking of reef fish in the stressed area.

1.3.1 Vermilion Snapper History of Management

Amendments

Amendment 1 [with its associated environmental assessment (EA), regulatory impact review (RIR), and initial regulatory flexibility analysis (IRFA)] to the Reef Fish FMP, implemented in 1990, had a primary objective to stabilize long-term population levels of all reef fish species by establishing a spawning age survival rate to achieve at least 20% spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing. A minimum size limit of 8 inches total length (TL) was established for vermilion snapper, but vermilion snapper were exempted from an aggregate snapper recreational bag limit. The stressed area was expanded to that it ran contiguously around the Gulf coast, and a longline boundary was established shoreward of which longlines could not be used for the harvest of reef fish. A commercial fishing permit was established and required for vessels to exceed the recreational bag limit (where applicable) and for the sale of reef fish. A framework procedure for the specification of the total allowable catch was created to allow for annual management changes.

Amendment 4 (with its associated EA and RIR), implemented in May 1992, established a moratorium on the issuance of new commercial reef fish vessel permits for a maximum period of three years.

Amendment 5 (with its associated supplemental environmental impact statement, RIR, and IRFA), implemented in February 1994, required that all finfish except for oceanic migratory species be landed with head and fins attached, and closed the region of Riley's Hump (near Dry Tortugas, Florida) to all fishing during May and June to protect mutton snapper spawning aggregations. This amendment also established a fish trap endorsement and a three year moratorium on the issuance on new fish trap permits.

Amendment 9 (with its associated EA and RIR), implemented in July 1994, extended the reef fish permit moratorium through December 31, 1995.

Amendment 11 (with its associated EA and RIR), implemented in January 1996, included the following: (1) limited sale of Gulf reef fish by permitted vessels to permitted reef fish dealers; (2) required that permitted reef fish dealers purchase reef fish caught in Gulf federal waters only from permitted vessels; (3) established limited transfer provision for fish trap endorsements; allow transfer of reef fish permits and fish trap endorsements in the event of death or disability; (4) implemented a new reef fish permit moratorium for no more than 5 years or until December 31, 2000.

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 14 (with its associated EA and RIR), implemented in March and April 1997, provided for a 10-year phase-out for the fish trap fishery. The amendment also provided the Regional Administrator of NMFS with authority to reopen a fishery prematurely closed before

the allocation was reached and modified the provisions for transfer of commercial reef fish vessel permits.

Amendment 15 (with its associated EA, RIR, and IRFA), implemented in January 1998, increased the vermilion snapper minimum size limit from 8 inches TL to 10 inches TL.

Amendment 17 (with its associated EA), implemented by NOAA Fisheries in August 2000, extended the commercial reef fish permit moratorium for another five years, from December 31, 2000 to December 31, 2005, unless replaced sooner by a comprehensive controlled access system.

Amendment 18A (EA/RIR/IRFA) was implemented on September 8, 2006, except for VMS requirements which were implemented May 6, 2007. Amendment 18A addresses the following: (1) prohibits vessels from retaining reef fish caught under recreational bag/possession limits when commercial quantities of Gulf reef fish are aboard, (2) adjusts the maximum crew size on charter vessels that also have a commercial reef fish permit and a United States Coast Guard certificate of inspection (COI) to allow the minimum crew size specified by the COI when the vessel is fishing commercially for more than 12 hours, (3) prohibits the use of reef fish for bait except for sand perch or dwarf sand perch, (4) requires devices and protocols for the safe release in incidentally caught endangered sea turtle species and smalltooth sawfish, (5) updates the TAC procedure to incorporate the Southeast Data Assessment and Review (SEDAR) assessment methodology, (6) changes the permit application process to an annual procedure and simplifies income qualification documentation requirements, and (7) requires electronic VMS aboard vessels with federal reef fish permits, including vessels with both commercial and charter vessel permits.

Amendment 19 (FSEIS/RIR/IRFA), also known as the Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves, or Generic Essential Fish Habitat (EFH) Amendment 2, was implemented on August 19, 2002. This amendment established two marine reserves off the Dry Tortugas where fishing for any species and anchoring by fishing vessels is prohibited.

Amendment 20 (EA/RIR/IRFA), implemented July 2003, established a three-year moratorium on the issuance of charter and headboat vessel permits in the recreational for-hire reef fish and coastal migratory pelagic fisheries in the Gulf EEZ.

Amendment 21 (EA/RIR/IRFA), implemented in July 2003, continued the Steamboat Lumps and Madison-Swanson reserves for an additional six years, until June 2010. In combination with the initial four-year period (June 2000-June 2004), this allowed a total of ten years in which to evaluate the effects of these reserves and to provide protection to a portion of the gag spawning aggregations.

Amendment 23 (SEIS/RIR/IRFA), implemented July 8, 2005, established a rebuilding plan for vermilion snapper, including an 11 inch total length minimum size limit, a 10-fish vermilion snapper bag limit within the 20-reef fish aggregate bag limit, and an April 22 through May 31 closed season for the commercial fishery.

Amendment 24 (EA/RIR/IRFA), implemented on August 17, 2005, replaced the commercial reef fish permit moratorium that was set to expire on December 31, 2005 with a permanent limited access system.

Amendment 25 (SEIS/RIR/IRFA), implemented on June 15, 2006, replaced the reef fish for-hire permit moratorium that expired in June 2006 with a permanent limited access system.

Amendment 27 (EA/RIR/IRFA), implemented February 2008, addressed the use of non-stainless steel circle hooks when using natural baits to fish for Gulf reef fish, and required the use of venting tools and dehooking devices when participating in the commercial or recreational reef fish fisheries effective June 1, 2008.

Amendment 31 (FEIS/RIR/IRFA), implemented May 26, 2010, established additional restrictions on the use of bottom longline gear in the eastern Gulf of Mexico in order to reduce bycatch of endangered sea turtles, particularly loggerhead sea turtles. The amendment (1) prohibits the use of bottom longline gear shoreward of a line approximating the 35-fathom contour from June through August; (2) reduces the number of longline vessels operating in the fishery through an endorsement provided only to vessel permits with a demonstrated history of landings, on average, of at least 40,000 pounds of reef fish annually with fish traps or longline gear during 1999-2007; and (3) restricts the total number of hooks that may be possessed onboard each reef fish bottom longline vessel to 1,000, only 750 of which may be rigged for fishing. The boundary line was initially moved from 20 to 50 fathoms by emergency rule effective May 18, 2009. That rule was replaced on October 16, 2009 by a rule under the Endangered Species Act moving the boundary to 35 fathoms and implementing the maximum hook provisions.

Amendment 34 (EA/RIR/IRFA), implemented November 2012, defined dually permitted vessels as vessels with both a charter-for-hire permit and a commercial reef fish permit. The amendment eliminated the earned income requirement for the renewal of commercial reef fish permits and increased the maximum crew size from three to four when dually permitted vessels are operating as a commercial reef fish vessel.

Framework Actions and Regulatory Amendments

August 1999: Closed two areas (i.e., created two marine reserves), known as Steamboat Lumps and Madison-Swanson (104 and 115 nautical square miles respectively), year-round to all fishing under the jurisdiction of the Gulf Council with a four-year sunset closure.

February 2007: Revised management measures for vermilion snapper to those prior to implementation of Reef Fish Amendment 23 by reducing the minimum size limit for from 11 inches to 10 inches TL; eliminating the 10 fish bag limit for vermilion snapper and retaining the current 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 for vermilion snapper.

September 2010: Provides a more specific definition of buoy gear by limiting the number of hooks, limiting the terminal end weight, restricting materials used for the line, restricting the length of the drop line, and where the hooks may be attached. In addition, the Council requested that each buoy must display the official number of the vessel (USCG documentation number or state registration number) to assist law enforcement in monitoring the use of the gear, which requires rulemaking.

June 2013: Modifies the frequency of headboat reporting to be on a weekly basis (or intervals shorter than a week if notified by the SRD) via electronic reporting, and will be due by 11:59 p.m., local time, the Sunday following a reporting week. If no fishing activity occurs during a reporting week, an electronic report so stating must be submitted for that week.

September 2013: Establishes a 10-vermilion snapper recreational bag limit within the 20-reef fish aggregate, and removes the requirement to have onboard and use venting tools when releasing reef fish.

Emergency Actions

Emergency Rule - Implemented May 18, 2009 through October 28, 2009: Prohibited the use of bottom longline gear to harvest reef fish east of 85°30' W longitude in the portion of the exclusive economic zone (EEZ) shoreward of the coordinates established to approximate a line following the 50– fathom (91.4–m) contour as long as the 2009 deepwater grouper and tilefish quotas are unfilled. After the quotas have been filled, the use of bottom longline gear to harvest reef fish in water of all depths east of 85°30' W longitude are prohibited [74 FR 20229].

Emergency Rule - Implemented May 3, 2010 through November 15, 2010: NMFS issued an emergency rule to temporarily close a portion of the Gulf of Mexico EEZ to all fishing [75 FR 24822] in response to an uncontrolled oil spill resulting from the explosion on April 20, 2010 and subsequent sinking of the Deepwater Horizon oil rig approximately 36 nautical miles (41 statute miles) off the Louisiana coast. The initial closed area extended from approximately the mouth of the Mississippi River to south of Pensacola, Florida and covered an area of 6,817 square statute miles. The coordinates of the closed area were subsequently modified periodically in response to changes in the size and location of the area affected by the spill. At its largest size on June 1, 2010, the closed area covered 88,522 square statute miles, or approximately 37 percent of the Gulf of Mexico EEZ.

1.3.2 Status Determination Criteria History of Management

Management measures from **Amendment 1** (implemented in 1990) had a primary objective to stabilize long-term population levels of all reef fish species by establishing a spawning age survival rate to achieve at least 20% spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing.

Amendment 3 (EA/RIR/IRFA), implemented in July 1991, provided additional flexibility in the annual framework procedure for specifying TAC by allowing the target date for rebuilding an

overfished stock to be changed. It also revised the FMP's primary objective from a 20% SSBR target to a 20% spawning potential ratio (SPR).

The **Generic Sustainable Fisheries Act Amendment** (GMFMC 1999b; EA/RIR/RFA), was partially approved and implemented in November 1999. It set the MFMT for most reef fish stocks including hogfish at $F_{30\% SPR}$. Estimates of maximum sustainable yield, MSST, and OY were disapproved because they were based on spawning potential ratio proxies rather than biomass based estimates.

Amendment 23 (SEIS/RIR/IRFA), implemented July 8, 2005, established MSY for vermilion snapper is the yield associated with F_{MSY} when the stock is at equilibrium. It also established $MFMT = F_{MSY}$, and $MSST = (1-M)*B_{MSY}$ or B_{MSY} proxy.

1.3.3 Annual catch limits (ACL) and annual catch targets (ACT) History of Management

The **Generic ACL/AM Amendment** (GMFMC 2011a), implemented in November 1999, established a vermilion snapper overfishing limit (OFL), ACL, and ACT. Vermilion snapper were classified as a Tier 3a species in the Council's ABC control rule. This tier is applied to stocks where no assessment is available, but landings data do exist, and recent landings do appear sustainable. As a Tier 3a species, the OFL was set equal to the mean of 1999-2008 landings plus two standard deviations and equaled 4.08 mp ww. To account for scientific uncertainty, the Gulf Council's SSC applied the default buffer from the OFL using the formula $ABC = \text{mean of the landings} + 1.0 * \text{standard deviation}$. This resulted in an ACL of 3.42 mps ww. This amendment also established an ACT for vermilion snapper using the ACL/ACT control rule. The control rule indicated a 14% buffer should be applied to the ACL resulting in an ACT of 2.94 mp ww. However, the ACT is not currently used for management purposes.

CHAPTER 2. MANAGEMENT OPTIONS

2.1 Action 1 – MSY Proxy

Alternative 1: No Action. Do not use a proxy. Use the vermilion snapper MSY estimated by the assessment model.

Alternative 2: The proxy for vermilion snapper MSY is the yield when fishing at $F_{30\% \text{ SPR}}$.

Discussion:

The Scientific and Statistical Committee in its review of the SEDAR 45 vermilion snapper standard assessment (SEDAR 45 2016) recommended that the yield when fishing at $F_{30\% \text{ SPR}}$ be used as a proxy for MSY, and based its advice for catch levels on that proxy (GMFMC 2016a). Although there are other potential proxies for MSY, the selection of any proxy other than the one recommended by the SSC would be inconsistent with National Standard 2, which requires that conservation and management measures be based on the best scientific information available. Therefore, the only viable alternative to no action (**Alternative 1**) is to adopt the 30% SPR proxy recommended by the SSC (**Alternative 2**). Only these two alternatives are presented, although other proxies are discussed below.

The status determination criteria (SDC) of maximum fishing mortality threshold (MFMT) and minimum stock size threshold (MSST) are functions of MSY or its proxy. The values for MFMT and MSST are determined by the proxy. The MFMT and MSST values under each of the alternatives are shown in Table 2.1.1 along with an alternative proxy that was not accepted by the SSC for comparison. Note that for MSST, annual stock egg production is used to represent spawning stock biomass (SSB).

Table 2.1.1. MFMT and MSST under each MSY proxy alternative.

	Alt. 1	Alt. 2	F_{CMAX} (for comparison only)
MSY proxy	none	Yield at 30% SPR	Maximum yield-per-recruit under prevailing conditions
MFMT	$F_{\text{MSY}} = 0.76$ (SEDAR 9)	$F_{30\% \text{ SPR}} = 0.106$ (SEDAR 45)	$F_{\text{CMAX}} = 0.246$ = $F_{12\% \text{ SPR}}$ (SEDAR 45)
MSST (1-M)*SSB_{Proxy}	$\text{SSB}_{\text{MSY}} =$ 52.7 trillion eggs (SEDAR Update 2011)	$\text{SSB}_{30\% \text{ SPR}} =$ 197 trillion eggs (SEDAR 45)	$\text{SSB}_{\text{CMAX}} =$ 81.4 trillion eggs (SEDAR 45)

Alternative 1 is the existing definition of MSY for vermilion snapper, which was adopted in Amendment 23 (GMFMC 2004). There is no proxy used for MSY. Instead, the assessment model generated estimate of MSY is used. In 2001, a vermilion snapper stock assessment (Porch and Cass-Calay, 2001) evaluated the stock status using two alternative methods. Based on a Pella-Tomlinson surplus production model the 2001 assessment estimated the value of MSY to be 3.37 mp whole weight. An alternative would have defined MSY for vermilion snapper as the yield associated with $F_{30\% SPR}$ when the stock is at equilibrium. Using a virtual population analysis (VPA) model the 2001 assessment estimated the MSY proxy value to be between 2.58 and 3.24 mp whole weight. The 2001 assessment pre-dated the SEDAR process, and the assessment was reviewed by a Reef Fish Stock Assessment Panel (RFSAP) rather than a SEDAR review panel. The RFSAP felt that the results of the VPA-based assessment were highly uncertain due to an enormous variance in size-at-age. The RFSAP endorsed the (non-proxy) MSY results based on the Pella-Tomlinson surplus production model as the most reliable. Amendment 23 (GMFMC 2004) included alternatives to define MSY based on either the actual model MSY estimate or the 30% SPR proxy. Based on the recommendation of the RFSAP, the Council selected MSY for vermilion snapper as the yield associated with F_{MSY} when the stock is at equilibrium.

Alternative 2 is the MSY proxy recommended by the SSC and used to make projections for OFL and ABC. In more recent vermilion snapper assessments, more reliable age and growth data has become available, and the assessment model has been replaced by a more flexible Stock Assessment 3 model. However, estimates of MSY from the assessment model are dependent on having a robust stock-recruit function. Although the SEDAR 45 assessment was able to derive a Beverton-Holt stock-recruit function using data from the years 1994-2012, the SSC had low confidence in the curve because most of the data points were concentrated in a narrow range of SSB (Figure 2.1.1) (GMFMC 2016a). Therefore, the SSC determined that a proxy for MSY should be used to determine stock status. After reviewing alternative proxies, including the yield that produces maximum yield-per-recruit under existing gear selectivities (yield at F_{CMAX}), the SSC concluded that the best proxy to use with vermilion snapper was the yield at $F_{30\% SPR}$ (GMFMC 2016a). As shown in Table 2.1.1, this resulted in achieving MSY at a much lower fishing mortality rate than the model estimate, and also resulted in an MSST spawning stock biomass that produces nearly 4 times as many eggs.

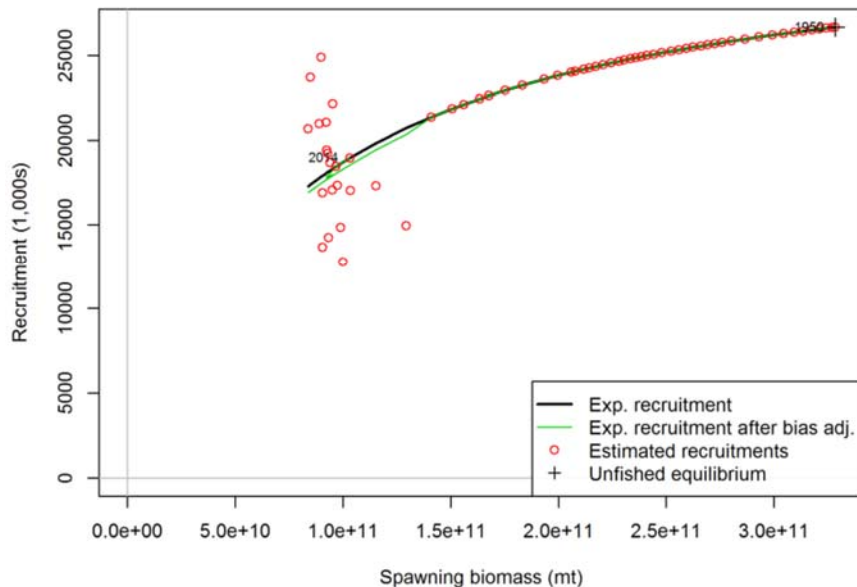


Figure 2.1.1. Beverton-Holt stock-recruit curve for vermilion snapper from SEDAR 45

Alternative MSY proxies include proxies based on maximum yield-per-recruit (yield at F_{MAX}) or on an SPR based proxy other than 30% SPR. Previous assessments have used 20% SPR (Schirripa 1996a,b, Schirripa 1998), or the actual MSY estimate from the assessment model (Porch and Cass-Calay 2001), or $F_{30\% SPR}$ (Schirripa and Legault 2000, SEDAR 9 2006), SEDAR 9 Update 2011), and F_{MAX} (Schirripa 1992, SEDAR 9 Update 2012).

The SSC considered using F_{CMAX} as a proxy. This is the same as F_{MAX} from the previous assessments. The SEDAR 45 assessment adopted the C_{MAX} terminology to indicate it represents current maximum-yield-per-recruit, which is the yield obtained when fishing under current gear selectivities. A true F_{MAX} would be the F that results in maximum-yield-per-recruit under optimum size and knife-edge selectivity, parameters which are unrealistic. In the 2012 update assessment (SEDAR 9 Update 2012), examination of the yield-per-recruit curve for vermilion snapper revealed that $F_{SPR30\%}$ was greater than F_{CMAX} for this stock under directed yield projections. For this reason, the SSC felt that in the 2012 assessment F_{CMAX} should be used as the proxy rather than $F_{SPR30\%}$ in this case.

However, in the SEDAR 45 assessment, F_{CMAX} was calculated to be $F_{CMAX} = 0.246$, corresponding approximately to $F_{12\% SPR}$. This is a higher F value than $F_{30\% SPR}$, and it results in a lower equilibrium spawning stock biomass (Table 2.1.1). The SSC was concerned about the sustainability of a proxy at this low an SPR level, and did not use it for management advice. It is therefore not included as an alternative, but is shown for discussion and comparison only.

Other possibilities for MSY proxies include SPR based proxies at other than 30%. A proxy of 20% SPR had been used in some of the early vermilion snapper stock assessments (Schirripa

1996a,b, Schirripa 1998). However, in 1998 the Council convened two Fish Stock Assessment Panels to review MSY proxies (FSAP 1998a,b). Based on the recommendations of those groups, the Council in 1999 proposed proxies of 30% for most reef fish species (GMFMC 1999). Biomass proxies based purely in terms of static SPR were rejected by NMFS because SPR by itself is not considered a biomass-based proxy. However, the yield when fishing at $F_x\% \text{ SPR}$ is considered an acceptable proxy, and has been used in subsequent amendments when defining MSY proxies for specific species. The SSC is currently reviewing MSY proxies in light of recent studies, but as of the writing of this amendment, the yield at $F_{30\% \text{ SPR}}$ remains their recommended proxy for most species.

2.2 Action 2 –Annual Catch Limit

Alternative 1: No Action. The annual catch limit for vermilion snapper will remain at 3.42 mp ww.

Alternative 2: The annual catch limit for vermilion snapper for the years 2017 through 2021 will be based on the annual ABC derived from fishing at 75% of F_{30%} SPR. (see table below)

Option a. After 2021, the annual catch limit will be remain at 3.03 mp ww.

Option b. After 2021, the annual catch limit will be set at 2.98 mp ww (equilibrium ABC).

Alternative 3: The annual catch limit for vermilion snapper for the years 2017 through 2021 will be 3.11 mp ww (constant catch average of the 5-year annual ACLs)

Option a. After 2021, the annual catch limit will be remain at 3.11 mp ww.

Option b. After 2021, the annual catch limit will be set at the equilibrium ABC level of 2.98 mp ww.

Alternative 4: The annual catch limit for vermilion snapper for the years 2017 through 2021 will be a constant catch at the equilibrium ABC of 2.98 mp ww

Discussion:

Table 2.2.1 shows the annual ACLs under each of the alternatives and options.

Table 2.2.1. Vermilion snapper ACL for 2017-2021 plus 2022 and beyond under each alternative.

Year	Alt 1 No action	Alt 2 Constant F	Alt 3 Constant catch at ave. of 2017-2021	Alt 4 Constant catch at equilibrium ABC
2017	3.42 mp	3.21 mp	3.11 mp	2.98 mp
2018		3.15 mp		
2019		3.10 mp		
2020		3.05 mp		
2021		3.03 mp		
2022+		3.05 mp (opt. a) 2.98 mp (opt. b)	3.11 mp (opt. a) 2.98 mp (opt. b)	

Table 2.2.2 shows the annual landings of vermilion snapper from 1966 through 2015. There is no recreational:commercial allocation. Accountability measures are based on total landings and apply to both sectors. Over the entire time period, landings by sector have been 74% commercial, 26% recreational. However, during the most recent 5 years (2011-2015), landings by sector have been 65% commercial, 35% recreational. Total landings have ranged from a low of 1.77 mp in 2000 to a high of 4.49 mp in 2009. Since 2011, landings have shown a declining trend, from 4.27 mp in 2011 to 2.34 mp in 2015.

Table 2.2.2. Vermilion snapper commercial and recreational landing in pounds whole weight, 1986-2015

Year	Commercial	Recreational	Total
1986	1,748,509	859,422	2,607,931
1987	1,605,405	703,202	2,308,607
1988	1,553,896	832,979	2,386,875
1989	1,657,410	598,818	2,256,228
1990	2,166,555	930,881	3,097,436
1991	1,793,380	970,547	2,763,927
1992	2,374,469	1,021,446	3,395,915
1993	2,722,983	958,393	3,681,376
1994	2,643,045	739,777	3,382,822
1995	2,183,844	886,552	3,070,396
1996	1,852,352	470,502	2,322,854
1997	2,132,004	590,121	2,722,125
1998	1,741,620	326,802	2,068,422
1999	2,043,474	406,677	2,450,151
2000	1,462,946	308,725	1,771,671
2001	1,723,017	555,252	2,278,269
2002	2,010,190	525,223	2,535,413
2003	2,422,367	566,999	2,989,366
2004	2,175,136	795,328	2,970,464
2005	1,870,155	521,974	2,392,129
2006	1,765,292	567,835	2,333,127
2007	2,383,953	612,758	2,996,711
2008	2,826,905	546,987	3,373,892
2009	3,796,100	691,317	4,487,417
2010	2,108,306	468,242	2,576,548
2011	3,146,168	1,126,853	4,273,021
2012	2,441,360	708,002	3,149,362
2013	1,418,401	1,165,104	2,583,505
2014	1,762,284	1,166,245	2,928,529
2015	1,365,056	972,510	2,337,566

Source: SEFSC Commercial ACL Database (Sept 2016) and ACL Database (Sept 2016)

There is no annual catch target (ACT) proposed for any of the alternatives because the ACT serves no function for vermilion snapper. The accountability measure for vermilion snapper that was adopted in the Generic Annual Catch Limits/Accountability Measures Amendment (GMFMC 2011) states that if the ACL is reached or projected to be reached within a fishing year, the Assistant Administrator for Fisheries shall file a notification with the Office of the Federal Register to close fishing for the remainder of the fishing year. There is no overage adjustment for exceeding the ACL.

Alternative 1 retains the existing ACL of 3.42 mp ww. This ACL is equal to the ABC adopted in 2012 under the Generic Annual Catch Limits/Accountability Measures Amendment (GMFMC 2011) using Tier 3a of the ABC control rule. This is a data poor method based on the average landings for 1999-2008 plus one standard deviation. Prior to 2012, there were no catch limits for vermilion snapper. Catches exceeded 3.42 mp ww three times (1993, 2009, and 2011). This ACL has not been exceeded since it was adopted in 2012. This ACL exceeds the ABC established by the SSC for 2017-2021 for all years. It does not exceed the OFL for any of the years (Table 2.2.3), but because it exceeds ABC, Alternative 1 is not a viable alternative.

Table 2.2.3. Vermilion snapper OFL and ABC projections under constant F and constant catch scenarios. Units are millions of pounds whole weight.

Year	Constant F		Constant Catch
	OFL (yield at F _{30%} SPR)	ABC (yield at 75% of F _{30%} SPR)	ABC (ave. of 2017-2012 ABCs)
2017	4.17 mp	3.21 mp	3.11 mp
2018	3.91 mp	3.15 mp	3.11 mp
2019	3.71 mp	3.10 mp	3.11 mp
2020	3.58 mp	3.05 mp	3.11 mp
2021	3.49 mp	3.03 mp	3.11 mp

Source: June 2015 SSC meeting summary

Alternative 2 sets the ACL equal to the annual ABC for each year during 2017-2021. In its determination of where to set SSC, the SSC felt that the P* method used in tier 1 of the ABC control rule produced unexpectedly small uncertainty estimates in the OFL, resulting in ABC values extremely close to OFL. The SSC felt that a more conservative ABC should be used, and after discussion, agreed to use the yield when fishing at 75% of F_{30%} SPR as the ABC yield (GMFMC 2016a). This is also the definition of optimum yield (OY) established in Amendment 23 (GMFMC 2004). The current biomass level is estimated to be 35% SPR which is above the equilibrium level, so this alternative results in a declining yield stream from 3.21 mp in 2017 to 3.03 mp in 2021. For the years 2022 and beyond, if **Alternative 2, Option a** is selected, the ACL will remain at the 2021 level of 3.03 mp until modified by future rulemaking, If **Alternative 2, Option b** is selected, the ACL will drop to the equilibrium yield of 2.98 mp until modified by future rulemaking. During the 30 year period 1986-1990, vermilion snapper landings have exceeded 3.03 mp 9 times, but only once (in 2012) since ACLs were implemented in 2012. Landings have exceeded 2.98 mp 11 times since 1986, but only 1 time (2012) since ACLs were implemented in 2012 (Table 2.2.2).

Alternative 3 sets the ACL equal to a constant catch of 3.11 mp during the years 2017-2021. This is the average of the annual ACLs under Alternative 2, and over the 5-year period is expected to have approximately the same effect on the stock biomass. For the years 2022 and beyond, if **Alternative 3, Option a** is selected, the ACL will remain at 3.11 mp until modified by future rulemaking. If **Alternative 3, Option b** is selected, the ACL will drop to the equilibrium yield of 2.98 mp until modified by future rulemaking. Landings have exceeded 3.11 mp 7 times since 1986, but only 1 time (2012) since ACLs were implemented in 2012 (Table 2.2.2).

Alternative 4 sets the ACL at a constant catch of 2.98 mp, which is the projected equilibrium catch if fished at 75% of $F_{30\% SPR}$. This is the most conservative alternative, but there is only a small difference between **Alternative 3** and **Alternative 4** of only 130,000 pounds. Landings have exceeded 2.98 mp 11 times since 1986, but only 1 time (2012) since ACLs were implemented in 2012 (Table 2.2.2).

The vermilion snapper stock biomass is currently estimated to be at 35% SPR. Analysis for SEDAR 45 indicates that fishing at the OFL level of $F_{30\% SPR}$ will eventually produce a catch level of 3.37 mp. Under **Alternative 1**, the fixed catch level of 3.42 mp is slightly higher than the catch at $F_{30\% SPR}$ and will therefore result in an SPR slightly below 30%. When fished at 75% of $F_{30\% SPR}$, under both a constant F (**Alternative 1**) or a constant catch (**Alternative 2**), the SPR is projected to drop from 35% to about 34% during the 2017-2021 period. If catches in subsequent years are maintained at the 2021 ACL (**Option a**), then SPR is projected to drop to slightly more to just under 34% by 2026 under both **Alternative 2, Option a** and **Alternative 3, Option a**. If catches in subsequent years are fixed at the long-term equilibrium rate of 2.98 mp (**Option b**), or are set at 2.98 mp from the beginning (**Alternative 4**), then SPR is projected to remain at 34%. In summary, under **Alternative 1**, the SPR for vermilion snapper is projected to drop to slightly under 30%, but under all scenarios for **Alternatives 2, 3, and 4**, the equilibrium SPR is projected to remain above 33%. It should be noted that the SSC considers these long-range projections to have a high level on uncertainty.

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