05/08/04

SECRETARIAL AMENDMENT 1

TO THE

REEF FISH FISHERY 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)

MAY 2004

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Abbreviations Used in This Document

ABC	Acceptable (or Allowable) Biological Catch
ASAP	Age Structured Assessment Model (used in stock assessment)
B_{MSY}	Stock biomass capable of producing maximum sustainable yield
EEZ	Exclusive Economic Zone (also known as federal waters)
EFH	Essential Fish Habitat
F	Rate of instantaneous fishing mortality, a measure of the rate at which fish are removed from the population by fishing.
— F_{MSY}	F that can sustain maximum sustainable yield
— $F_{0.1}$	F when the yield-per-recruit curve is at 10% of the slope at origin. This is usually a conservative estimate of F_{MSY}
— F_{MAX}	F that can produce maximum yield-per-recruit
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
GW	Gutted weight
HPUE	Harvested fish per target trip
IRFA	Initial Regulatory Flexibility Analysis
M	Natural Mortality Rate
MFMT	Maximum Fishing Mortality Threshold
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act
NSG	National Standard Guidelines
NMFS	National Marine Fisheries Service
OY	Optimum Yield
RA	Regional Administrator (NMFS Southeast Regional Office) (formerly Regional Director)
RFA	Regulatory Flexibility Act of 1980
RFSAP	Reef Fish Stock Assessment Panel
RIR	Regulatory Impact Review
SBA	Small Business Administration
SSC	Scientific and Statistical Committee
SEFSC	Southeast Fisheries Science Center, Miami, Florida (NMFS Southeast Regional Office)
SEP	Socioeconomic Panel

SFA	Sustainable Fisheries Act of 1996
SPR	Spawning Potential Ratio
SSBR	Spawning Stock Biomass Ratio or Spawning Stock Biomass per Recruit (an older term for SPR)
TAC	Total Allowable Catch
TL	Total Length
YPR	Yield-Per-Recruit
Z	Total Mortality Rate

Executive Summary

The purpose of this Secretarial Amendment is to establish biological reference points and stock status determination criteria for the red grouper stock in U.S. waters of the Gulf of Mexico in accordance with requirements of the revisions to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as amended by the Sustainable Fisheries Act (SFA), to establish and implement a rebuilding strategy for the red grouper stock, and to implement additional measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish stocks. The proposed measures in this amendment are based on the results of a 2002 red grouper stock assessment and the measures proposed by the Gulf of Mexico Fishery Management Council (Council) at its July 2002 meeting, and subsequently modified at its January 2003 meeting. The proposals are as follows:

Biological Reference Points and Status Determination Criteria:

MSY	7.560 million pounds (MP)
F_{MSY}	0.306
SS_{MSY}	840 metric tons mature female gonad weight
MSST	80% (1-M where M=0.2) of SS_{MSY} (currently estimated by proxy to be 672 metric tons mature female gonad weight)
MFMT	F_{MSY} (currently estimated at 0.306), or the F consistent with recovery to the MSY level in no more than 10 years.
OY	The yield obtained from a fishing mortality rate equal to 75% of F_{MSY} (currently estimated to be 7.385 MP gutted weight at equilibrium)

Red Grouper Rebuilding Strategy:

Adopt a 10-year red grouper rebuilding plan based on a three-year interval rebuilding strategy. The annual allowable biological catch (ABC) during the first three-year interval will be 6.56 MP gutted weight (GW).

Proposed Commercial Red Grouper Management Measures:

- 8.80 MP GW shallow-water grouper quota.
- 5.31 MP GW red grouper quota.

Proposed Recreational Red Grouper Management Measures:

- Bag limit of two red grouper out of the five aggregate grouper bag limit per person, with a double bag limit allowed for persons on qualified for-hire boats that are out over 24 hours.

Other Proposed Management Measures:

- Tilefish quota - 0.44 MP GW.
- Deep-water grouper quota - 1.02 MP GW.

Environmental Assessment (EA) Cover Sheet

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Name of Action

Secretarial Amendment 1 to the Reef Fish Fishery Management Plan to Set a 10-year Rebuilding Plan for Red Grouper, with Associated Impacts on Gag and Other Groupers.

Type of Action

(X) Administrative
() Draft

( ) Legislative
(X) Final

Summary

In October 2000, the National Marine Fisheries Service (NMFS) issued a determination that the Gulf of Mexico red grouper stock is overfished and undergoing overfishing. This document would amend the Reef Fish Fishery Management Plan (FMP) to end overfishing and rebuild the red grouper stock. The rebuilding plan seeks to achieve approximately a 9.4% reduction in total red grouper harvest during the first three years of a ten-year rebuilding plan, with subsequent harvest levels to be determined at an appropriate time. Red grouper are the primary species of a shallow-water grouper aggregate, of which the second most common species is gag. Gag was recently found to be neither overfished nor undergoing overfishing, but was being fished at a rate too high to achieve optimum yield. Consequently, this amendment evaluates the impact of actions to rebuild red grouper on other shallow-water grouper with an emphasis on gag. Deep-water grouper and tilefish are considered probable alternative target stocks by commercial fishermen displaced by the actions in this document. Therefore, this amendment also contains actions and evaluation of pro-active measures to protect these deep-water reef fish resources.

Filing Dates with EPA

DSEIS filed with EPA on: May 10, 2002

DSEIS comment period end: June 30, 2002

Notice of change to an Environmental Assessment filed in Federal Register: October 3, 2003

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Much of the material in this document is used for both Secretarial Amendment 1 and the EA. The table of contents and sections that comprise the EA are as follows:

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Fishery Impact Statement- Social Impact Assessment

This table of contents and summary of impacts on participants and communities are provided to aid the reader in reviewing fishery impacts by referencing corresponding sections of the amendment that are inclusive of the Fishery Impact Statements (FIS) and the Social Impact Assessment.

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G. Deep-Water Grouper and Tilefish Quotas	Sections 6.6, 7.6.5, 8.0, 9.3.2, 10.7

Summary

Biological reference points and stock status determination criteria, such as MSY, MSST, and MFMT, are mainly biological in nature but have relevance to the determination of impacts on fishing participants to the extent that they provide the general benchmark for regulatory measures. Regulatory measures, such as those considered in this amendment, that flow from the choice of these criteria are the ones that have immediate impacts on fishing participants. The determination of optimum yield (OY) is mainly done on biological grounds, but also may incorporate social and economic considerations. The general impact of these alternatives will become more important at such time as the red grouper stock is fully rebuilt to B_{MSY}, because OY will be the management goal.

All rebuilding scenarios are expected to result in short-term negative but long-term positive socioeconomic impacts on both the commercial and recreational fishing participants. The Proposed Alternatives for the commercial sector are expected in the short-term to have negative impacts that will be mostly borne by longline, high-volume vertical line, and fish trap vessels. However, over time, all segments of the commercial sector are expected to benefit from the rebuilding strategy, except that fish traps will be completely phased out of the fishery by 2007. The Proposed Alternative for the recreational sector is expected to reduce the red grouper harvest of this sector. Since the proposed measure is specific to red grouper, anglers would still have the flexibility to fish for other groupers or reef fish species. In this sense, the likelihood of trip cancellations due to the proposed measure is relatively low. The short-term negative impacts to the recreational sector then are expected to be mainly borne by anglers, with the for-hire sector only minimally affected. Over time, benefits are expected to accrue to both anglers and for-hire operators as the red grouper stock is fully rebuilt.

As mentioned previously, the short-term negative impacts of all rebuilding scenarios are likely

to cause social disruptions among fishing participants, including owner and crew of the commercial and for-hire vessels, owner and employees of fish dealers, marinas, and other support industries. However, such disruptions are not expected to be substantial under the Proposed Alternatives for both the commercial and recreational sectors. The reduction in the commercial red grouper quota and the bag limit reduction for the recreational sector are not likely to significantly alter the operations of commercial and for-hire vessels. These vessels are still expected to continue operating, although longline and other high-volume vessels may have to find ways to either reduce their costs or increase their catch and revenues at the same cost levels. Further, the reductions for both red grouper and all shallow-water grouper, may result in fishery closures. If a long closed season for the commercial fishery does occur, imports can displace domestic production, and vessel crew may be compelled to find other sources of income that may or may not be fishery-related. A similar long closed season for the recreational fishery, although unlikely under the Proposed Alternative, would tend to raise the seasonal unemployment rate in areas where for-hire vessel operations are clustered, if these vessels cannot successfully redirect effort to other fisheries. Finding employment in other fishery or non-fishery related areas would depend on employment opportunities and skills of the displaced individuals.

In terms of initial impacts, the red grouper commercial quota and shallow-water grouper quota adjustments and closures would not impose regulatory bias in negatively affecting the various commercial fishery participants. The eventual outcome during the rebuilding period may depend on the ability of various commercial fishing entities to adapt to a derby condition likely to characterize the fishery under quota management in a relatively open access fishery. A derby in the fishery is likely to alter fishing opportunities for many vessels, fishing practices among commercial fishermen, and business practices among dealers and other support industries.

Additional alternatives to reduce fishing mortality include commercial shallow-water grouper closed season, commercial grouper trip limits, recreational grouper closed seasons, and recreational grouper bag limits. For the commercial sector, a longer closed season would, in addition to the general short-term reductions in revenues and profits, likely invite more imports. This situation can stabilize prices to the consumers but may result in domestic producers losing some markets. Uniform trip limits would have differential impacts among the longline, vertical line, and fish trap segments of the fishery and between small and large vessels, with lower trip limits affecting the longliners more than others and large vessels more than small ones. For the recreational sector, closed seasons can initially result in fewer angler trips, and thus lower for-hire vessel revenues, but such negative impacts may be mitigated if effort is successfully shifted to the open months. Bag limits can effect a reduction in recreational catch if set at relatively low levels, such as one-fish red grouper in the aggregate five-grouper bag limit. Closed seasons, however, are expected to effect more negative impacts on the for-hire sector than reduced bag limits, since trip cancellations are more likely to occur under a closed season than under a bag limit reduction.

Changing the commercial fishing year will start to have impacts on fishing participants if quotas are set at low levels. Alternatives 1 and 2 would allow longer closed fishing season than status quo, and such conditions may result in some market loss particularly if imports compensate for the stoppage in domestic production.

For the most part, deep-water grouper and tilefish fisheries are prosecuted by fishermen who also fish for shallow-water groupers. The Proposed Alternatives, which sets a quota on deep-water grouper and tilefish equal to the average landings for these species in recent years, may be expected to maintain vessel harvest and revenues from these sources.

Potentially affected by the measures proposed in this amendment are about 160 longline vessels, 800 vertical line vessels, and 60 fish trap vessels with home ports in Florida. Also

harvesting a minimal amount of grouper are about 60 vessels using powerheads. There are about 227 fish dealers possessing federal permits to buy and sell reef fish. Of these dealers, 146 are located in Florida. There are about 1,377 for-hire vessels with reef fish and 1,437 vessels with coastal migratory pelagic permits. Of this number, 926 vessels in the state of Florida have either an active Gulf of Mexico moratorium coastal migratory pelagic permit, reef fish permit, or both.

The fishing communities identified in the EA as dependent on grouper fishing are expected to be potentially affected by the measures considered in this amendment. Depending on the severity of measures adopted, these communities would experience challenging pressures on their economic and social infrastructures that support participation in fishing activities. Most of the impacts from the various measures in this amendment would be borne by entities located in Florida and thus on communities where these entities are located or conduct business. Permit owners for the longline vessels are clustered in Cortez, Madeira Beach, Miami, St. Petersburg and Tampa. Permit owners for vertical line vessels are clustered in Apalachicola, Carrabelle, Cedar Key, Clearwater, Crystal River, Destin, Fort Myers, Indian Rocks, Madeira Beach, Marathon, Panacea, Panama City, Pensacola, Nokomis, St. Petersburg, Steinhatchee, Tampa, Tarpon Springs, and Yankeetown. Permit owners for fish trap vessels are clustered in Destin, Homosassa, Naples, Steinhatchee, and Tarpon Springs. There is no clear clustering of permit owners for powerhead vessels. Each of the following locations have more than three permitted dealers: Destin, Fort Myers Beach, Key West, Madeira Beach, Marathon, Panama City, Pensacola, St. Petersburg, Tampa, and Tarpon Springs. Permit owner addresses for for-hire vessels are clustered in Apalachicola, Carrabelle, Clearwater, Destin, Marathon, Naples, Panama City Beach, Pensacola, and Sarasota/Nokomis/Englewood. Additional impacts from the alternatives proposed in this amendment will be borne by extended communities (i.e., support industries such as fish dealers, marinas, ship yards, maintenance facilities, gear supply firms). However, any negative impacts and the subsequent social disruption among fishery participants are not expected to be substantial or of long-term duration.

1.0 INTRODUCTION

In October 2000, NMFS issued a determination that the Gulf of Mexico red grouper stock is overfished and undergoing overfishing. This determination was based on the results of a 1999 red grouper stock assessment (Schirripa et al. 1999), which assessed the status of the stock as of 1997, and several subsequent analyses by the NMFS Southeast Fisheries Science Center (SEFSC) and the Council's Reef Fish Stock Assessment Panel (RFSAP). Under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), once a stock is declared to be overfished, the Council has one year to submit a plan to NMFS to end overfishing and rebuild the stock to a level capable of supporting maximum sustainable yield (MSY) on a continuing basis. If, within one year of being notified that a stock is overfished, the Council does not submit a rebuilding plan, then the Magnuson-Stevens Act requires that NMFS (on behalf of the Secretary of Commerce), within nine months, prepare a Secretarial plan or plan amendment and any accompanying regulations to end overfishing and rebuild the stocks.

The Council originally planned to include the red grouper rebuilding plan as part of draft Reef Fish Amendment 18. Even before red grouper were declared overfished, Amendment 18 was being assembled to review the overall management of grouper fisheries in the Gulf of Mexico. However, because of its broad scope and the need to prepare a comprehensive draft supplemental environmental impact statement (DSEIS), the development of draft Amendment 18 has proceeded slowly. Adding to the delays were the unforseen terrorist attacks of September 11, 2001, which occurred while the Council was meeting to review updated analyses for the red grouper rebuilding plan. In the wake of those attacks and the subsequent declaration of a national emergency and shutdown of the U.S. transportation system, the Council was forced to cancel its September 2001 meeting, delaying Amendment 18 even further. Finally, at the December 2001 meeting, the Council voted to separate the red grouper rebuilding plan from Amendment 18, and to develop it as a separate regulatory amendment in order to speed its completion and submission to NMFS.

In February 2002, the Council was advised by NMFS that, because the Council had missed its October 2001 deadline for submitting a red grouper rebuilding plan, the plan could no longer be submitted as a Council regulatory amendment, but it would instead be a Secretarial Amendment under the requirement that NMFS prepare a plan within nine months of the Council's deadline.

This document was submitted by NMFS on September 27, 2002, as Secretarial Amendment 1 and SEIS to the Reef Fish Fishery Management Plan. Subsequent to the submission of Secretarial Amendment 1, the RFSAP reviewed a new red grouper stock assessment prepared by the SEFSC. The 2002 assessment confirmed the previous conclusion that red grouper were overfished in 1997, but found that the stock was in an improved condition by 2001. The improved condition of the stock was due primarily to two factors: new fecundity-at-age information which found that young adult red grouper contribute more to the stock-egg production than previously thought, and a strong 1996 year-class that grew large enough to enter the fishery in about 1999. Although the stock status was improved and was no longer considered to be overfished, it had not reached the biomass level needed to produce MSY on a continuing basis (B_{MSY}). Therefore, measures to end overfishing and a rebuilding plan are still needed. However, because the current (2001) stock biomass is closer to B_{MSY} than the biomass in 1997, a less restrictive rebuilding plan is needed to attain B_{MSY} within 10 years or less.

The original version of this Secretarial Amendment proposed a rebuilding plan divided into three-year intervals. For the first three-year interval, the original plan called for a 45% reduction in harvest from the 1990-2000 average harvest, with harvest levels in subsequent years to be determined by future stock assessments. In this revised draft, a 9.4% reduction from the 1999-2001 average harvest is the first three-year target. Due to the influence of the

1996 year class, which began in 1999 and will continue for several more years, the 1999-2001 harvest was considered to be a more realistic baseline from which to measure management objectives than the period going back to 1990. It should be noted, that while percent reductions in harvest are discussed in this document, the true objective is to achieve a particular harvest level consistent with rebuilding to B_{MSY} within 10 years. The percent reductions from a baseline are used in order to provide a common basis for evaluating the relative impact of various management measures.

2.0 HISTORY OF GROUPER MANAGEMENT

The following discussion describes only the management actions that affect grouper harvest. For a complete history of management of the entire reef fish fishery, refer to the most recent Reef Fish FMP plan amendment.

2.1 Management Activities Other Than Regulatory Amendments

The Reef Fish Fishery Management Plan was implemented in November 1984. The regulations, designed to rebuild declining reef fish stocks, included prohibitions on the use of fish traps, roller trawls, and powerhead-equipped spear guns within an inshore stressed area and directed NMFS to develop data reporting requirements in the reef fish fishery. NMFS has collected commercial landings data since the early 1950s, recreational harvest data since 1979, and, in 1984, initiated a dockside interview program to collect more detailed data on commercial harvest.

In July 1985, the Florida Marine Fisheries Commission (FMFC) established a Florida state regulation to set a minimum size limit of 18 inches total length (TL) for red grouper, gag, yellowfin grouper, Nassau grouper, and jewfish (goliath grouper). In December 1986, the FMFC set a state recreational bag limit of five grouper per person per day, with an off-the-water possession limit of 10 per person, for any combination of groupers excluding rock hind and red hind.

Amendment 1 to the Reef Fish Fishery Management Plan, implemented in 1990, was a major revision of the original FMP. It set as a primary objective of the FMP the stabilization of long-term population levels of all reef fish species by establishing a survival rate of biomass into the stock of spawning age to achieve at least 20% spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing. The target date for achieving the 20% SSBR goal was set at January 1, 2000. Among the grouper management measures implemented were:

- Set a 20-inch total length minimum size limit on red, Nassau, yellowfin, black, and gag groupers;
- Set a 50-inch total length minimum size limit on jewfish (goliath grouper);
- Set a five-grouper recreational bag limit;
- Set an 11.0 MP commercial quota for groupers, with the commercial quota divided into a 9.2[1] MP shallow-water grouper quota and a 1.8 MP deep-water grouper quota. Shallow-water grouper were defined as black grouper, gag, red grouper, Nassau grouper, yellowfin grouper, yellowmouth grouper, rock hind, red hind, speckled hind, and scamp (until the shallow-water grouper quota is filled). Deep-water grouper were defined as misty grouper, snowy grouper, yellowedge grouper, warsaw grouper, and scamp once the shallow-water grouper quota is filled. Jewfish (goliath grouper) is not included in the quotas;
- Allow a two-day possession limit for charter vessels and headboats on trips that extend beyond 24 hours, provided the vessel has two licensed operators aboard as required by the U.S. Coast Guard, and each passenger can provide a receipt to verify the length of the trip. All other fishermen fishing under a bag limit are limited to a single day possession limit;

- Establish a framework procedure for specification of total allowable catch (TAC) to allow for annual management changes;
- Establish a longline and buoy gear boundary at approximately the 50-fathom depth contour west of Cape San Blas, Florida, and the 20-fathom depth contour east of Cape San Blas, inshore of which the directed harvest of reef fish with longlines and buoy gear was prohibited, and the retention of reef fish captured incidentally in other longline operations (e.g., sharks) was limited to the recreational bag limit. Subsequent changes to the longline/buoy boundary could be made through the framework procedure for specification of TAC;
- Limit trawl vessels (other than vessels operating in the unsorted groundfish fishery) to the recreational size and bag limits of reef fish;
- Establish fish trap permits, allowing up to a maximum of 100 fish traps per permit holder;
- Prohibit the use of entangling nets for directed harvest of reef fish. Retention of reef fish caught in entangling nets for other fisheries is limited to the recreational bag limit;
- Establish the fishing year to be January 1 through December 31;
- Extend the stressed area to the entire Gulf coast; and
- Establish a commercial reef fish vessel permit.

Amendment 2, implemented in 1990, prohibited the harvest of jewfish (goliath grouper) to provide complete protection for this species in federal waters in response to indications that the population abundance throughout its range was greatly depressed. This amendment was initially implemented by emergency rule.

On November 7, 1989, NMFS announced that anyone entering the commercial reef fish fishery in the Gulf of Mexico and South Atlantic after a control date of November 1, 1989, may not be assured of future access to the reef fish fishery if a management regime is developed and implemented that limits the number of participants in the fishery. The purpose of this announcement was to establish a public awareness of potential eligibility criteria for future access to the reef fish resource, and does not prevent any other date for eligibility or other method for controlling fishing effort from being proposed and implemented.

Amendment 3, 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 depending on changes in scientific advice, except that the rebuilding period cannot exceed 1.5 times the generation time of the species under consideration. It revised the FMP's primary objective, definitions of OY and overfishing and framework procedure for TAC by replacing the 20% SSBR target with 20% spawning potential ratio (SPR). The amendment also transferred speckled hind from the shallow-water grouper quota category to the deep-water grouper quota category.

Amendment 4, implemented in May 1992, established a moratorium on the issuance of new reef fish permits for a maximum period of three years. The moratorium was created to moderate short-term future increases in fishing effort and to attempt to stabilize fishing mortality while the Council considers a more comprehensive effort limitation program. It allows the transfer of permits between vessels owned by the permittee or between individuals when the permitted vessel is transferred. Amendment 4 also changed the time of the year that TAC is specified from April to August and included additional species in the reef fish management unit.

Amendment 5, implemented in February 1994, established restrictions on the use of fish traps in the Gulf of Mexico exclusive economic zone (EEZ), implemented a three-year moratorium on the use of fish traps by creating a fish trap endorsement and issuing the endorsement only to fishermen who had submitted logbook records of reef fish landings from fish traps between January 1, 1991, and November 19, 1992, created a special management zone (SMZ) with gear restrictions off the Alabama coast, created a framework procedure for establishing future

SMZ's, 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.

Amendment 6, implemented in June 1993, extended the provisions of an emergency rule for red snapper endorsements for the remainder of 1993 and 1994, and it allowed the red snapper trip limits for qualifying and non-qualifying permitted vessels to be changed under the framework procedure for specification of TAC.

Amendment 7, implemented in February 1994, established reef fish dealer permitting and record keeping requirements, allowed transfer of fish trap permits and endorsements between immediate family members during the fish trap permit moratorium, and allowed transfer of other reef fish permits or endorsements in the event of the death or disability of the person who was the qualifier for the permit or endorsement. A proposed provision of this amendment that would have required permitted vessels to sell harvested reef fish only to permitted dealers was disapproved by the Secretary and was not implemented.

Amendment 8 proposed establishment of a red snapper Individual Transferable Quota (ITQ) system. It was approved by NMFS and final rules were published in the Federal Register on November 29, 1995. However, concerns about Congressional funding of the ITQ system made it inadvisable for the ITQ system to become operational, pending Congressional action. In October 1996, Congress, through re-authorization of the Magnuson-Stevens Act, repealed the red snapper ITQ system and prohibited Councils from submitting, or NMFS from approving and implementing, any new individual fishing quota program before October 1, 2000.

Amendment 9, implemented in July 1994, provided for collection of red snapper landings and eligibility data from commercial fishermen for the years 1990 through 1992. The purpose of this data collection was to evaluate the initial impacts of the limited access measures being considered under Amendment 8 and to identify fishermen who may qualify for initial participation under a limited access system. This amendment also extended the reef fish permit moratorium and red snapper endorsement system through December 31, 1995, in order to continue the existing interim management regime until longer term measures can be implemented. The Council received the results of the data collection in November 1994, at which time consideration of Amendment 8 resumed.

Withdrawn **Amendment 10** would have extended the validity of additional fish trap endorsements for the duration of the fish trap moratorium that was implemented under Amendment 5. These additional endorsements were to have been issued under an emergency rule, requested in March 1994, to alleviate economic hardships after the Council heard from fishermen who entered the fish trap fishery after the November 19, 1992, cutoff date and stated that they were unaware of the impending moratorium. The Council rejected the proposed amendment in May 1994, after NMFS stated that it had notified fishermen of the pending moratorium and fish trap endorsement criteria during the time between Council final action and NMFS implementation, if they asked about fish trap rules or if they requested application materials and NMFS was aware that it was for purposes of entering the fish trap fishery. The Council also considered arguments that the change in qualifying criteria circumvented the intent of the fish trap moratorium to halt expansion of the fish trap fishery at the November 19, 1992, level. After the Council rejected Amendment 10, NMFS subsequently rejected the emergency request.

Amendment 11 was partially approved by NMFS and implemented in January 1996. The six approved provisions were: (1) limit sale of Gulf reef fish by permitted vessels to permitted reef fish dealers; (2) require that permitted reef fish dealers purchase reef fish caught in Gulf federal waters only from permitted vessels; (3) allow transfer of reef fish permits and fish trap endorsements in the event of death or disability; (4) implement a new reef fish permit

moratorium for no more than five years or until December 31, 2000, while the Council considers limited access for the reef fish fishery; (5) allow permit transfers to other persons with vessels by vessel owners (not operators) who qualified for their reef fish permit; and, (6) allow a one time transfer of existing fish trap endorsements to permitted reef fish vessels whose owners have landed reef fish from fish traps in federal waters, as reported on logbooks received by the Science and Research Director of NMFS from November 20, 1992, through February 6, 1994. NMFS disapproved a proposal to redefine OY from 20% SPR (the same level as overfishing) to an SPR corresponding to a fishing mortality rate of $F_{0.1}$ until an alternative operational definition that optimizes ecological, economic, and social benefits to the Nation could be developed. In April 1997, the Council resubmitted the OY definition with a new proposal to redefine OY as 30% SPR. The re-submission document was disapproved by NMFS.

Amendment 12, implemented in January 1997, reduced the greater amberjack bag limit from three fish to one fish per person, and created an aggregate bag limit of 20 reef fish for all reef fish species not having a bag limit.

Amendment 13, implemented in September 1996, further extended the red snapper endorsement system through the remainder of 1996 and, if necessary, through 1997, in order to give the Council time to develop a permanent limited access system that was in compliance with the new provisions of the Magnuson-Stevens Act.

Amendment 14, implemented in March and April 1997, provided for a 10-year phase-out for the fish trap fishery; allowed transfer of fish trap endorsements for the first two years and thereafter only upon death or disability of the endorsement holder, to another vessel owned by the same entity, or to any of the 56 individuals who were fishing traps after November 19, 1992, and were excluded by the moratorium; and prohibited the use of fish traps west of Cape San Blas, Florida. The amendment also provided the Regional Administrator (RA) 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. Additionally, the amendment prohibited the harvest or possession of Nassau grouper in the Gulf of Mexico EEZ, consistent with similar prohibitions in Florida state waters, the South Atlantic EEZ, and the Caribbean EEZ.

Amendment 15, implemented in January 1998, prohibited harvest of reef fish from traps other than permitted reef fish traps, stone crab traps, or spiny lobster traps;

Amendment 16A, submitted to NMFS in June 1998, was partially approved and implemented on January 10, 2000. The approved measures provided: (1) that the possession of reef fish exhibiting the condition of trap rash on board any vessel with a reef fish permit that is fishing spiny lobster or stone crab traps is prima facie evidence of illegal trap use and is prohibited except for vessels possessing a valid fish trap endorsement; (2) that NMFS establish a system design, implementation schedule, and protocol to require implementation of a vessel monitoring system (VMS) for vessels engaged in the fish trap fishery, with the cost of the vessel equipment, installation, and maintenance to be paid or arranged by the owners as appropriate; and (3) that fish trap vessels submit trip initiation and trip termination reports. Prior to implementing this additional reporting requirement, there will be a one-month fish trap inspection/compliance/education period, at a time determined by the NMFS Regional Administrator and published in the Federal Register. During this window of opportunity, fish trap fishermen will be required to have an appointment with NMFS enforcement for the purpose of having their trap gear, permits, and vessels available for inspection. The disapproved measure was a proposal to prohibit fish traps south of 25.05 degrees north latitude beginning February 7, 2001. The status quo 10-year phase-out of fish traps in areas in the Gulf of Mexico EEZ is therefore, maintained.

Amendment 16B was submitted to NMFS in January 1999, and was implemented by NMFS on November 24, 1999. This amendment set a recreational bag limit of one speckled hind and one warsaw grouper per vessel, with the prohibition on the sale of these species when caught under the bag limit.

Amendment 17 was submitted to NMFS in September 1999, and was implemented by NMFS on August 10, 2000. This amendment extended the commercial reef fish permit moratorium for another five years, from its previous expiration date of December 31, 2000, to December 31, 2005, unless replaced sooner by a comprehensive controlled access system. The purpose of the moratorium is to provide a stable environment in the fishery necessary for evaluation and development of a more comprehensive controlled access system for the entire commercial reef fish fishery.

Amendment 18 is currently under development and will address issues primarily involving grouper management.

Amendment 19, also known as the Generic Amendment Addressing the Establishment of the Tortugas Marine Reserves, was submitted to NMFS in March 2001, and was implemented on August 19, 2002. This amendment, affecting all FMPs for the Gulf fisheries (Amendment 19 to the Reef Fish FMP), establishes two marine reserve areas off the Tortugas area and prohibits fishing for any species and anchoring by fishing vessels inside the two marine reserves.

Amendment 20, also known as the Charter/Headboat Moratorium Amendment, affects the Reef Fish FMP (Amendment 20), the Coastal Pelagic FMP (Amendment 14) and was submitted to NMFS in October 2001. This amendment was implemented by NMFS on July 29, 2002, except for some provisions which became effective on December 26, 2002. This amendment establishes a three-year moratorium on the issuance of new charter and headboat vessel permits in the recreational for-hire fisheries in the Gulf of Mexico EEZ. The purpose of this moratorium is to limit future expansion in the recreational for-hire fishery while the Council monitors the impact of the moratorium and considers the need for a more comprehensive effort management system in the for-hire recreational fishery. Although the control date notice which announced that a limited access system would be considered was dated November 18, 1998, the Council set a qualifying cut-off date of March 29, 2001, in order to include all currently permitted vessels and vessels which have applied for a permit as of that date. The qualifying provisions also include persons who had a recreational for-hire vessel under construction prior to March 29, 2001, and who can show expenditures of at least five thousand dollars. In addition, persons who meet the eligibility requirements to qualify as a historical captain (USCG licensed and operating as a captain of a for-hire vessel prior to March 29, 2001, will qualify for a permit within 90 days of the final rule, and at least 25% of earned income was from recreational for-hire fishing in one of the last four years ending March 29, 2001) will be issued a letter of eligibility, which will be replaced by a permit/endorsement valid only on the vessel that is operated by the historical captain.

[1] 57 FR 5995, February 19, 1992. Annual commercial quotas were established under regulations implementing the FMP for the Reef Fish Resources of the Gulf of Mexico for (1) for deep-water groupers, combined, of 1.8 MP; and (2) for shallow-water groupers, combined, of 9.2 MP. Deep-water grouper are yellowedge, misty, warsaw, and snowy groupers, and speckled hind (deep-water grouper), and, after the quota for shallow-water grouper is reached, scamp. Shallow-water groupers are all other groupers, including scamp before the commercial quota for shallow-water grouper quota is reached, but excluding jewfish (goliath grouper). The grouper quotas are expressed in terms of whole weight, historically calculated by converting the GW of grouper to whole weight by multiplying the GW by 1.18. Recent studies of landings indicate that a conversion factor of 1.05 is more appropriate. Using the revised conversion factor, the annual commercial quota for deep-water groupers and shallow-water groupers are recalculated to be 1.6 and 8.2 MP respectively (1.8 ÷ 1.18 x 1.05 =

1.6; 9.2 ÷ 1.18 x 1.05 = 8.2). In accordance with the framework procedure of the FMP, the Council recommended and NMFS published a rule (57 FR 994, February 19, 1992) to increase the recalculated annual quota for shallow-water grouper by 1.6 MP to 9.8 MP.

Previous Environmental Decision Documents

An EIS was included as part of the original plan submitted for implementation in 1981. The EIS/FMP described the fishery including user groups, vessels and gear, habitats, economic characteristics, social and community structure, biological characteristics of the stocks, and effects of proposed and alternate management measures.

An SEIS was included as part of Amendment 5 submitted for implementation in 1993. This SEIS updated the descriptions of the affected environment, and evaluated the effects of proposed and alternate management measures regarding fish trap restrictions, special management zones (SMZs), condition of fish landing requirements, red snapper minimum size limit changes, and a seasonal closure on Riley's hump to protect mutton snapper spawning aggregations. This SEIS and amendment were integrated into a single document.

An SEIS will be included as part of Amendment 18, which is currently being developed. This SEIS will update the previous EIS and SEIS, and will evaluate the effects of several proposed and alternate management measures dealing with grouper management. Much of the descriptive environmental information in this Secretarial Amendment has been taken from the Amendment 18 draft SEIS.

In addition to the above, the Council has prepared the following documents which combined the plan amendment, environmental assessment (EA), regulatory impact review (RIR), and initial regulatory flexibility analysis (IRFA) into single integrated documents:

- Amendment 1/EA/RIR/IRFA (August 1989) - evaluated the effects of TACs (including quotas, bag and size limits) set for red snapper, groupers (shallow and deep water groups) and amberjack and of size and bag limits set for other species.

- Amendment 2/EA/RIR/IRFA (February 1990) - described the fishery for jewfish and evaluated the effects of a prohibition on harvest of jewfish.

- Amendment 3/EA/RIR/IRFA (February 1991) - evaluated the effects of changes to the stock restoration schedules and reclassifying a species as deep-water grouper.

- Amendment 4/EA/RIR/IRFA (October 1991) - evaluated the effects of technical changes to TAC framework procedure, reclassifying a species as deep-water grouper, and establishing a three-year moratorium on issuance of reef fish commercial vessel permits.

- Amendment 5/EA/RIR/IRFA (February 1994) - evaluated the effects of restrictions on the use of fish traps in the Gulf of Mexico EEZ.

- Amendment 6/EA/RIR/IRFA (January 1993) - evaluated extension of red snapper commercial vessel trip limits during 1993 and 1994, and a proposed closure of the commercial red snapper fishery in June through August or September.

- Amendment 7/EA/RIR/IRFA (August 1993) - evaluated the impacts of reef fish dealer permitting and record keeping requirements, and changes in the transferability provisions for fish trap permits and endorsements.

- Amendment 8/EA/RIR/IRFA (June 1995) - evaluated the impacts of implementing a red snapper individual transferable quota system (ITQ).

- Amendment 9/EA/RIR/IRFA (March 1994) - evaluated the impacts of establishing a system to collect the historical red snapper landings data needed to determine initial ITQ allocations under Amendment 8, and of extending the reef fish permit moratorium and red snapper endorsement system until January 1996.

- Amendment 10/EA/RIR/IRFA - This document, which would have proposed, and analyzed the impacts, of changing the qualification criteria for a fish trap endorsement, was not submitted or implemented.

- Amendment 11/EA/RIR/IRFA (June 1995) - evaluated the impacts of making editorial revisions to the TAC framework procedure, plus substantial revisions allowing in-season adjustments through the TAC framework procedure, specifying that a TAC within or below the ABC range need be set only for overfished stocks, specify that the Council rather than the RFSAP is responsible for setting the recovery period, and respecify the generation time multiplier for determining the red snapper recovery period. The amendment also evaluated the impacts of reef fish dealer and vessel permit sales provisions, transferability of permits and endorsements, creating a new reef fish permit moratorium until December 31, 2000, require charter and headboat permits, and a requirement that permitted reef fish vessels abide by federal regulations regardless of where the fish are caught.

- Amendment 12/EA/RIR/IRFA (December 1995) - evaluated the impacts of setting size and bag limits for amberjack species, adjusting the red snapper minimum size limit, and setting an aggregate limit for reef fish species that do not have an individual bag limit.

- Amendment 13/EA/RIR/IRFA (March 1996) - evaluated the impact of extending the red snapper endorsement system until December 31, 1997, or until replaced by an ITQ system or permanent license limitation system.

- Amendment 14/EA/RIR/IRFA (August 1996) - evaluated the effects of establishing a 10-year fish trap phase out, prohibiting the use of fish traps west of 85°30' west longitude (Cape San Blas, Florida), authorizing the Regional Administrator to reopen a prematurely closed recreational red snapper season, changing the transferability provisions of reef fish commercial permits, and prohibiting Nassau grouper harvest.

- Amendment 15/EA/RIR/IRFA (June 1997) - evaluated the impacts of establishing a red snapper license limitation system, with two classes of red snapper licences, and appeals board, opening red snapper commercial season from noon on the first to noon on the 15th of each month until the quota is filled, separating the commercial quota into two sub-seasons, beginning February 1 with two thirds of the quota, and September 1 with the remaining quota, a requirement that vessels tending traps other than reef fish traps may not exceed the reef fish bag limits, an increase in the minimum size limit of vermilion snapper, a closure of the commercial greater amberjack fishery during March, April, and May, adjustments to the 20-reef fish aggregate bag limit, and removal of sea basses, porgies and grunts from management under the FMP.

- Amendment 16A/EA/RIR/IRFA (June 1998) - evaluated the impacts of shortening the fish trap phase-out, prohibiting the possession of reef fish exhibiting trap rash aboard spiny lobster and stone crab vessels that do not have a fish trap endorsement, requesting that NMFS establish a design, implementation schedule and protocol for vessel monitoring systems (VMS), and establishing additional fish trap vessel reporting requirements.

- Amendment 16B/EA/RIR/IRFA (January 1999) - evaluated the impacts of setting a slot limit and bag limit for lesser amberjack and banded rudderfish, removing queen triggerfish from the FMP, removing the distinction between fish in the management unit and fish in the fishery but not the management unit, establishing minimum size limits for cubera

snapper, dog snapper, mahogany snapper, schoolmaster, mutton snapper, scamp, gray triggerfish, and hogfish, and setting bag limits for hogfish, speckled hind, and warsaw grouper.

- Amendment 17/EA/RIR/IRFA (September 1999) - evaluated the impacts of extending the reef fish permit moratorium another five years, until December 31, 2005, unless replaced sooner by a comprehensive controlled access system.

- Amendment 19/EA/RIR/IRFA (June 2001) - evaluated the impacts of establishing two marine reserves near the Dry Tortugas, Florida.

- Amendment 20/EA/RIR/IRFA (June 2001) - evaluated the impacts of creating a charter vessel and headboat permit moratorium.

In addition, an EA/RIR/IRFA was prepared for about 21 regulatory amendments submitted from 1990 to 2001, which evaluated the impacts of implementing management measures under the framework procedure to set TAC.

The above environmental decision-making documents are incorporated into this EA by reference.

2.2 Regulatory Amendments

A July 1991 regulatory amendment, implemented November 12, 1991, provided a one-time increase in the 1991 quota for shallow-water groupers from 9.2 MP to 9.9 MP. This action was taken to provide the commercial fishery an opportunity to harvest 0.7 MP that went unharvested in 1990 due to an early closure of the fishery in 1990. NMFS had projected the 9.2 MP quota to be reached on November 7, 1990, but subsequent data showed that the actual harvest was 8.5 MP.

A November 1991 regulatory amendment, implemented June 22, 1992, raised the 1992 commercial quota for shallow-water groupers to 9.8 MP (using the corrected gutted-to-whole weight conversion factor of 1.05, see footnote 1), after a red grouper stock assessment indicated that the red grouper SPR was substantially above the Council's minimum target of 20%, and the Council concluded that the increased quota would not materially impinge on the long-term viability of at least the red grouper stock.

A September 1993 regulatory amendment was prepared that would have moved the longline and buoy gear restricted area boundary off central and south-central Florida inshore from the 20-fathom depth contour to the 15-fathom depth contour for a one-year period beginning January 1, 1994. However, longline industry representatives requested that the amendment not be submitted due to concerns that it would lead to a quota closure. In addition, the NMFS SEFSC expressed concern that there were inadequate experimental controls to properly evaluate the impact of the action. Consequently, this amendment was not submitted.

An October 1993 regulatory amendment, implemented January 1, 1994, set the opening date of the 1994 commercial red snapper fishery as February 10, 1994, and restricted commercial vessels to landing no more than one trip limit per day. The shallow-water grouper regulations were also evaluated but no change was made. The shallow-water grouper TAC, which previously had only been specified as a commercial quota, was specified as a total harvest of 15.1 MP (with 9.8 MP allocated to the commercial quota) and 20-inch TL size limit for gag, red, Nassau, yellowfin and black grouper.

A rejected December 1994 regulatory amendment would have reduced the minimum size limit for red grouper from 20 inches TL to 18 inches TL in response to complaints from the

commercial sector that regulations were too restrictive to allow them to harvest their quota of shallow-water grouper. NMFS rejected the proposed action because of concern that it would result in the recreational sector exceeding its allocation. In March 1995, a revised regulatory amendment was submitted to NMFS that would reduce the red grouper size limit to 18 inches TL for only the commercial sector. That regulatory amendment was rejected by NMFS because newly discovered biases in the growth rate data collected in recent years resulted in uncertainty about the current status of the red grouper stock. Further analysis by NMFS biologists and the RFSAP reduced that uncertainty to the point where the status of red grouper stocks was determined to be most likely at or above 27% SPR, well above the overfishing threshold. In September 1995, a second revised regulatory amendment was submitted to NMFS to reduce the commercial red grouper size limit to 18 inches TL. This second revision was rejected by NMFS because they felt it would create user conflicts, produce long term economic losses to commercial fishermen, allow the harvest of juvenile fish, and potentially lead to the commercial quota being filled early and create a derby fishery.

An August 1999 regulatory amendment, implemented June 19, 2000, increased the commercial size limit for gag from 20 to 24 inches TL, increased the recreational size limit for gag from 20 to 22 inches TL, prohibited commercial sale of gag, black, and red grouper each year from February 15 to March 15 (during the peak of gag spawning season), and established two marine reserves on areas suitable for gag and other reef fish spawning aggregations sites that are closed year-round to fishing for all species under the Council's jurisdiction. The two sites cover 219 square nautical miles near the 40-fathom depth contour, off west central Florida. An additional proposal to continue increasing the recreational minimum size limit for gag and black grouper by one inch per year until it reached 24 inches TL was rejected by NMFS because it was felt that it would have a disproportionate impact on the recreational fishery vs. the commercial fishery.

2.3 Control Date Notices

Control date notices are used to inform fishermen that a license limitation system or other method of limiting access to a particular fishery or fishing method is under consideration. If a program to limit access is established, anyone not participating in the fishery or using the fishing method by the published control date may be ineligible for initial access to participate in the fishery or to use that fishing method. However, a person who does not receive an initial eligibility may be able to enter the fishery or fishing method after the limited access system is established by transfer of the eligibility from a current participant, provided the limited access system allows such transfer. Publication of a control date does not obligate the Council to use that date as an initial eligibility criteria. A different date could be used, and additional qualification criteria could be established. The announcement of a control date is primarily intended to discourage entry into the fishery or use of the gear based on economic speculation during the Council's deliberation on the issues. The following summarizes control dates that have been established for the Reef Fish FMP. A reference to the full Federal Register notice is included with each summary.

November 1, 1989 - Anyone entering the commercial reef fish fishery in the Gulf of Mexico and South Atlantic after November 1, 1989, may not be assured of future access to the reef fish resource if a management regime is developed and implemented that limits the number of participants in the fishery. [54 FR 46755]

November 18, 1998 - The Council is considering whether there is a need to impose additional management measures limiting entry into the recreational-for-hire (i.e., charter vessel and headboat) fisheries for reef fish and coastal migratory pelagic fish in the EEZ of the Gulf of Mexico and, if there is a need, what management measures should be imposed. Possible

measures include the establishment of a limited entry program to control participation or effort in the recreational-for-hire for reef fish and coastal migratory pelagics. [63 FR 64031] (In the Charter/Headboat Moratorium Amendment, approved by the Council for submission to NMFS in March 2001, a qualifying date of March 29, 2001, was adopted.)

July 12, 2000 - The Council is considering whether there is a need to limit participation by gear type in the commercial reef fish fisheries in the exclusive economic zone (EEZ) of the Gulf of Mexico and, if there is a need, what management measures should be imposed to accomplish this. Possible measures include modifications to the existing limited entry program to control fishery participation, or effort, based on gear type, such as a requirement for a gear endorsement on the commercial reef fish vessel permit for the appropriate gear. Gear types which may be included are longlines, buoy gear, handlines, rod-and-reel, bandit gear, spear fishing gear, and powerheads used with spears. [65 FR 42978]

3.0 PURPOSE AND NEED FOR ACTION

Purpose

The primary purpose of this Secretarial Amendment is to define biological reference points and stock status determination criteria established by the Sustainable Fisheries Act (SFA), and establish a rebuilding plan for the Gulf of Mexico stock of red grouper. The stock was declared overfished and to be undergoing overfishing by NMFS in October 2000, based on the results of a 1999 stock assessment. Subsequently, a 2002 assessment found that the stock was in an improved condition and was no longer overfished, but it was not yet at the biomass level capable of producing MSY (B_{MSY}). Therefore, measures to reduce overfishing and a rebuilding plan are still needed to restore the stock to the B_{MSY} level in 10 years or less. The progress and success of the rebuilding plan will be measured through periodic NMFS stock assessments.

A secondary purpose of this amendment is to evaluate and control the impact of the red grouper rebuilding plan on other species. Gag and red grouper are the major species in the shallow-water grouper complex, and measures to reduce red grouper harvest will likely affect gag harvest as well. Based on a 2001 gag stock assessment, gag are not overfished, nor are they undergoing overfishing. However, the gag fishing mortality rate still needs to be reduced in order to reach the OY level. Gag are only slightly under the overfishing threshold, and any effort shifting from red grouper to gag could result in overfishing of the gag stock.

Deep-water grouper and tilefish are likely alternate target species for fishing effort displaced from the shallow-water grouper fishery by fishing restrictions. Pro-active conservation measures to limit deep-water grouper and tilefish harvest to recent harvest levels will help to protect those stocks while more information is collected to determine appropriate harvest levels.

Need

The Gulf of Mexico red grouper stock was declared to be overfished and undergoing overfishing by NMFS in October 2000, based on a 1999 stock assessment. Although a subsequent 2002 stock assessment found the stock to be in an improved condition, and was no longer considered to be overfished, it was not yet at the biomass level capable of producing MSY (B_{MSY}) on a continuing basis. Once a stock is determined to be overfished, the Magnuson-Stevens Act requires that the Council, within one year, submit a plan to NMFS to end overfishing and rebuild the stock. The stock should be rebuilt in as short a time as possible, but not to exceed 10 years, except in cases where the biology of the stock of fish,

other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise. In such cases, the NMFS technical guidelines establish the maximum rebuilding period as the time it would take to rebuild to a level capable of sustaining MSY on a continuing basis in the absence of fishing mortality, plus one mean generation time. In the case of the Gulf of Mexico red grouper stock, the stock can be rebuilt within 10 years, and is therefore, subject to the 10-year maximum rebuilding period.

The Proposed Alternatives to reduce the red grouper and shallow-water grouper quotas may result in commercial closed seasons or in certain vessels harvesting less than their accustomed levels of shallow-water grouper due to increased fishing restrictions. This could result in effort shifting to target deep-water grouper or tilefishes. There has never been a deep-water grouper commercial quota closure, and there is uncertainty as to whether it was set at an appropriate level in Amendment 1. A 2002 stock assessment for yellowedge grouper, which is the dominant species in the deep-water grouper fishery, was inconclusive as to the status of the stock. However, that assessment revealed that yellowedge grouper are much longer-lived than previously thought, up to 85 years rather than 35 years. Because long-lived fish are often more susceptible to fishing pressure, the RFSAP recommended that yellowedge grouper harvest not exceed the average harvest of 1986-2001 (840,000 pounds). Reducing the deep-water grouper quota from its current level will assure that yellowedge grouper do not exceed this recommended harvest level.

Tilefishes currently have no quota in the Gulf of Mexico. These stocks appear to be able to sustain recent harvest levels but it is not known whether or how much of an increase can be sustained. Adjustments to the commercial quota for deep-water groupers and tilefishes are needed to provide pro-active protection of these stocks until stock assessments can be produced to provide biological guidance.

Under the Magnuson-Stevens Act, if the Council fails to submit a plan or plan amendment to NMFS within one year of the overfished/overfishing determination, then NMFS has nine months to prepare a Secretarial plan to end overfishing and rebuild the stock. The Council began working on a rebuilding plan in January 2001, to be included as part of draft Reef Fish Amendment 18. However, due to a number of delays, including delays caused by the September 11, 2001, terrorist attacks, the Council failed to meet its deadline for submitting a Council plan amendment or regulatory amendment. Consequently, this action is being taken as a Secretarial Amendment instead of a Council amendment. This does not change the requirement that a plan be prepared to rebuild the stock within 10 years.

4.0 LIST OF PROPOSED ACTIONS AND BRIEF EXPLANATION

The Proposed Alternatives are listed in this section, along with a brief explanation of why the Proposed Alternative was selected. More comprehensive discussions of both Proposed and Rejected Alternatives, including comparative discussions, are in Section 6. The Alternatives are as follows:

6.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

6.2.1 MSY, F_{MSY} and B_{MSY}

Proposed Alternative: Alternative 2. Red grouper maximum sustainable yield (MSY), fishing mortality rate at MSY (F_{MSY}), and spawning stock biomass proxy at MSY (SS_{MSY}) shall be the most recent values estimated by the RFSAP (currently September 2002) when a spawner-recruit curve steepness value of 0.7 is used in the assessment model, based in the most recent red grouper stock assessment (i.e. from the 2002 assessment).

MSY	7.560 MP
F_{MSY}	0.306
SS_{MSY}	840 metric tons mature female gonad weight

Brief Explanation: These are the values calculated by the NMFS SEFSC and the RFSAP (2002) for a spawner-recruit steepness value of 0.7. Although estimates for steepnesss of both 0.7 and 0.8 were calculated, the RFSAP felt that results from the steepness of 0.7 were more likely to reflect the true values, based on individual Panel members research on other groupers and other species with similar life histories.

6.2.2 Minimum Stock Size Threshold

Proposed Alternative: Alternative 1. Red grouper minimum stock size threshold (MSST) shall be 80% (1-M where M=0.2) of SS_{MSY} (This is currently estimated by proxy to be 672 metric tons of mature female gonad weight, based on the results of the 2002 stock assessment).

Brief Explanation: This alternative follows the recommendation of the NMFS Technical Guidance document (Restrepo et al. 1998).

6.2.3 Maximum Fishing Mortality Rate

Proposed Alternative: Alternative 1. Red grouper maximum fishing mortality threshold (MFMT) shall be F_{MSY} (currently estimated at 0.306, based on the results of the 2002 stock assessment), or the F consistent with recovery to the MSY level in no more than 10 years.

Brief Explanation: This alternative allows the maximum harvest consistent with achieving MSY, and specifies it as a parameter rather than a specific value. This allows the value to be updated with future assessments if new information or improved estimation methods so warrant.

6.2.4 Optimum Yield

Proposed Alternative: From 2004-recovery, red grouper optimum yield (OY) is the yield defined by the fishing mortality rate consistent with the rebuilding strategy to B_{MSY} within

the adopted rebuilding period. After achieving the rebuilding target, OY shall be the yield corresponding to a fishing mortality rate equal to 75% of F_{MSY}: produces 98% of MSY or higher and 120% of SS_{MSY} (SEFSC, 2003); (F_{OY} = 0.229, OY = 7.385 MP GW based on the results of the 2002 stock assessment at a spawner-recruit steepness of 0.7).

Brief Explanation: This alternative follows the recommendation of NMFS SEFSC (2003), and therefore, is based on the best available scientific information. Stocks managed at this OY level are expected to have no more than a 20%-30% probability of exceeding MFMT when MFMT is defined as in the Proposed Alternative in Section 6.2.3.

6.3 Rebuilding Overfished Stock

6.3.1 Rebuilding Strategy

Proposed Alternative: Alternative 3. Adopt a 10-year red grouper rebuilding plan to B_{MSY} with a spawner-recruit steepness parameter of 0.7 based on a three-year interval rebuilding strategy. The annual ABC during the first three-year interval will be the average of the first three years under a constant F strategy, i.e., 6.56 MP GW. The ABC for subsequent intervals will be set following a future stock assessment by a regulatory amendment or plan amendment.

Brief Explanation: This alternative allows harvest to increase in a stepwise fashion as the stock recovers. Setting three-year intervals when harvest will be kept constant allows short-term stability in the management and matches the frequency of adjustments to the probable frequency of new stock assessments. Extending the recovery period to the full 10 years allowed under the Magnuson-Stevens Act allows the highest harvest during rebuilding and minimizes social and economic disruptions.

6.3.2 Rebuilding Scenarios

Commercial Scenario

Proposed Alternative: Alternative 3. Adjust the shallow-water grouper quota by an amount equal to an adjustment in the red grouper commercial allocation of TAC (9.4% red grouper reduction from the 1999-2001 average); Sub-option a: 8.80 MP GW.

Brief Explanation: The proposed shallow-water grouper quota represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest. This quota is expressed in GW rather than whole weight to reflect the condition in which commercially harvested grouper are landed, and to avoid any inaccuracies that could be introduced from applying a gutted to whole weight conversion factor.

Recreational Scenario

Proposed Alternative: Alternative 1. Reduce the allowable bag limit for red grouper to two fish of the five fish aggregate. It is the Council's intent that the double bag limit allowance apply on qualified for-hire vessels that are out over 24 hours, i.e., a 10 grouper per person bag limit of which no more than four can be red grouper.

Brief Explanation: The proposed bag limit change is expected to achieve a reduction in recreational red grouper harvest of 9%. This is very close to the 9.4% reduction needed for

the first three-year interval of the rebuilding plan. This bag limit will bring the total recreational harvest reduction within the range sought, while still allowing recreational red grouper fishermen to have multi-fish harvest trips.

6.4 Shallow-Water Grouper Quota

6.4.1 Shallow-Water Grouper Quota Adjustments

See Section 6.3.2 - Commercial Rebuilding Scenario

6.4.2 Shallow-Water Grouper Quota Actions

Proposed Alternative: Alternative 5. The commercial shallow-water grouper fishery will close when: 1) the commercial quota of red grouper (5.31 MP) is reached, or 2) the commercial shallow-water grouper aggregate (8.80 MP) quota is reached, whichever occurs first.

Brief Explanation: The red grouper stock is undergoing overfishing and management measures are needed to end overfishing and rebuild the red grouper stock. Thus, the rebuilding plan seeks to achieve approximately a 9.4% reduction in total red grouper harvest by reducing the red grouper harvest from the 1999-2001 average commercial catch (5.86 MP) to 5.31 MP, and specifies this as an quota for the commercial sector. Closure of the fisheries when either the red grouper quota or the shallow water grouper aggregate quota is reached may result in one or the other not being filled. Additionally, these actions will reduce the fishing mortality rate on red grouper and perhaps other shallow-water grouper species such as gag, allow the red grouper stock to rebuild, and reduce bycatch mortalities on the shallow-water grouper and red grouper stocks when the fisheries are closed simultaneously.

6.6 Deep-Water Grouper and Tilefish Quotas

Tilefish:

Proposed Alternative: Alternative 1(b). Establish a quota for tilefish (all tilefish species in aggregate), which can be subsequently adjusted through the framework procedure for setting total allowable catch. The initial quota will be set at 0.44 MP GW (average annual harvest 1996-2000).

Deep-water Grouper:

Proposed Alternative: Alternative 2(b). Reduce the quota for deep-water grouper from 1.35 MP GW to 1.02 MP GW (average annual harvest 1996-2000).

Brief Explanation: A pro-active quota adjustment on deep-water reef fishes was deemed necessary by the Council because some of the proposed measures in this document, i.e., a reduction in the red grouper quota and shallow-water grouper quota that could potentially result in quota closures, could result in effort shifting to the deep-water species. In addition, the RFSAP, after reviewing a yellowedge grouper stock assessment, recommended that yellowedge grouper harvest not exceed the 1986-2001 average annual landings of 840 thousand pounds GW. These alternatives cap tilefish and deep-water grouper harvests at their recent average annual catches. Separate tilefish and deep-water

grouper quotas are proposed rather than a combined deep-water reef fish quota in order to provide more control over the harvest of each species group, and based on the advice of the Standing and Special Reef Fish SSC that it is ill-advised to use an aggregate quota for deep-water grouper and tilefish combined.

5.0 STATUS OF RED GROUPER STOCK

The current assessment of the status of the red grouper stock is based on the NMFS 2002 red grouper stock assessment (NMFS 2002), which updates information from the previous assessment (Schirripa et al. 1999), and subsequent analyses conducted between 1999 and 2001. Appendix C contains a summary of the 1999 assessment and supplemental analyses. Assessments were also conducted by NMFS on red grouper in 1993 and 1991.

The following is a condensed version of the red grouper stock assessment summary provided by the RFSAP (currently September 2002). The NMFS assessment scientists noted that the present 2002 assessment was produced based on recommendations from the December 2000 report of the RFSAP.

This is the fourth stock assessment completed for red grouper. The first stock assessment was completed by Goodyear and Schirripa (1991), which was followed by Goodyear and Schirripa (1993). A more extensive (with data from 1950 and later rather than 1986 and later) stock assessment for red grouper was completed by Schirripa et al. (Assessment 3.0; 1999).

Natural Mortality

The natural mortality rate (M) of red grouper has never been estimated directly. It is assumed here to be 0.2 per year, as was done in the previous assessment.

Estimation of Yield, Harvest and Catch

Catch is generally used to refer to the number of fish caught and often includes live releases. Harvest is used to refer to the number of fish killed in the fishing process and may include fish landed, discarded dead at sea and fish used for bait; this is particularly used for the A+B1 estimates from the Marine Recreational Fisheries Statistics Survey (MRFSS) (A=observed kill, B1=unobserved kill). Yield is used to refer to landings in pounds for the commercial fishery and the headboat fishery; it is also used to refer to weight of the harvest (MRFSS). The red grouper commercial landings and recreational harvest in terms of GW are summarized in Table 6.3. Note that while the commercial landings do not directly include dead discards, the estimates of discard mortality were incorporated into the assessment.

Commercial yields were tabulated from the Accumulated Landings System (ALS) database maintained at the SEFSC. Yield for each of two commercial gear categories was used in the assessment to create derived age composition. The two commercial gear categories were (1) longline and (2) handline combined with other gears.

Recreational catches (harvests and releases) were tabulated from the MRFSS, the SEFSC Headboat Survey and the Texas Parks and Wildlife (TPWD) data sets. MRFSS data were available through 2001, headboat catch estimates were available through 1999, and TPWD estimates were available through 2000. For the headboat survey the average catch and yield from 1995-1999 was used to estimate the 2000 and 2001 values. Red grouper were not recorded in the TPWD data set during 1986-2000, though small numbers were recorded as landed in the headboat survey. Discard mortality rates were determined as was done by Schirripa et al. (1999).

Indices of Abundance

Several indices of abundance were developed based on observations of catch-per-unit-effort (CPUE) and limited fishery-independent surveys. Data available from the Reef Fish Logbook Program were used to develop standardized CPUE series for commercial fish traps, handlines and bottom longlines from August 1990 to December 2001. Catch was defined as total pounds landed in whole weight. Effort was defined as hook multiplied by hours for handline and days-at-sea for bottom longline and trap gears. The catches of recreational vessels fishing in the Gulf of Mexico and Atlantic Ocean are monitored by the MRFSS, which collects from fisherman interviews, among other things, the number of each species that were landed and observed by a sampler (type A), the number of fish killed but not seen by an sampler (B1, including dead discards), the number released alive (B2), and the number of hours spent fishing. Thus, it is possible to construct CPUE indices of abundance by dividing the total catch (A+B1+B2) by the number of angler-hours (number of anglers in the party times the number of hours fished). One may also compute harvest-per-unit-effort (HPUE), using the type A and B1 catches, but this measure is directly affected by size and bag limit regulations. Fishery-independent trap and video surveys were conducted as part of the Southeast Area Monitoring Program (SEAMAP) during the months of June, July, and August from 1992-1997 (data courtesy of C. T. Gledhill, NMFS, Pascagoula Laboratory). An abbreviated video survey was conducted in 2001, and a complete survey in 2002; however, the data are still being quality assured. The trap survey was not continued in 2001 or 2002 and therefore, was not updated. Accordingly, no updates were possible and the indices from the 1999 assessment were retained.

Age and Growth Determination and Age Composition of the Catch

For this assessment, new data found in Lombardi-Carlson et al. (2002) on catch-at-age and growth rate, based upon their 1992-2001 red grouper ageing analyses, were available. The RFSAP felt this to be an improvement over the age-slicing technique used in the previous assessment by Schirripa et al. (1999), and the new data on catch-at-age were incorporated into assessments runs from which management advice was proffered.

New Fecundity Data and Assessment Model Selection

Collins et al. (2002) analyzed over 2,000 red grouper gonads sampled from the eastern Gulf of Mexico during 1992 and 2001, and also provided age-specific data on sex ratio and an estimate of the proportion of the female population that is actively spawning. The previous assessment (Schirripa et al. 1999), did not have access to the new data on fecundity reported by Collins et al. (2002) and therefore, used the product of gonad weight and the proportion of each age class that was female, a proxy for per capita fecundity. Gonad weight was expressed as a power function of total length (GWTvsTL), which was converted to a function of age (GWTvsAGE) via the old growth equation.

In the assessment model runs, the release mortality for the longline fleet was assumed to be 33% and steepness was assumed to be either 0.7 or 0.8 (the RFSAP continues to believe that while there is uncertainty in the steepness values, a value of 0.7 is more realistic than 0.8). The assessment is most sensitive to the differences in the modeled fecundity of younger fish. The fecundity curves based upon the new fecundity data ascribe relatively greater productivity to ages 3-5 than the original GWTvsTL curve derived by Schirripa et al. (1999).

Stock Status and Current F

A summary of the assessment model results is presented in Table 5.1. Depending upon whether spawner-recruit curve steepness values of 0.7 or 0.8 are used in the new assessment model runs described above, which incorporate all of the new biological data on red grouper, the outcomes indicate that red grouper is no longer overfished, but in the case of steepness equals 0.7, the population is experiencing overfishing. It should be noted, however, that while the population currently appears to be recovering, biomass levels in 1999 indicate that when the stock first was determined to be overfished, indeed it was based upon levels determined in this 2002 assessment, thus warranting the development of a rebuilding schedule. The RFSAP was cautiously optimistic about the apparent rapid recovery from the overfished condition, but was concerned that recent increases in landings may be attributable to a single strong year-class moving through the fishery, albeit that it has no direct evidence that this is the case. Current estimates of F range from 0.315 (steepness = 0.7) to 0.316 (steepness = 0.8), and F_{1997}/F_{msy} range from 1.031 to 0.869 and F_{1997}/F_{oy} range from 1.374 to 1.159, respectively, with the different values of steepness, thus necessitating the need for only modest harvest reductions if the actual steepness value is assumed to be closer to 0.7.

Red Grouper ABC Rationale and Recommendations

Based upon the rationale given above, the RFSAP recommended that the ABC range for red grouper under a constant catch yield stream be 7.03 to 7.12 MP per year. This level of harvest should lead to recovery of the red grouper population to levels approaching B_{msy} by 2012.

However, the RFSAP strongly recommended that the Council adopt a constant F fishing strategy for red grouper at this time, indicating an ABC range of 6.17 to 7.36 MP in 2003 (Table 6.1). Additionally, the yield stream under constant F indicates an ABC range of 6.59 to 7.63 MP in 2004. It should be noted, however, that the high end of the ABC range in all cases is based upon assessment model runs that assume a steepness value of 0.8. While a steepness value of 0.8 is not out of the question, it is on the high end of the range for species with life history characteristics similar to those of red grouper (Rose et al. 2001), and higher than the best fit to the limited spawner-recruit data (steepness = 0.68) currently available for this species (Schirripa et al. 1999). Moreover, because red grouper life history is made additionally complex by hermaphrodism, that has unknown consequences with respect to spawner-recruit relationships, caution is recommended when biological benchmarks are hovering around threshold levels. Furthermore, while B_{msy} is a threshold biomass level, B_{oy} is the ultimate biomass target and constant F_{oy} catch levels necessary to achieve B_{oy} within the rebuilding schedule are lower when steepness = 0.8 (5.67 MP in 2003 and 6.14 MP in 2004). As such, if NMFS wishes to take a conservative approach and begin to manage red grouper towards B_{oy}, a constant F yield of 5.67 to 6.17 MP in 2003, and 6.14 to 6.59 MP in 2004 is recommended.

Additionally, it should be noted that the increasing stock size seen in recent years appears to be due in large part to increased recruitment entering the fishery. Recruitment is variable, and variation in recruitment is difficult to predict. This creates the real possibility that setting a TAC at any given level may be acceptable one year under current standards, and unacceptable in another. The result is a stock that varies between being fished within acceptable limits one year, and being overfished in another. This is one of the benefits of moving to a strategy based on OY rather than MSY. Annual fluctuations in recruitment would be much less likely to result in an overfishing situation under an OY management strategy.

6.0 MANAGEMENT ALTERNATIVES

6.1 Introduction

The following sections contain the management alternatives to establish the biological reference points and stock status determination criteria for red grouper, determine a rebuilding strategy, and adopt specific management measures to implement that strategy. In order to allow the stock to rebuild, the rate of harvest will need to be reduced to a level below that needed to merely sustain the stock at its present status. The short-term socioeconomic impacts are likely to be negative and directly related to the level of TAC established relative to present total catch. Long-term impacts will invariably be positive in that a more stable fishery will result from improved population abundance and stability.

6.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

6.2.1 MSY, F_{MSY} and B_{MSY}

The specific values in the alternatives in this section are based on the 2002 red grouper stock assessment.

In the red grouper stock assessment, spawning stock biomass (SS) was used in the stock assessment as a proxy for stock biomass (B). Thus, SS_{MSY} is a proxy for B_{MSY}. The two terms are used interchangeably in this document.

<u>Alternative 1</u>: Red grouper maximum sustainable yield (MSY), fishing mortality rate at MSY (F_{MSY}), and spawning stock biomass proxy at MSY (SS_{MSY}) shall be the most recent range of values estimated by the RFSAP (currently September 2002), based on the most recent red grouper stock assessment (i.e. from the 2002 assessment).

MSY 7.264 - 7.560 MP
F_{MSY} 0.306 - 0.364
SS_{MSY} 715 - 840 metric tons mature female gonad weight

Proposed=> **<u>Alternative 2</u>: Red grouper maximum sustainable yield (MSY), fishing mortality rate at MSY (F_{MSY}), and spawning stock biomass proxy at MSY (SS_{MSY}) shall be the most recent values estimated by the RFSAP (currently September 2002) when a spawner-recruit steepness value of 0.7 is used in the assessment model, based on the most recent red grouper stock assessment.**

MSY 7.560 MP
F_{MSY} 0.306
SS_{MSY} 840 metric tons mature female gonad weight

<u>Alternative 3</u>: Red grouper maximum sustainable yield (MSY), fishing mortality rate at MSY (F_{MSY}), and spawning stock biomass proxy at MSY (SS_{MSY}) shall be the most recent values estimated by the RFSAP (currently September 2002) when a spawner-recruit steepness value of 0.8 is used in the assessment model, based on the most recent red grouper stock assessment.

MSY 7.264 MP
F_{MSY} 0.364
SS_{MSY} 715 metric tons mature female gonad weight

<u>Alternative 4</u>: No action. Do not define parameters for red grouper maximum sustainable yield (MSY), fishing mortality rate at MSY (F_{MSY}), or spawning stock biomass proxy at MSY (SS_{MSY}).

<u>Discussion</u>: The maximum sustainable yield (MSY), fishing mortality rate associated with MSY (F_{MSY}), and a proxy for the stock biomass capable of supporting MSY (SS_{MSY}) are basic stock parameters that are needed in order to determine stock recovery targets. In the case of red grouper, mature female gonad weight is used as a biomass proxy for spawning stock. The range of values is the highest and lowest values associated with the red grouper assessment model reported by the RFSAP, in its September 2002 report (RFSAP 2002). The range of values resulted from varying the steepness of the spawner-recruit curve in the projection model between 0.7 and 0.8.

Alternative 1 specifies MSY, F_{MSY}, and SS_{MSY} as ranges of values encompassing the full range of values recommended by the RFSAP under the range of likely assumptions for the red grouper assessment model. The use of a range rather than point values would allow the Council and NMFS some flexibility in status determination and rebuilding targets. In a previous report, the RFSAP (2000) reported that any values within the ranges are equally likely to be the true values. However, more recently, the RFSAP (2002) advised that, while there is uncertainty in the steepness values, a value of 0.7 is more realistic than 0.8. Note: The numerical estimates of MSY, F_{MSY}, and SS_{MSY} may change in future stock assessments, but the functional part of the alternative states that it is the range of values recommended by the RFSAP that be adopted.

Alternative 2 (the Proposed Alternative) specifies MSY, F_{MSY}, and SS_{MSY} based on the low steepness value of 0.7 for the spawner-recruit curve. In its review of the 2002 red grouper stock assessment, the RFSAP (2002) stated that, while a steepness value of 0.8 is not out of the question, it is on the high end of the range for species with life history characteristics similar to those of red grouper (Rose et al. 2001), and higher than the best fit to the limited spawner-recruit data (steepness = 0.68) currently available for this species (Schirripa et al. 1999). Moreover, because red grouper life history is made additionally complex by hermaphrodism, which has unknown consequences with respect to spawner-recruit relationships, some caution is recommended when biological benchmarks are hovering around threshold levels. This steepness level gives the stock the highest estimate of MSY, the lowest F_{MSY} to produce MSY, and requires the highest spawning stock size, SS_{MSY}, to maintain the fishery. Because it requires a lower fishing mortality rate, this is a more conservative alternative than Alternative 3, but it will ultimately result in a higher yield.

Alternative 3 specifies MSY, F_{MSY}, and SS_{MSY} based on the high steepness value of 0.8 for the spawner-recruit curve. This assumption gives the stock the lowest estimate of MSY, the highest F_{MSY} to produce MSY, and the lowest spawning stock size, SS_{MSY}, to maintain the fishery. The RFSAP (2002) advised that, while there is uncertainty in the steepness values, a value of 0.7 is more realistic than 0.8. Because it allows a higher fishing mortality rate, this is a less conservative alternative than Alternative 2 and will allow higher initial ABCs, but it will ultimately result in lower estimates of yield at equilibrium.

<u>Biological Impacts</u>: All of the estimated values in the alternatives are within the range of possible true values. These parameters provide the basis for setting the biological thresholds for overfishing and overfished status determination. However, the RFSAP (currently September 2002) advised that they believe the values derived from using a

spawner-recruit steepness value of 0.7 are more realistic than 0.8. The Proposed Alternative uses a value of 0.7, which produces the most conservative estimate of fishing mortality to produce MSY. As such, the Proposed Alternative will provide greater stability to the resource, and ultimately a higher spawning stock biomass size and ABC, while Alternative 3, which is based on a steepness value of 0.8, provides the highest (least conservative) estimate of F_{MSY}. This allows ABC to be higher in the short term, but ultimately results in a lower MSY and a lower spawning stock biomass. Alternative 1 provides a range of values bracketed by the results from using steepnesses of 0.7 and 0.8. Depending upon how this range is utilized for management, this alternative can be more conservative than the Proposed Alternative. In actual practice, the subsequent management measures in this amendment are mostly based on the mid-point of the range, which is intermediate between the 0.7 and 0.8 steepness results, and less conservative than the Proposed Alternative.

Alternative 4 (no action) does not specify any parameters for MSY, F_{MSY}, or SS_{MSY}. Since these parameters must be specified before minimum stock size threshold, maximum fishing mortality rate, or optimum yield parameters can be determined and a rebuilding plan formulated, this alternative is not acceptable. Additionally, this alternative is the least precautionary because the F associated with no action ($F20\%_{SPR}$) is higher than that recommended by the RFSAP to achieve MSY. Fishing at this level could result in growth or recruitment overfishing to the determent of the stock. It is included to provide a full range of alternatives for NEPA compliance.

Socioeconomic Impacts: The setting of MSY, F_{MSY}, and SS_{MSY} parameters does not by itself create socioeconomic impacts. However, it affects the determination of OY targets and minimum stock size thresholds and eventually the setting of TACs and associated management measures. Overly conservative parameters can lead to greater conservation than necessary and greater short-term socioeconomic loss from forgone yield due to management restrictions. Conversely, setting the parameters at a too non-conservative level can produce greater short-term socioeconomic benefits from increased yield, but a long-term loss due to the stock being fished to a level less than the true MSY level. Alternative 1 provides a likely range of values that allows some flexibility to balance socioeconomic impacts against conservation benefits. Alternatives 2 and 3 provide the end-point values of the ranges of values set under Alternative 1, and thus each of these two alternatives provides relatively rigid parameter values that would limit NMFS's ability to balance socioeconomic impacts and conservation benefits. Alternative 4 (no action) preserves the short-term socioeconomic conditions in the red grouper fishery but leaves no clear direction for purposes of conserving and managing the stock.

In addition to the relative implications of the various alternatives, as discussed above, certain socioeconomic implications of the alternatives as they specifically relate to MSY need some elaboration. At the start it should be noted that the alternatives, other than the no action alternative, specify MSY not in numerical but in functional form. Thus, the specific value of MSY can change depending on the findings of the most recent stock assessment, and this change has in fact materialized when comparing the 1999/2000 stock assessment to that of 2002. Alternative 1 sets MSY between 7.264 MP to 7.560 MP. The upper end of this range is MSY under Alternative 2 (Proposed Alternative) while the lower end is MSY under Alternative 3. For the period 1986-2001, the combined commercial and recreational landings averaged at 7.2 MP annually, with peak of 10.1 MP in 1989 (see Table 6.3). The five-year interval average landings dropped from 8.1 MP in 1986-1990 to 7.3 MP in 1991-1995, and finally to 6.2 MP in 1996-2001 (six-year interval). If future stock assessments lead to MSY estimates close to the range

specified under the various MSY alternatives, it will appear that more recent landings history (last 6 or 10 years) can be accommodated by MSY specifications. Landings in earlier years, particularly the peak of 10.1 MP, would not be allowed if the fishery is constrained to the specified MSY. This implies that if further restrictions are imposed on the fishery in the immediate future, not only will there arise short-term negative socioeconomic impacts, but such negative impacts may persist in the long-term. This consideration of possible numerical values of MSY limits the ability of NMFS to balance conservation with socioeconomic impacts under any of the alternatives. To the extent, however, that MSY specifications provide guidance in successfully conserving the stock, it is possible that the alternatives specifying an MSY may still provide better socioeconomic conditions than the no action alternative, particularly in the sense of guiding fishery participants with their plans regarding more realistic magnitude of future harvest and benefits from the fishery. For example, since current MSY estimates are close to landings in the last 10 years and well below landings in earlier years, scale operations in both the commercial and recreational sectors have to be set more in line with recent rather than earlier landings history.

6.2.2 Minimum Stock Size Threshold

The specific values in the alternatives in this section are based on the 2002 red grouper stock assessment and the Proposed Alternative in Section 6.2.1.

Proposed=> **Alternative 1: Red grouper minimum stock size threshold (MSST) shall be 80% (1-M where M=0.2) of SS_{MSY} (This is currently estimated by proxy to be 672 metric tons mature female gonad weight).**

Alternative 2: Red grouper minimum stock size threshold (MSST) shall be 100% of SS_{MSY} (This is currently estimated by proxy to be 840 metric tons mature female gonad weight).

Alternative 3: Red grouper minimum stock size threshold (MSST) shall be 50% of SS_{MSY} (This is currently estimated by proxy to be 420 metric tons mature female gonad weight).

Alternative 4: No action. Do not specify a red grouper minimum stock size threshold (MSST).

Discussion: The Minimum Stock Size Threshold (MSST) is the smallest stock size allowed before a stock is declared overfished. The Magnuson-Stevens Act requires that OY for stocks be managed on the basis of MSY. However, stocks can have natural fluctuations in biomass. The NMFS Technical Guidance (Restrepo et al. 1998) allows MSST to be set at any level down to the greater of ½ the spawning stock size capable of sustaining MSY or the minimum level at which the stock can be rebuilt within 10 years (for all practicable purposes, ½ of the SS_{MSY} level will usually be the applicable criterion for determining the lowest possible MSST). The recommended default rule for setting MSST is to set it at the greater of the percentage value representing 1-M (M=natural mortality rate), or 50% of SS_{MSY}. For red grouper, M=0.2, thus the MSST would be (1 - 0.2) or 80% of SS_{MSY}.

The Proposed Alternative (Alternative 1) follows the recommendation of the NMFS Technical Guidance The functional part of the alternative refers to the percent of SS_{MSY} that represents the threshold. The estimates by proxy are the current values of the

threshold estimated by the most recent biological information, and are subject to change in future assessments.

Red grouper, as with other groupers, are protogynous hermaphrodites, i.e., they initially mature as females and then transition to males. The effect of protogynous hermaphrodism on a stock's susceptibility to overfishing is not well understood, and a precautionary approach argues against setting the MSST lower than the recommended default rule.

Biological Impacts: The Proposed Alternative (Alternative 1) specifies MSST as 80% of the SS_{MSY} level, based on the default rule. Using the Proposed Alternative for SS_{MSY} (Alternative 2), this results in a threshold biomass level of 672 metric tons of mature female gonad weight, as calculated by the assessment model.

Alternative 2 specifies MSST as 100% of the SS_{MSY} level (840 metric tons mature female gonad weight, based on the Proposed Alternative for SS_{MSY}). This is more conservative than the Proposed Alternative, and would require that the stock be managed so as to never fall below SS_{MSY}. Although the uncertainties about the consequences of a protogynous hermaphrodite life history may call for a precautionary approach, this level of conservation may be greater than needed, particularly if it results in the stock, once recovered to SS_{MSY}, frequently crossing the overfished threshold due to natural variability in recruitment and year-class strength, resulting in frequent determinations of an overfished or not overfished stock

Alternative 3 specifies MSST as 50% of the SS_{MSY} level (420 metric tons mature female gonad weight, based on the Proposed Alternative for SS_{MSY}). This is the lowest MSST level allowed under the NMFS Technical Guidance document. The red grouper spawning stock size in 1997 was estimated by the 1999 stock assessment to be at 56% - 70% of SS_{MSY}, and by the 2002 stock assessment to be 62% - 75% of SS_{MSY}, therefore, the red grouper stock would not have been declared overfished under this MSST level. However, given the uncertainties associated with a protogynous hermaphroditic life history, and the apparent low levels of year-to-year fluctuations in the stock, setting MSST at this level does not appear to be warranted. Furthermore, it is uncertain if the stock could recover to B_{MSY} from an MSST set at 50% of SS_{MSY} within a 10-year period while fishing at MFMT set at F_{MSY} (SEFSC 2002).

Alternative 4 (no action) does not specify any MSST for red grouper. Since MSST must be specified in order to determine whether a stock is in an overfished state, this alternative is not acceptable. It is included in order to provide a full range of alternatives for NEPA compliance.

Socioeconomic Impacts: The current choices for MSST have significantly different socioeconomic implications when taking into account their potentially associated management measures. As per the most recent stock assessment, the current red grouper spawning stock size is estimated at 84% to 98.5% of SS_{MSY}. Under this condition, the stock would be considered overfished only under Alternative 2. However, the stock was declared as overfished in 1997 when the 1999 stock assessment estimated the stock size at 56% to 70% of SS_{MSY}. The most recent assessment also estimated the 1997 stock size at 62% to 75% of SS_{MSY}. At any rate, the implication here is that more stringent measures would have to be imposed when a stock is determined to be overfished (Alternative 2) than when it is not (Alternatives 1, 3, and 4). For the "non-overfished" alternatives, more stringent measures may be expected from adoption of a higher MSST

(Proposed Alternative) than a lower one (Alternative 3). In effect then, lower MSST thresholds, including no action, allow a larger allowable harvest, which produces larger short-term socioeconomic benefits. However, it also increases the risk of a possible future collapse or gradually decreasing harvest, with the attendant socioeconomic disruption. Setting MSST at a very high level would produce stability in year-to-year harvest but would also produce relatively large negative short-term socioeconomic impacts from the forgone yields.

Although the general implications of the various alternatives for MSST have been pointed out, the choice of which alternative provides the best balance between conservation benefits and adverse socioeconomic impacts cannot be ascertained. This lack of clear choice is partly a function of the lack of probability with each MSST alternative that at that level the stock would be "actually" overfished and the associated rebuilding strategy would be successful in meeting the target MSY. For example, if all MSST alternatives have an equal probability of being "correct" such that their associated rebuilding paths would successfully rebuild the stock within 10 years, a lower MSST level which, as discussed above, is associated with lower adverse socioeconomic impacts would be economically superior over others. As implied, however, in the "Biological Impacts" discussion, it appears that a higher MSST level has a higher probability of protecting the stock, whereas a lower MSST level is associated with a lower probability of protecting the stock. In this case, it would no longer hold true that a lower MSST level, which is associated with lower adverse socioeconomic impacts, would be economically better than a higher MSST level, since it is associated with lower probability that future benefits would accrue.

6.2.3 Maximum Fishing Mortality Rate

The specific values in the alternatives in this section are based on the 2002 red grouper stock assessment and the Proposed Alternative in Section 6.2.1.

Proposed=> **<u>Alternative 1</u>: Red grouper maximum fishing mortality threshold (MFMT) shall be F_{MSY} (currently estimated at 0.306 in the 2002 assessment), or the F consistent with recovery to the MSY level in no more than 10 years when a rebuilding plan is required.**

<u>Alternative 2</u>: Red grouper maximum fishing mortality threshold (MFMT) shall be the current (2001) fishing mortality rate as determined in the September 2002 report of the RFSAP (F = 0.315 in the 2002 assessment), or the F consistent with recovery to the MSY level in no more than 10 years when a rebuilding plan is required.

<u>Alternative 3</u>: Red grouper maximum fishing mortality threshold (MFMT) shall be 80% of F_{MSY} (F = 0.245 in the 2002 assessment), or the F consistent with recovery to the MSY level in no more than 10 years when a rebuilding plan is required.

<u>Alternative 4</u>: Red grouper maximum fishing mortality threshold (MFMT) shall be F_{MAX} (F = 0.476 in the 2002 assessment) as a proxy for F_{MSY} or the F consistent with recovery to the MSY level in no more than 10 years when a rebuilding plan is required.

<u>Alternative 5</u>: Status Quo. Red grouper maximum fishing mortality threshold (MFMT) shall be $F_{30\% \text{ static SPR}}$ (F = 0.563 in the 2002 assessment) as a proxy for F_{MSY}, or the F consistent with recovery to the MSY level in no more than 10 years.

<u>Discussion</u>: The Maximum Fishing Mortality Threshold (MFMT) is the highest rate of fishing, including bycatch and release mortality, which can be applied to a stock on a sustainable basis. For overfished stocks under a rebuilding plan, it is the highest rate of fishing that is consistent with a rebuilding plan that will allow the stock to recover within the recovery time frame. When the fishing mortality rate exceeds MFMT, a stock is considered to be undergoing overfishing. It will drop below the SS_{MSY} level and may drop below the MSST level if no action is taken to reduce fishing mortality.

The Proposed Alternative (Alternative 1) specifies that MFMT be set at F_{MSY}, which is the highest level that can attain MSY on a continuing basis. Unlike Alternative 4, it does not specify a method or proxy for determining F_{MSY}. This allows the best available scientific information and methodology to be used in determining F_{MSY} with each successive stock assessment. However, different proxies of F_{MSY} can yield significantly different results (e.g., $F_{0.1} = 0.238$, $F_{max} = 0.476$, $F_{30\% \text{ static SPR}} = 0.563$), and could lead to substantial shifts in the numerical value of MFMT in subsequent assessments. The current method for determining F_{MSY} in the red grouper stock assessment is through an iterative process described in the 1999 assessment (Schirripa et al. 1999) as follows:

> The F_{MSY} estimate was computed by calculating the spawning-stock-per-recruit (SPR) and yield-per-recruit (YPR) under a given F. The stock-recruitment relationship was rearranged such that spawning stock is a function of SPR to derive the spawning stock for that F value. Plugging this spawning stock back into the stock-recruitment relationship generates an estimate of the expected recruitment in equilibrium at that F value. Multiplying this equilibrium recruitment by the YPR gives an estimate of the yield for that F value. The F value is then changed until the equilibrium yield is maximized.

Alternative 2 sets MFMT at the current F (current 2001). However, this is above the F_{MSY} level, and fishing above F_{MSY} on a continuing basis is not allowed under the Magnuson-Stevens Act. It is included in order to provide a full range of alternatives for NEPA compliance.

Alternative 3 sets MFMT at a level that is 80% of F_{MSY}. This is an allowable and more conservative level than the Proposed Alternative. However, the management target for a recovered stock is the fishing mortality rate associated with optimum yield (F_{OY}) rather than F_{MSY}. Provided that F_{OY} is measurably less than F_{MSY}, this alternative provides an unneeded level of conservatism.

Alternative 4 sets MFMT at F_{MAX}. The RFSAP recommended this proxy for F_{MSY} for gag and for protogynous hermaphrodites in general (RFSAP 2001) over SPR based proxies for reasons explained below under biological impacts. However, F_{max} is not always a conservative estimate of F_{MSY}. In the 2002 red grouper stock assessment, a direct estimate of F_{MSY} was made, making a proxy unnecessary. F_{MAX} was also computed in the assessment and was found to be much less conservative than the direct F_{MSY} estimate ($F_{MSY} = 0.306$, $F_{max} = 0.476$) and would likely result in the stock entering or maintaining an overfished state.

Alternative 5, status quo, retains the overfishing threshold as $F_{30\% \text{ static SPR}}$ as a proxy for F_{MSY}. This level was adopted in the Generic SFA amendment (and subsequently approved by NMFS) based on the recommendation of the Council's second Ad Hoc FinFish Stock Assessment Panel (FSAP 1998), which stated:

> The panel recommends that the other Gulf finfish species under the jurisdiction of the Council be managed with an MSY and B_{MSY} SPR proxy level of 30%, provided there is a minimum size limit of at least the size at 50% maturity, unless certain life history characteristics or management strategies warrant a more precautionary approach.

However, a more recent recommendation by the RFSAP (2001) suggested that SPR may not be a reasonable proxy for F_{MSY} for protogynous species, because it only relates F to female biomass, does not account for the level of older male biomass in the population, and is more likely than the other alternatives to produce a non-conservative estimate of F_{MSY}. The $F_{30\% \text{ static SPR}}$ estimate was calculated in the 2002 red grouper stock assessment at F = 0.563, making it the least conservative of all the proxies considered.

Biological Impacts: The Proposed Alternative (Alternative 1) uses an F_{MSY} that was estimated directly (as opposed to using a proxy) in the 2002 red grouper stock assessment by multiplying the estimated equilibrium recruitment by the yield-per-recruit (YPR) under a given fishery selectivity pattern and F, and determining the F that provided the highest yield. The resulting values are based on a spawner-recruit steepness of 0.7, as proposed in Section 6.2.1 (at a steepness of 0.8, F_{MSY} would be 0.364). This methodology is dependent on estimates of spawning-stock-per recruit (SPR). Under this alternative, overfishing is currently occurring, since the current F (F_{2001} = 0.315) is higher than the estimate of F_{MSY} (F_{MSY} = 0.306).

Under Alternative 2, overfishing is also currently occurring. Although F_{2001} would not be above MFMT (since it would be equal to MFMT), a rebuilding plan is needed since the stock was declared overfished in 2001, and this F is above the fishing rate needed to affect a 10-year recovery. Even if the stock were in a rebuilt state, this alternative would allow a fishing mortality rate approximately 3% above the directly estimated F_{MSY}. This could result in the spawning stock size dropping back down below SS_{MSY}.

Under Alternative 3, overfishing is also currently occurring, since the current (2001) fishing rate is above the MFMT. This is the most conservative level of MFMT, and it would reduce the likelihood of the spawning stock dropping below either SS_{MSY} or MSST, once the stock is recovered. However, setting a conservative MFMT threshold level is not necessary if the OY target is sufficiently conservative, since management of a stock that is not overfished is based on the OY target rather then MSY threshold.

Alternative 4 specifies MFMT as F_{MAX} used as a proxy for F_{MSY}, or the F consistent with recovery to the MSY level in 10 years. When F_{MSY} cannot be estimated directly, the NMFS Technical Guidelines allow the use of a proxy. However, F_{MAX} is generally considered a non-conservative estimate of F_{MSY}. For red grouper, the level of F_{MAX} (0.475) is estimated to be on the order of 1.55 times the directly estimated F_{MSY} and, as such, is an F that exceeds the permissible level (NMFS 2001).

Alternative 5, use $F_{30\% \text{ static SPR}}$ as a proxy for F_{MSY}, is the status quo proposed by the Council and approved by NMFS in the Generic SFA plan amendment for all of the reef fish except red snapper, Nassau grouper, and goliath grouper (jewfish). The technical

guidelines suggest that long-term average fishing mortality rate equivalent to a 30-40% level of spawning per recruit (SPR) may be a reasonable proxy for F_{MSY}. However, this estimate only relates F to female biomass. In a protogynous hermaphrodite species such as red grouper, this does not takes into account the level of older male biomass in the population, and is more likely than the other alternatives to produce a non-conservative estimate of F_{MSY}. The level of $F_{30\% \text{ static SPR}}$ (0.563) for red grouper was estimated to be approximately 50% higher than F_{MSY} and thus in excess of the permissible level of MFMT. This is the least conservative of the alternatives considered.

Socioeconomic Impacts: MFMT is mainly a biological concept, but it also sets the tone for the type of management measures that may have to be imposed on the fishery. Current fishing mortality rate is estimated at 0.315, and any alternative for MFMT associated with a fishing mortality higher than 0.315 requires the imposition of stringent management measures. But depending upon the selection of MSST, all of the alternatives may require a reduction in harvest, and consequent reduction in short-term economic benefits, consistent with a rebuilding plan. When the stock is fully rebuilt to the target SS_{MSY}, the Proposed Alternative would allow a fishing mortality rate at the MSY level, which would produce a yield that is a little above more recent historical yield. Alternative 2 would allow a significantly higher yield, but would increase the likelihood that the stock again become overfished as to require a rebuilding plan. Alternative 3 is the most conservative alternative. Under this alternative, it is likely that a stock, once recovered, will remain healthy, but yield will be at a level less than more recent harvests, and the fishery will forgo a portion of the sustainable yield. Alternative 4 is less conservative than the Proposed Alternative, and would likely produce a yield higher than that of the more recent period. This alternative would have a less likelihood of maintaining a healthy stock, once it is recovered, than the Proposed Alternative, but would also lead to forgoing a smaller portion of the sustainable yield. Alternative 5 (status quo) is the least conservative among the alternatives. It would provide for a higher yield but would also likely delay the rebuilding of the stock.

6.2.4 Optimum Yield

The specific values in the alternatives in this section are based on the 2002 red grouper stock assessment and the Proposed Alternative in Section 6.2.1.

Alternative 1: From 2004-recovery, red grouper optimum yield (OY) is the yield defined by the fishing mortality rate consistent with the rebuilding strategy to B_{MSY} within the allowable rebuilding period. After achieving the rebuilding target, OY shall be the yield corresponding to a fishing mortality rate that produces 90% of MSY (approximately 55% of F_{MSY}; (F_{OY} = 0.126, OY = 6.803 MP GW).

Alternative 2: From 2004-recovery, red grouper optimum yield (OY) is the yield defined by the fishing mortality rate consistent with the rebuilding strategy to B_{MSY} within the allowable rebuilding period. After achieving the rebuilding target, OY shall be the yield corresponding to a fishing mortality rate that produces 100% of F_{MSY}. (F_{OY} = 0.306, OY = 7.560 MP GW based on the results of the 2002 stock assessment at a spawner-recruit steepness of 0.7).

Proposed=> **Alternative 3: From 2004-recovery, red grouper optimum yield (OY) is the yield defined by the fishing mortality rate consistent with the rebuilding**

strategy to B_{MSY} within the allowable rebuilding period. After achieving the rebuilding target, OY shall be the yield corresponding to a fishing mortality rate that produces 75% of F_{MSY}: produces 98% of MSY (SEFSC 2003) or higher and 120% of SS_{MSY}; (F_{OY} = 0.229, OY = 7.385 MP GW based on the results of the 2002 stock assessment at a spawner-recruit steepness of 0.7).

Alternative 4: No action. Do not specify a red grouper optimum yield (OY).

Discussion: In the Magnuson-Stevens Act, the term "optimum," with respect to the yield from a fishery, means the amount of fish which will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems; is prescribed as such on the basis of the maximum sustainable yield from the fishery, as reduced by any relevant economic, social, or ecological factor; and in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery. The alternatives in this section set OY at a level that is equal to or more conservative than MSY. The OY is a management target, but unlike rebuilding an overfished stock to the MSY level, there is no time constraint to further rebuild to the OY level.

The NMFS guidelines for National Standard 1 state that, "target reference points, such as OY, should be set safely below limit reference points, such as the catch level associated with the fishing mortality rate or level defined by the status determination criteria." The guidelines also state that, "the annual harvest level obtained under an OY control rule must always be less than or equal to the harvest level that would be obtained under the MSY control rule."

For Alternatives 1 to 3, OY through the recovery period is set as the yield consistent with the rebuilding plan selected in Section 6.3. These rebuilding plans begin in 2004 with an end date of 2014. Once the rebuilding plan is complete, OY should be selected to meet the criteria set forth in NMFS National Standard Guidelines on the Magnuson-Stevens Act.

The Proposed Alternative (Alternative 3) sets OY using the method recommended by the NMFS Technical Guidance (Restrepo et al. 1998) to set OY at the yield obtained by fishing at 75% of F_{MSY}, which in a fully recovered stock, is expected to be 98% of MSY (SEFSC 2003) or higher. If the management actions proposed in this amendment (quota reductions) change the selectivity of the commercial fishery, estimates of MSY and OY could also change. In this document it is assumed that the proposed management actions will not have a significant effect on selectivity. At this OY level, there is no more than a 20%-30% probability of exceeding MFMT, according to the NMFS Technical Guidance. The functional part of the alternative is the method for setting OY, i.e., at yield corresponding to 75% of F_{MSY}. The specific numerical estimates of F_{OY} and OY may change with future stock assessments.

Alternative 1 sets a specific OY yield level, i.e., 90% of the MSY yield. To accomplish this requires reducing F_{OY} to 55% of F_{MSY} and is therefore, more conservative than the Proposed Alternative. This was initially selected as a Proposed Alternative by the Council because it was felt that the resulting yield, 90% of MSY, was sufficiently different from MSY so to be a measurable difference. However, once it became clear that NMFS felt that 75% of F_{MSY} and 98% of MSY (SEFSC 2003) provided sufficient

protection for the stock, the Council felt that allowing the higher harvest level would optimize benefits from the stock without incurring an unacceptable risk of overfishing.

Alternative 3 sets OY equal to MSY. Although this provides the greatest possible yield from the stock, it also results in fishing the stock on the edge of overfishing. This is a risk-prone alternative which the Council did not feel was acceptable.

Alternative 4 is the no action alternative. OY is a management consideration only for stocks that are not overfished. Although red grouper is now above the MSST overfished threshold (80% of B_{MSY}), it is not yet rebuilt to the B_{MSY} level. The 2002 stock assessment confirmed the previous assessment's finding that the stock was below MSST and in an overfished state in 1997, and therefore, the management target remains rebuilding to the biomass capable of supporting MSY. It would be possible to defer selection of OY until the stock is approaching its MSY level without impairment to the rebuilding process, but selecting OY at this time allows the full suite of biological reference points and stock status determination criteria to be implemented and simplifies future management of the rebuilt stock by removing the OY issue from the table.

Biological Impacts: The Proposed Alternative (Alternative 3) is the recommended default target in the NMFS Technical Guidance (Restrepo et al, 1998). This document recommends that a precautionary fishing mortality target be set at 75% of F_{MSY}. At this level, the resulting yield in a fully recovered stock would be approximately 98% or higher of MSY (SEFSC 2003) while stock biomass would be approximately 120% of the MSY level (SEFSC 2003). If the fishery selectivity does not change as a result of actions in this amendment, yield will be 97% of MSY and stock biomass will be 125% of the MSY level.

Alternative 1 sets the OY target at 90% of the MSY level, a level that produces a yield measurably less than MSY. Management at this target will benefit the stock by harvesting below the maximum theoretical yield. This will maintain the stock biomass at a level measurably higher than the MSY level and will reduce the likelihood that the stock might fluctuate below MSST and trigger a rebuilding program. The target OY yield is more conservative than the recommended default target, which produces approximately 98% of MSY (see discussion for Alternative 3). However, if uncertainty about the effect of a protogynous hermaphroditic life history on sensitivity to overfishing suggests a precautionary approach, then a OY level more conservative (e.g., smaller yields and lower F_{OY}) than the NMFS default recommendation may be more appropriate for red grouper.

Alternative 2 is the least conservative alternative. It sets OY equal to MSY. This maximizes the yield from the stock. However, the stock biomass is maintained at a lower level than under the Proposed Alternative. It will inevitably fluctuate above and below the MSY level, and there is a greater likelihood of the stock fluctuating below MSST and triggering a rebuilding program than with the Proposed Alternative.

Socioeconomic Impacts: As currently worded, the specification of OY under each alternative is based mainly on biological considerations, but also may incorporate social and economic considerations. From a purely economic standpoint, OY may be considered to be approximated by maximum economic yield (MEY), which in general is lower than MSY and thus readily qualifies under the Magnuson-Stevens Act as a potential OY. Achieving MEY, however, is generally embedded in the management regime adopted. A management regime that rationalizes effort in the fishery, such as an

IFQ program, offers a higher likelihood of achieving MEY than other management regimes. When other than purely economic factors, such as the employment, historical and cultural importance of a fishery to certain communities, are also considered in the determination of OY, the associated harvest level would be different from MEY. For example, if employment promotion is introduced into the process of determining OY, the resulting harvest level will likely be higher than MEY, since in most instances MEY would require an employment level that is consistent with the best use of labor resources in conjunction with other resources, including fish. As with MEY, a management regime would have to be developed to insure that a certain specified level of employment is achieved.

Given the foregoing discussion, the ability to describe the socioeconomic implications of the various OY alternatives is reduced to describing the socioeconomic status of the fishery at various harvest levels associated with each choice of OY.

In general, the higher the allowable yield, the better the socioeconomic outcome would likely be. But this outcome has to be modified by the long-term sustainability of the stock at a chosen OY and the type of management regime adopted for the fishery. Among the alternatives, the Proposed Alternative is the most conservative from a biological standpoint. It will result in the smallest but also the most stable yield, since it will result in the lowest likelihood of a recovered stock biomass dropping below MSST and forcing a recovery plan. Alternatives 2 and 3 allow a greater harvest, but also a greater risk of the stock biomass dropping below MSST. Alternative 4 (no action) does not specify any OY, and while it may not meet SFA requirements to specify OY it does present interesting implications noted below.

Based on the most recent stock assessment, the Proposed Alternative sets OY at 7.385 MP, which is between that set by Alternative 1 of 6.803 MP and Alternative 2 of 7.560 MP. Similar to MSY, OY can change depending on the findings of future stock assessments. For the current purpose, however, the mentioned OY levels are assumed to remain the same after the rebuilding period. For the period 1986-2001, the combined commercial and recreational landings averaged at 7.2 MP annually, with a peak of 10.1 MP in 1989 (see Table 6.3). The five-year interval average landings dropped from 8.1 MP in 1986-1990 to 7.3 MP in 1991-1995, and finally to 6.2 MP in 1996-2001 (six-year interval). Given these numbers, it would appear that, once the stock is recovered, only the more recent landings history can be accommodated by any of the OY specifications. Landings in earlier years, particularly the peak of 10.1 MP, would not be allowed if, after the rebuilding period, the fishery is constrained to any of the currently estimated OY level. This implies that if restrictions are imposed on the fishery, not only would there be short-term negative socioeconomic impacts, but the likelihood of such negative impacts to be outweighed by future benefits would be low. Herein fits the different perspective offered by the no action alternative as discussed below.

The no action alternative may be interpreted in two ways. First, OY is not currently specified but would be set after the stock is fully recovered or when it is nearing full recovery. In this case, the possibility exists that socioeconomic information may be available as to be explicitly included in the specification of OY. Second, a specific OY would not be set even when the stock is fully recovered but would be simply stated as any harvest at or below the specified MSY. Under an open access system, OY would likely be equal to MSY, but under a controlled access system, particularly of the IFQ type, OY would fall below MSY.

A biological specification of OY is instructive in terms of at least knowing the yield target of managing the fishery, but specifying management solely on the basis of a biological definition of OY may not trace a path that provides the best economic results. For example, open access management measures may force the fishery to produce at the biologically specified OY, but the economic status of the fishery may be worse off than that achieved under a controlled access type of management even at lower yield levels. Unless then an OY is specified, implicitly or explicitly, with accompanying general management approach that would allow the fishery to be economically efficient, none of the alternatives may be considered superior over any other alternatives.

Although each OY alternative is specified mainly on biological grounds, socioeconomic factors can come into play when a choice of a specific OY is made. As noted earlier, each OY alternative is associated with a different harvest level such that choosing one over another would yield its own unique socioeconomic consequences. It is in this nature that socioeconomic factors are considered in the Council's choice of OY.

Further discussions of the economic implications of the various numerical OY alternatives are found in Section 7.6.1. In essence, the various numerical values of OY do not significantly differ with respect to the number of years it would take to fully recover the economic losses during the rebuilding period.

6.3 Rebuilding Overfished Stock

In October 2000, NMFS issued a determination that the Gulf of Mexico red grouper stock is overfished and undergoing overfishing. This determination was based on the results of a 1999 red grouper stock assessment (Schirripa et al. 1999), which assessed the status of the stock as of 1997, and several subsequent analyses by the NMFS SEFSC and the Council's RFSAP. Under the Magnuson-Stevens Act, once a stock is declared overfished, the Council has one year to submit a plan to NMFS to end overfishing and rebuild the stock to a level capable of supporting maximum sustainable yield (MSY) on a continuing basis. Subsequent to the 1999 red grouper stock assessment, the SEFSC prepared a new assessment that found that the stock was in an improved condition by 2001 and was no longer considered to be overfished. However, even if the alternative selected for MSST indicates that the stock is no longer overfished, it has not reached a level needed to produce MSY on a continuing basis. Therefore, a rebuilding plan is still needed. However, because the current (2001) stock status is closer to B_{MSY} than the status in 1997, a less restrictive rebuilding plan is needed to attain B_{MSY} within 10 years or less.

6.3.1 Rebuilding Strategy

The specific values in the alternatives in this section are based on the 2002 red grouper stock assessment and the Proposed Alternative in Section 6.2.1.

<u>Alternative 1</u>: Adopt a 10-year red grouper rebuilding plan based on a constant catch strategy. The annual ABC during the rebuilding period is initially set at 7.03 MP GW (Table 6.1). This ABC range may be modified following a future stock assessment by a regulatory amendment or plan amendment.

<u>Alternative 2</u>: Adopt a 10-year red grouper rebuilding plan based on a constant fishing mortality rate (F) strategy. The annual ABC yield streams

during the rebuilding period is initially set to correspond to schedule indicated in Table 6.1 for a spawner-recruit steepness of 0.7 and an MSY target (6.17 MP in 2003). This ABC yield stream may be modified following a future stock assessment by a regulatory amendment or plan amendment.

Proposed=> **<u>Alternative 3</u>: Adopt a 10-year red grouper rebuilding plan based on a three-year interval rebuilding strategy. The annual ABC during the first three-year interval (2003-2005) will be 6.56 MP GW (i.e, the average of the first three years under a constant F strategy from Table 6.1). The ABC for subsequent intervals will be set following a future stock assessment by a regulatory amendment or plan amendment.**

<u>Alternative 4</u>: Adopt a 10-year rebuilding plan based initially on a constant catch strategy, with intent to switch to a constant F strategy at an appropriate future time. The initial ABC would be set at the average of the constant F ABCs for the years to be kept at constant catch, as shown in Table 6.4.

<u>Alternative 5</u>: Adopt a rebuilding strategy as in one of the above alternatives, but for a shorter time interval. Pending a reevaluation of the ABC yield stream by NMFS, the following are proportional reductions to the 10-year ABC ranges above:

- **a 2-4 years (T_{min}): ABC = 0 for the duration of the rebuilding period**
- **b. 5 years: ABC = 1/6 of the 10-year schedule**
- **c. 6 years: ABC = 2/6 of the 10-year schedule**
- **d 7 years: ABC = 3/6 of the 10-year schedule**
- **e. 8 years: ABC = 4/6 of the 10-year schedule**
- **f. 9 years: ABC = 5/6 of the 10-year schedule**

<u>Alternative 6</u>: Status quo - do not adopt a rebuilding plan for red grouper.

<u>Discussion</u>: There are two basic rebuilding strategies: constant catch (Alternative 1) and constant F (Alternative 2). The remaining alternatives, including the Proposed Alternative, consist of various permutations or combinations of these two strategies. The constant catch strategy (Alternative 1) allows the highest initial harvest, but requires that the harvest be kept at that level for the full recovery period. Constant F (Alternative 2) requires a more restrictive initial harvest, but it allows the harvest to increase as the stock recovers. These strategies are illustrated in terms of controls rules in Figure 2.

The Proposed Alternative (Alternative 3) is a variation of the constant F strategy, a stepwise strategy. This allows the catch to be adjusted in three-year (or other time-frame) increments, rather than every year. This strategy allows harvest to increase in a stepwise fashion as the stock recovers. Setting three-year intervals when (F) or harvest will be kept constant allows short-term stability in the management of this species and also matches the frequency of adjustments to the probable frequency of new stock assessments. Extending the recovery period to the full 10 years allowed under the Magnuson-Stevens Act allows the highest harvest levels during the rebuilding period and minimizes economic and social disruption to all sectors of the fishery and to those fishing communities dependent on it. Note that although Alternative 3 specifically calls for future stock assessments, periodic reassessment would be required under any recovery

program (and is therefore, implied in all of the alternatives) in order to monitor the recovery program's effectiveness and to incorporate any new biological information.

Alternative 4 is a mixed-strategy, beginning as constant catch and switching to constant F after a certain number of years. The ABCs for the constant catch portion of this strategy are calculated as the average of the annual constant F ABCs for those years (from the constant F ABC, Table 6.1), and are listed in the alternative as sub-options for 2 to 9 years of constant catch. This approach, while requiring a deeper initial harvest reduction than straight constant catch, would be less severe than under a straight constant F strategy, and it would allow ABC to increase in the transition year to constant F and the years thereafter. Alternative 5 could be used in combination with one of the other alternatives to reduce the recovery time frame. Under the National Standard guidelines, the maximum recovery period can be no longer than 10 years (unless the stock would not recover in 10 years even in the absence of all fishing mortality), but it can be shorter than 10 years. The shortest possible recovery period is two to four years, which is the recovery time estimated by the RFSAP in the absence of all fishing. For the remaining time frames (five to nine years), the ABCs are calculated as a proportional reduction from the ABCs under a 10-year plan. Alternative 6 (Status quo) could only be acceptable if the stock were determined not to be overfished.

Biological Impacts: All of the alternatives except status quo will provide the same biological benefit rebuilding the red grouper stock to the SS_{MSY} level in 10 years or less, however, with different degrees of risk. Alternative 1 (constant catch) puts much of the recovery toward the end of the program and would be more susceptible to negative events during the recovery. For this reason, this could be considered the most biologically risk-prone alternative. Alternative 2 (constant F) puts much of the recovery at the beginning of the program, so that if poor year classes or other negative events occur later in the recovery they will have less of an impact on the recovery. For this reason, this could be considered the most biologically risk-averse of the 10-year alternatives. Alternative 6 (status quo) does not provide any rebuilding, and is not an acceptable alternative.

The Proposed Alternative (Alternatives 3) provides more rebuilding up front than Alternative 1 but less than Alternative 2, and is intermediate in risk. It allows an initial period of stability while data is collected for a new stock assessment. Alternative 4 is similar to Alternative 3 in that it provides an initial period of stability, but Alternative 4 does not define the length of the initial period, and it switches to a constant F strategy with annual TAC changes rather than another interval of constant catch. In order to allow enough of a stock buildup to provide for a switch from a constant catch to a constant F strategy, the TAC for the initial constant catch period would need to be lower than under a pure constant catch strategy. Alternative 5 would shorten the recovery time frame, reducing the likelihood of a poor year-class or other negative event occurring. Alternative 6 (status quo) would result in a failure of the stock to achieve B_{MSY}, although there may be periods of apparent improvement due to occasional strong year-classes.

As noted in the Section 9.2.8 of the Environmental Consequences section, red grouper act a environmental engineers, excavating sandy substrata to expose carbonate rock. These excavations can serve as refuge for many species of fish and invertebrate species, including snowy grouper, vermilion snapper, black grouper and spiny lobster (Coleman and Williams 2002). Recovery of the red grouper stock should therefore provide habitat benefits to these other species as well.

Socioeconomic Impacts: Over the 10-year rebuilding period for red grouper, the Council's main control instruments for the directed fishery are TAC and associated regulatory measures to constrain harvests to the chosen TAC. The economic issue involved in a rebuilding strategy may be characterized as a tradeoff in value of catches over time (Waters and Holiman 2001). A larger TAC now would yield greater commercial and recreational benefits in the short-term, but at the expense of a slower stock recovery. Conversely, a smaller TAC now would generate fewer short-term benefits, but likely would also lead to a faster realization of the benefits of a larger red grouper resource in the future made possible by a faster recovery of the fish stock. The net present value approach is useful in this particular situation. Net present value is calculated as a weighted sum of annual net benefits expected to be received over time. The weighting factor is determined by the discount rate and declines exponentially over time. The choice of a discount rate plays an important role, especially when net present valuation is done over a longer period. A higher discount rate would favor a rebuilding period that generates more short-term benefits. Conversely, a lower discount rate would favor a rebuilding period with larger benefits in the long-term. In general, a seven% discount rate is used for net present valuation in U.S. fisheries.

Net present value calculations are presented in the RIR section. For the current purpose, it is sufficient to compare the relative impacts of the various alternatives. Relative to landings in the last three years (1999-2001), the alternative TACs would result in the following short-term reductions in landings: three% for Alternative 1, 15% for Alternative 2, and 10% for Alternative 3 (Proposed Alternative). Some possible options under Alternative 4 appear to provide higher TACs than either of the first three alternatives. Alternative 5 generally provides for much lower TACs, particularly in the short term. Among the first three alternatives, the required reductions in landings under Alternatives 2 and 3 are significant while those for Alternative 1 are relatively minimal. The magnitude of short-term economic impacts would closely correlate with the required reductions in landings, with Alternative 2 being associated with the largest negative economic impacts in the short-run. Depending on the results of future stock assessments, TACs may be increased or decreased. An increase in future TACs may partially or fully offset the short-term negative economic impacts. On the other hand, a decrease in future TACs would result in further deterioration of the economic status of the fishing participants, especially that as currently estimated MSY and OY are not substantially different from landings in the last 10 years.

Because the various rebuilding strategies would result in constraining the activities of both the commercial and recreational sectors, the comparative social impacts in terms of employment and disruptions in family and community activities would closely correlate with the economic implications of the various rebuilding strategies. Strategies that promote higher TACs would be less disruptive than those that require lower TACs, at least in the short run.

6.3.2 Rebuilding Scenarios

The following scenarios are for the first three years of a rebuilding plan based on the Proposed Alternatives under the section, Rebuilding Strategy. They adhere to the following conditions, and are based on attaining approximately the mid-point of the range of harvest reduction needed:

- Use a three-year interval strategy in setting TAC
- ABC for first three-year period is 6.56 MP

- 9.4% harvest reduction from 1999-2001 average (2.0% reduction from the 1990-2000 average)
- Achieve harvest reduction for both commercial and recreational sectors

Selecting the same percent harvest reduction for the commercial and recreational sectors will preserve the existing red grouper harvest ratio of 81% commercial to 19% recreational (Table 6.3). This ratio has changed in favor of the commercial fishery from the previous years ratio of 76:24 while gag harvest has changed in favor of the recreational fishery during the same time (Table 6.3). This is possibly because the differential gag size limits implemented in 2000 (24 inches commercial, 22 inches recreational) have caused a shift in recreational harvest toward gag, and possibly because the strong 1996 red grouper year class has become more prominent in the offshore commercial fishery as it has perhaps started to be fished out on the combined commercial and recreational fishery closer to shore. Selecting different reduction percentages for each sector would change the red grouper harvest ratio and could indirectly affect the gag harvest ratio (see Note).

The Council, at the recommendation of NMFS, decided to base its harvest reduction strategy on the baseline years 1999-2001 rather than 1990-2000 as had previously been used. This change was made because the fishery is currently being influenced by the strong 1996 red grouper year-class, and will likely continue to be influenced for the next three years (after which a new stock assessment will be prepared and a new ABC selected for the second three-year interval).

6.3.2.1 Commercial Proposed Scenario Summary

The proposed commercial scenario reduces the shallow-water grouper quota from 9.35 MP GW to 8.80 MP GW.

Discussion: The proposed shallow-water grouper quota of 8.80 MP GW represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest. This quota is expressed in GW rather than whole weight to reflect the condition in which commercially harvested grouper are landed, and to avoid any inaccuracies that could be introduced from applying a gutted to whole weight conversion factor. The method for calculating this quota is described in the section on shallow-water grouper quota alternatives.

Note concerning commercial-to-recreational allocations:

The commercial-to-recreational ratio of red grouper caught during 1990-2000 was 76:24, little changed from the 1986-1989 pre-regulatory ratio (75:25). However, in recent years (1999-2001) the commercial-to-recreational ratio has shifted to 81:19 (Table 6.3). There are two likely reasons for this shift. First, in 2000, differential gag minimum size limits were implemented (24 inches commercial, 22 inches recreational), which allowed the recreational sector to focus more on gag. In fact, Table 6.3 shows that the recreational proportion of gag harvest increased in 1999-2001 compared to 1990-2000 (although it is still lower than in the 1986-1989 pre-regulatory period). Second, the strong 1996 year-class of red grouper entered the fishery around 1999. Since commercial sector catches predominately were red grouper while the recreational sector catches predominately were gag, this year-class provides more of a boost to commercial harvest than to recreational harvest. As the year-class is fished out and exits the fishery, the commercial-to-recreational ratio should revert back towards historical levels. Single-species grouper

allocations are not specified in Reef Fish Amendment 1, and the current amendment does not attempt to address the question of single-species grouper allocations. Instead, it achieves the needed reductions in red grouper harvest by applying the same percentage reductions to each sector, thus effectively maintaining allocations at current levels. If the proposed commercial and recreational scenarios were to be altered to force a re-allocation of red grouper back to the recreational sector by applying all of the needed harvest reduction to the commercial sector, then the commercial sector would require an 11.75% reduction rather than a 9.4% reduction while the recreational sector remained at status qu o to bring the overall red grouper harvest to the 6.56 MP ABC. This would require that the Commercial Proposed Scenario be modified to have an 8.66 MP GW shallow-water grouper quota (rather than 8.80 MP GW). Assuming that the 11.75% commercial reduction is achieved and that recreational red grouper harvest remains at its 1999-2001 average, this would shift the allocation to 79:21.

6.3.2.2 Recreational Proposed Scenario Summary

The proposed recreational scenario reduces the allowable bag limit for red grouper to two fish of the five fish grouper aggregate. It is the Council's intent that the double bag limit allowance apply on qualified for-hire vessels that are out over 24 hours, i.e., a 10 grouper per person bag limit of which no more than four can be red grouper.

Discussion: The Proposed Recreational Scenario reduces the allowable bag limit for red grouper. Setting a two red grouper bag limit (out of the five grouper aggregate bag limit) is projected to produce a 9% harvest reduction in the recreational sector. Although this percent reduction is slightly less than the 9.4% called for, the 0.4% difference is not significant since the recreational sector only accounted for 19% of the total red grouper harvest during 1999-2001. This scenario achieves close to the reduction sought while minimizing disruption to the recreational fishing industry, and it avoids possible adverse impacts on release mortality that could occur from an increase in the minimum size limit.

6.3.2.3 Impacts on Gag Harvest:

Gag, along with red grouper, are the dominant species in the shallow-water grouper aggregate, and it is therefore, appropriate to consider the effects of management measures to implement a red grouper rebuilding plan on gag harvest. Based on a 2001 stock assessment, gag in 1999 appear to be neither overfished nor undergoing overfishing, but harvest has not yet been reduced to OY levels.

Based on the recommendation of the RFSAP that MSY be the yield resulting from F_{MAX} (RFSAP 2001), and the recommendation of the NMFS Technical Guidance (Restrepo et al. 1998) that F_{OY} be set at 75% of F_{MSY}, the current (1997-99 geometric mean) fishing mortality is only slightly under the overfishing threshold, and an additional 24% reduction in fishing mortality from the 1999 level is needed to achieve the OY target.

Some reduction in gag harvest can be expected to have already occurred as a result of regulations implemented in 2000:

Size limits: The recreational minimum size increase from 20 to 22 inches TL was expected to reduce recreational gag harvest initially by 0%-16.35% depending upon which baseline was used. Using the longest available baseline (1990-98), a 7% recreational reduction was expected, and from the commercial sector, the minimum size increase from

20 to 24 inches TL was expected to reduce commercial gag harvest by 6% (GMFMC 1999). The combined gag harvest reduction was about 6.5%.

Closed Seasons: The commercial February 15 - March 15 closed season was expected to produce an 10% reduction in commercial gag harvest (based on the monthly distribution of gag harvest reported in this amendment). However, observations of harvest during February-March after the closed season was implemented in 2001 compared with 1999-2000 (no closed season) suggest that gag/black grouper harvest during the February-March period actually increased 3% during the February-March period (from a 1999-2000 average of 238.2 metric tons whole weight to 244.5 in February-March 2001). Part of this increase may be due to one or more strong year-classes entering the fishery. However, if the closed season is effective in reducing gag harvest compared to not having the closed season, then the relative proportion of the annual catch that occurs in February-March should be substantially lower after the closed season was implemented than before regardless of the absolute total. A comparison of 1999-2000 (when there was no closed season) with 2001 (closed season in effect) shows that the February-March contribution to the annual red grouper and gag/black grouper harvest was 20% in 1999-2000, and 18% in 2001. Thus relative catch was only 2% less in the year when the February 15-March 15 closed season was in effect. This is a smaller impact than previously estimated (8% for red grouper and 10% for gag/black), and likely reflects the impact of effort shifting to the weeks that were open at the beginning of February and end of March. Consequently, after accounting for observed effort shifting, repeal of the closed season resulted in no more than a 2% decrease in commercial gag/black grouper harvest.

Closed Areas: The area closures of the Steamboat Lumps and Madison/Swanson sites were estimated to reduce commercial gag harvest by about 2% (GMFMC 1999). The impact on the recreational fishery was not estimated, but it would be less than the commercial impact and probably negligible due to the distance from shore of the closed areas.

Based on the above discussion, the cumulative impacts of the 2000 regulations on gag harvest (excluding the closed season) are expected to be 8% commercial harvest reduction and 7% recreational reduction, for an overall reduction (based on a post-1990 commercial:recreational allocation of 43:57) of about 7%.

6.3.3 Combined Commercial and Recreational Proposed Scenarios

Discussion: The combined Commercial and Recreational Proposed Scenarios are projected to produce a 9% reduction in recreational harvest of red grouper, and a 9.4% reduction in commercial harvest. The overall combined reduction is projected to be 9.4%. After three years, the regulations and the status of the stock will be reevaluated.

Reducing the shallow-water grouper quota from 9.35 MP GW to 8.80 MP GW represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest.

The two-fish red grouper recreational bag is projected to reduce recreational red grouper harvest by 9%. However, according to NMFS bag limit analyses done in 2001 on angler trips where red grouper were caught, the average number of red grouper taken per angler

trip was only 1.2 fish, and only 6% of the angler trips caught more than two red grouper[1]. Therefore, this proposal will have little impact on most recreational fishermen.

Taken as a whole, the combined commercial and recreational Proposed Scenarios are projected to reduce red grouper harvest by approximately 9.4%, at least in the first year. After three years, the regulations and status of stock will be reevaluated.

Biological Impacts: On the commercial sector, the Proposed Scenario will reduce the fishing mortality rate of all shallow-water groupers rather than just red grouper since the quota will apply to all shallow-water groupers in aggregate. This will reduce the possibility of effort shifting between shallow-water grouper species. However, the reduced quota could result in some vessels increasing their offshore fishing for deep-water reef fish. Vessels affected by the reduced quota will primarily be larger, longline vessels that are more capable of making the longer trips. The deep-water grouper and tilefish quota proposed elsewhere in this amendment should keep fishing mortality on these species from expanding.

For the recreational sector, the Proposed Scenario will reduce the harvest of red grouper by an estimated 9%. Fishermen affected by the two red grouper bag limit may shift effort to other groupers. However, the two-fish red grouper recreational bag limit will impact only approximately 6% of the recreational red grouper fishermen[2], if the impact on other species will be limited.

Socioeconomic Impacts: The Proposed Commercial Scenario reduces the overall shallow-water grouper commercial quota to account for the required reduction in the red grouper component of the overall quota. Additionally, the proposed quota reduction alternative is estimated to result in a 9.4% reduction in red grouper landings and 6% reduction in gag and black grouper landings, or 8.5% reduction in shallow-water grouper landings. Based on 1999-2001 average landings, these percent reductions translate to reductions of 556 thousand pounds or $1.33 million for red grouper only, 130 thousand pounds or $312 thousand for gag only, or 754 thousand pounds or $1.8 million for the entire shallow-water grouper fishery. Assuming the 1999-2001 average distribution of catches by gear type remains the same, longline vessels would bear approximately 90% of red grouper reductions and 83% of gag reductions, or 89% of all shallow-water grouper reductions. Vertical line vessels would bear none of the red grouper reductions and 17% of the gag reductions, or 5.5% of all shallow-water grouper reductions. Fish trap vessels would bear 10% of red grouper reductions and none of the gag reductions, or 5.5% of all shallow-water grouper reductions.

The Proposed Recreational Scenario reduces the allowable bag limit for red grouper to two fish of the five fish grouper aggregate and is expected to reduce recreational harvest by 9%. This alternative is specific to red grouper such that the reaction of anglers to potential reduction in red grouper harvest may not be in terms of outright trip cancellations. Anglers can switch to other species on a trip once the bag limit is met. In

[1] According to NMFS bag limit analyses conducted in January 2001, out of 629 intercepts where red grouper were landed, 131 (21%) landed more than 1 red grouper, 39 (6%) landed more than 2 red grouper, 20 (3%) landed more than 3 red grouper, and 10 (1.5%) landed more than 4 red grouper.

[2] According to NMFS bag limit analyses conducted in January 2001, out of 629 intercepts where red grouper were landed, 131 (21%) landed more than 1 red grouper, 39 (6%) landed more than 2 red grouper, 20 (3%) landed more than 3 red grouper, and 10 (1.5%) landed more than 4 red grouper.

any event, certain reductions in consumer surplus may arise from this management action, since angler flexibility is being constrained.

For the purpose of determining some general estimates on the magnitude of impacts of this scenario, it is assumed that the reduction in harvest due to the reduced bag limit is comparable to reductions in target trips. Considering, however, that trip cancellations are unlikely, the consumer surplus reduction under a bag limit change may be deemed less than that under closed seasons, even if the amount of harvest reduction happens to be the same. If a 9% reduction in red grouper harvest were to translate to the same percent reduction in red grouper target trips, losses in consumer surplus would amount to $2.2 million. This amount is likely to be an overestimate, since as shown in Table 6.14 a two-fish red grouper bag limit would affect only 6,100 catch trips and catch trips generally exceed target trips as shown in Table 6.8. If the $213 per trip consumer surplus were applied to catch trips affected by the two-fish bag limit for red grouper, consumer surplus loss would only amount to $1.3 million. A comparable reduction in for-hire vessel revenues cannot be estimated for the reason that the bag limit change may not result in trip cancellations. Anglers may lose some benefits from the bag limit change but are still likely to take charter or headboat trips.

6.4 Shallow-Water Grouper Quota

6.4.1 Shallow-Water Grouper Quota Adjustments

The current shallow-water grouper commercial quota is 9.8 MP pounds whole weight, which is equivalent to 9.35 MP GW quota. The options in this section are for GW quotas.

The baseline period used for recent average commercial catch in the following alternatives is 1999-2001. This is a period impacted by the strong 1996 year-class, which will continue to affect the fishery for the next few years. The baseline average harvest levels from which the percent reductions are calculated are:

red grouper	5.86 MP GW (Table 6.3)
gag	2.18 MP GW (Table 6.3)

The initial proposed red grouper ABC for commercial and recreational harvest combined under a three-year interval rebuilding program is 6.56 MP. Using a red grouper species allocation of 81% commercial (based on the 1999-2001 historical allocation, Table 6.3), that equates to a commercial allocation of 5.31 MP. A reduction in commercial red grouper harvest from 5.86 to 5.31 MP represents a red grouper reduction of 9.4%. Since red grouper are only a portion of shallow-water grouper, the percent reduction on the overall shallow-water grouper quota will be different depending on how it is calculated.

<u>Alternative 1</u>: Reduce the shallow-water grouper quota by 1.58 MP GW, from 9.35 to 7.77 MP GW (10% reduction from the 1999-2001 shallow-water grouper average harvest of 8.61 MP).

<u>Alternative 2</u>: Reduce the shallow-water grouper quota by 1.19 MP GW, from 9.35 to 8.16 MP GW (5% reduction from the 1999-2001 shallow-water grouper average harvest of 8.61 MP).

Proposed => **<u>Alternative 3</u>: Adjust the shallow-water grouper quota by an amount equal to an adjustment in the red grouper commercial allocation of TAC (9.4% red grouper reduction from 1999-2001 average).**

Proposed sub-option **Sub-option a: 8.80 MP GW**
Sub-option b: (i) 8.06 MP GW
(ii) 7.43 MP GW
(iii) 7.83 MP GW
Sub-option c: 7.80 MP GW

(See discussion for an explanation of the sub-options)

<u>Alternative 4</u>: Status quo. Retain the existing shallow-water grouper quota of 9.35 MP GW (9.8 MP whole weight).

<u>Discussion</u>: The current shallow water grouper quota is 9.8 MP whole weight, equivalent to 9.35 MP GW. In prior years, the shallow-water grouper quota was set using red grouper as an indicator species for the entire shallow-water grouper aggregate. Since stock assessments were prepared only for red grouper, this approach incorporated the best available scientific information. In 1997 and 2001, stock assessments were prepared by NMFS for gag, and other shallow-water grouper species have been suggested as candidates for future assessments (e.g. black grouper). With multiple species assessments and ABCs, the use of a red grouper ABC alone as the basis for setting the shallow-water grouper aggregate quota is no longer a method that incorporates the best available scientific information.

Quotas for the alternatives were calculated in the following manner:

<u>Alternatives 1 and 2</u>: The last ABC recommendation by the RFSAP for red grouper was made in 1993 (RFSAP 1993). The RFSAP report is not clear on whether these are gutted or whole weight ABCs. Since the stock assessment was done in GW, it is assumed that the resulting ABCs are also in GW. At that time, the ABC (to achieve 20% SPR) was 10.0 - 10.6 MP. It appears that the aggregate shallow-water grouper allocation of 65% commercial was used to determine the red grouper portion of the shallow-water grouper quota. This equates to a commercial red grouper allocation of 6.50 - 6.89 MP. Reducing this allocation to 5.31 MP results in the following reductions needed:

	Alt. 1 Reduce from high end of 1993 <u>allocation</u>	Alt. 2 Reduce from low end of 1993 <u>allocation</u>
1993 commercial red grouper allocation:	6.89 MP	6.50 MP
2003 commercial red grouper allocation:	5.31 MP	5.31 MP
Difference - quota reduction needed:	1.58 MP	1.19 MP

	<u>Alt. 1</u>	<u>Alt. 2</u>
Current shallow-water grouper quota:	9.35 MP	9.35 MP
Quota reduction needed:	1.58 MP	1.19 MP
New shallow-water grouper quota:	**7.77 MP**	**8.16 MP**

Alternatives 1 and 2 use the previous red grouper allocation of TAC rather than the actual harvest levels as the baseline for reducing the quota. Because these alternatives are based

on a paper reference point rather than actual landings, they may not be as appropriate as the remaining alternatives to use as a basis for setting the new quota. They produce results close to the other alternatives because the recent landings have been close to the quota.

Alternative 3 (with sub-options): Alternative 3 is the Proposed Alternative. It is based on achieving a 9.4% red grouper harvest reduction from the 1999-2001 average harvest. The 1999-2001 baseline was felt to be more appropriate than a longer-term baseline due to the recent increase in harvest rates, apparently due to the effect of the strong 1996 year-class. This year-class will likely continue to affect harvest for at least the next few years. There are several sub-options in Alternative 3. They were calculated as follows:

Sub-option a: (Proposed sub-option): This is the most literal interpretation of the Proposed Alternative. It simply reduces the quota by 9.4% of the 1999-2001 average red grouper harvest. In pounds GW, this is a reduction of 0.55 MP, but it leaves an allowable shallow-water grouper harvest level that is 0.19 MP higher than the 1999-2001 average, which will likely be used to make up for some of the reduction of the red grouper allocation.

The 1999-2001 average commercial catch of red grouper:		5.86 MP (Table 6.3)
Remaining portion of current quota:	9.35 - 5.86 =	3.49 MP
Total current shallow-water grouper quota		9.35 MP
The new quota is:		
Red grouper reduced by 9.4%:	0.906 * 5.86 =	5.31 MP
Remaining portion of current quota (from above):		3.49 MP
New shallow-water grouper quota:		**8.80 MP**

The shallow-water grouper harvest during 1999-2001 was, on average, less than the 9.35 MP quota. The 1999-2001 average harvest was 8.61 MP GW, which is 0.74 MP less than the quota. Thus, there is some wiggle room for the harvest to exceed the desired level under Alternative 3(a), and it is less conservative than the other quota alternatives. However, this alternative is the least complicated and easiest calculation for most people to understand.

Sub-option b: This is similar to sub-option a, except that it eliminates the average unused shallow-water grouper quota in addition to reducing the red grouper allocation by 9.4% of the 1999-2001 average harvest. In order to calculate unused quota, it calculates the component of the quota that comprises gag and other groupers. Other groupers are set to their 1999-2001 average harvest.

The gag component of the quota is set in one of three ways, which accounts for the three sub-options:

(i) Set gag to the 1999-2001 average harvest;

(ii) Set gag to the commercial allocation 31% of the 5 MP ABC recommended by RFSAP, using 1986-1989 (pre-regulation) average harvest (Table 6.3) to calculate commercial and recreational allocations;

(iii) Set gag to the commercial allocation 39% of the 5 MP ABC recommended by RFSAP, using 1999-2001 average harvest (Table 6.3) to calculate commercial and recreational allocations.

The 1999-2001 average commercial catch of red grouper:		5.86 MP (Table 6.3)	
The 1999-2001 average commercial catch of gag:		2.18 MP (Table 6.3)	
The 1909-2001 average catch of other groupers:		0.57 MP (calculated)	
The 1999-2001 average unused quota (9.35 - above):		0.74 MP	
Total current shallow-water grouper quota:		9.35 MP	
The new quota is:			
	(i)	(ii)	(iii)
Red grouper reduced by 9.4%:	5.31 MP	5.31 MP	5.31 MP
Gag:	2.18 MP	1.55 MP	1.95 MP
Other groupers:	0.57 MP	0.57 MP	0.57 MP
Do not allocate any unused quota:	0.00 MP	0.00 MP	0.00 MP
New quota:	**8.06 MP**	**7.43 MP**	**7.83 MP**

Sub-option b is a more conservative approach to setting the quota than sub-option a, since it deducts the unused quota when calculating a new quota. Alternative 3(b)(i) leaves the allocation of gag and other grouper harvest at existing levels and only reduces the red grouper portion of the quota (along with eliminating the unused portion). Alternatives 3(b)(ii) and 3(b)(iii) are calculated the same way as Alternative 3(b)(i), except that, in addition to reducing red grouper harvest, they also incorporate a reduction in gag harvest based on the 5 MP GW gag ABC recommended by the RFSAP. Alternative 3(b)(ii) allocates 31% of the gag ABC to the commercial sector (based on the historical 1986-1989 harvests), while Alternative 3(b)(iii) allocates 39% of the gag ABC to the commercial sector (based on the baseline 1999-2001 harvests). These alternatives attempt to achieve multiple objectives (reductions in both red grouper and gag) and are more conservative than most of the other alternatives. However, the calculations are more complicated than for the other alternatives. The Council rejected these alternatives because of their complexity, the focus Secretarial Amendment 1 on red grouper, and the desire to avoid triggering a quota closure except as a last resort.

Sub-option c: This option is the most likely to achieve an actual 9.4% reduction in red grouper harvest, by eliminating the average unused shallow-water grouper quota and then reducing the remaining shallow-water grouper quota by 9.4%.

The new quota is:	
Total shallow-water grouper harvest reduced by 9.4%:	
0.906 * (5.86+2.18+0.57) =	7.80 MP
Do not allocate any unused quota:	0.00 MP
New shallow-water grouper quota:	**7.80 MP**

Sub-option c applies the 9.4% harvest reduction across the board on all shallow-water groupers. However, gag require a different reduction level (10% to 43% reduction to achieve OY, as indicated in the calculations for Alternatives 3(b)(ii) and 3(b)(iii)), and no harvest reduction is currently needed for other grouper. Although this alternative produces a shallow-water grouper quota nearly identical to Alternative 3(b)(iii), it arrives at that quota through a less specific method of calculation. The Council rejected sub-option c for the same reasons discussed for rejecting sub-option b.

Alternative 4 is the status quo alternative. It retains the existing shallow-water grouper quota, and does not impose species TACs or commercial allocations. Management measures implemented elsewhere in this amendment will be designed to maintain red grouper and gag harvests within their ABC ranges, but quota closures will not occur unless the entire aggregate quota is reached.

Biological Impacts: Alternatives 1, 2 and 3 reduce the shallow-water grouper quota which will reduce fishing mortality on all shallow-water grouper species. Given that only red grouper in the shallow-water grouper aggregate is classified as undergoing overfishing, this could be considered conservative and pro-active with regard to the other species. However, the shallow-water grouper quota has been filled once in recent years, and these adjustments increase the likelihood of that happening. Once there is a quota closure, there is a danger of a derby fishery developing in subsequent years, as has occurred with red snapper. However, the SEFSC has developed a quota monitoring system for shallow-water and deep-water groupers, similar to that for red snapper, that should make quota monitoring for these species more efficient and will decrease the probability of quota overages occurring.

Alternative 4 is status quo. Under this alternative there will be no reduction in fishing mortality through the use of quota closures. If management measures are successful in reducing the fishing mortality rate to a level consistent with the ABC ranges, the quota will not be filled and will have no biological impact. If management measures are not successful in reducing the fishing mortality rate to a level consistent with the ABC ranges, the quota will allow overfishing to occur. However, compared to having no quota, it will limit the potential rate of overfishing by providing a stop to grouper fishing if and when it is reached, although at a fishing mortality rate above the overfishing thresholds.

Socioeconomic Impacts: Alternative 4 is the status quo, which specifies a commercial shallow-water grouper quota of 9.35 MP. Alternative 1 would reduce this quota to 7.77 MP while Alternative 2 would reduce the quota to 8.16 MP. Alternative 3 would reduce the quota to as low as 7.43 MP to as high as 8.80 MP. Alternative 3, Sub-option a, which provides for an 8.80 MP quota is the Council's Proposed Alternative.

Relative to the current shallow-water grouper quota of 9.35 MP, the various quota alternatives would result in the following quota reductions: 17% under Alternative 1, 13% under Alternative 2, 9.4% under Alternative 3-a (Proposed Alternative), 14% under Sub-option b(i) of Alternative 3, 21% under Sub-option b(ii) of Alternative 3, 16% under Sub-option b(iii) of Alternative 3, and 17% under Sub-option c of Alternative 3. However, relative to average commercial landings of shallow-water grouper in the 1999-2001 period, these reduced quotas would amount to a 10% reduction for Alternative 1, 5% reduction for Alternative 2, and 0% reduction for the Council's proposed sub-option under Alternative 3. The other sub-options for Alternative 3 would reduce landings ranging from 5% to 14%.

Over the short-run, the relevant expected reductions are more likely those with respect to landings in the last three years (1999-2001). Thus, the potential reductions in landings would range from zero to 14% under the various alternatives. The Proposed Alternative is very close to the average landings in the last three years so that it may not result in any landings reductions of shallow-water grouper. Using these percent reductions, Alternative 1 would reduce total landings by 0.84 MP or $2.0 million of ex-vessel revenues while Alternative 2 would reduce total landings by 0.45 MP or $1.1 million in ex-vessel

revenues. Reductions under Alternative 3 range from zero under the Proposed Alternative to 1.18 MP or $2.8 million in ex-vessel revenues under Alternative 3(b)(ii).

Of particular importance in any quota reductions that would actually be binding in terms of actual landings being projected to exceed the quota is the possibility of an early closure. Faced with an early closure in one year, fishermen may be expected to fish harder in subsequent fishing years, resulting into an ever shortening season. This derby-like attitude was experienced in the commercial red snapper fishery when the quota was initially lowered in 1991 from 3.1 MP to 2.04 MP. Fishing days dropped from 365 in 1990 to 236 in 1991, and to 52 in 1992 before a quota increase through an emergency action allowed 42 additional fishing days. Subsequent quota increases mitigated somewhat the derby effect, but as fishermen adapted to higher quotas, additional regulatory fixes had to be adopted to address the derby issue. To this day, no effective solution to the derby problem in the red snapper fishery has been instituted although an IFQ-type solution is currently being considered. The derby in the red snapper resulted, among others, in supply gluts and low ex-vessel prices. Waters (2002) estimated that for the period 1996-1999 commercial red snapper fishermen generated $35.6 million in revenues and might have forgone an additional $17.3 million due to the derby condition in the fishery.

The impacts of the various quota alternatives would partly depend on the type of measures adopted to control the harvest of red grouper to the commercial allocation of the TAC. If the red grouper commercial quota is explicitly specified as a quota and thus the fishery is closed upon reaching the quota, a derby in the red grouper fishery may ensue. If only the red grouper fishery is closed by then, fishermen can shift part of their effort to target other groupers. This may not necessarily result in early closure of the shallow-water grouper if the extra effort expended on red grouper during the open season were originally directed at other groupers. If closure of the red grouper segment also means closure of the entire shallow-water grouper fishery, then a derby may be expected in both the red grouper and other grouper fisheries, along with a subsequent reduction in vessel revenues and profits.

Another scenario that may occur is that the red grouper quota is not explicitly specified so that no red grouper quota closures occur. But to control the harvest of red grouper other measures considered in this amendment, such as red grouper seasonal closures or red grouper trip limits, etc., may have to be adopted. If these measures force fishermen to target other grouper species, then early closures in the other grouper fisheries may occur, eventually leading to a derby in those fisheries. Thus, it is possible that a derby in the other grouper fisheries may occur even if there is no derby in the red grouper fishery.

Considering that the other proposed actions (other than quotas) in this amendment, such as the shallow-water grouper trip limit, would affect the harvest of all shallow-water groupers, the occurrence of a derby would depend on the level of total shallow-water grouper established relative to the expected harvest under the proposed actions in this amendment. In the particular case of the shallow-water grouper trip limit, the expected harvest reduction is approximately equal to the proposed reduction in the shallow-water grouper quota. If this measure were truly effective, the potential for the reduced quota to be exceeded appears to be less likely. Further, if a red grouper or shallow-water grouper quota is approved as a method of reducing fishing mortality, trip limits would serve only to slow down but not actually reduce overall fishing mortality, per se, as additional trips may be made with an accompanying increase in fishing effort. Thus, the need for quotas to fully constrain harvest. Trip limits, however, may be useful to prolong part of an annual fishing season once a "quota trigger" such as the one proposed in the commercial

scenario, has been reached. Further, trip limits may also be useful if a derby fishery for either the shallow-water grouper or red grouper fisheries results from establishment of their respective quotas.

In terms of initial impacts, quota adjustment and closures, unlike a uniform trip limit, would not impose a regulatory bias in negatively affecting the various commercial participants. The eventual outcome during the rebuilding period would depend on the ability of various commercial fishing entities to adapt to the reduced quota and other measures proposed in this amendment.

6.4.2 Shallow-Water Grouper Quota Actions

Note: Alternative 3 can be adopted concurrently with either Alternative 1 or 2.

Alternative 1: When the commercial allocation of red grouper is reached, the commercial fishery for red grouper will close. The remaining shallow-water grouper species can continue to be harvested until the shallow-water grouper aggregate quota is reached.

Alternative 2: When the commercial allocation of red grouper is reached, the commercial fishery for red grouper will close. In addition, all commercial shallow-water grouper fishing will close:

a. in waters south and east of 85º30' west longitude (near Cape San Blas, Florida)
b. in waters south of 23º north latitude (Tampa)
c. throughout the Gulf of Mexico EEZ

Alternative 3: If the commercial allocation of red grouper has not been filled when the shallow-water grouper aggregate quota is reached, continued harvest of red grouper is allowed until the allocation is reached.

Alternative 4: Status quo. The commercial fishery for shallow-water grouper will close when the aggregate quota is reached.

Proposed => **Alternative 5: The commercial shallow-water grouper fishery will close when: 1) the commercial quota of red grouper (5.31 MP) is reached; or 2) the commercial shallow-water grouper aggregate quota (8.80 MP) is reached; which ever occurs first.**

Discussion: These alternatives determine whether the commercial red grouper quota is effectively treated as a single species quota or as part of an aggregate quota, and provides ways to both allow or halt fishing for other shallow-water grouper species when the red grouper quota is reached, while minimizing red grouper fishing and bycatch mortality.

Alternative 4 is the simplest to implement. It is a less precise management measure than the other alternatives, since the proportion of quota that each grouper species comprises can change, but it minimizes bycatch mortality that may occur when fishing while some species are open and others are closed.

Biological Impacts: Alternative 1 essentially treats red grouper as a separate quota. Allowing the remaining shallow-water grouper fishery to continue will result in bycatch

mortality of red grouper in areas where red grouper occur along with other grouper species.

Alternative 2 is a modification of Alternative 1, when the red grouper quota is filled before the shallow-water grouper quota, it allows the remaining shallow water grouper to be caught but only in areas where the red grouper stock is scarce or nonexistent. Suboption (a) closes the waters where 98% of the red grouper are caught, but also closes the area between 85º30' west longitude (near Cape San Blas, Florida) and 28º north latitude (Tampa Bay), where a large amount of gag are caught. Suboption (b) results in allowing harvest where some red grouper occur, but it allows continued access to gag throughout the gag range. Suboption (c) closes the entire Gulf to shallow-water grouper harvest when the red grouper commercial quota is filled. This is the more conservative alternative than Alternative 1, but may result in the shallow-water grouper quota never being filled due to a red grouper commercial quota closure. In effect, it puts all shallow-water grouper on a rebuilding plan whether they need it or not.

Alternative 3 attempts to address the reverse situation, that of the shallow-water quota being filled before the red grouper quota is taken. This alternative closes all shallow-water grouper to commercial fishing except red grouper until the red grouper quota is filled. However, since red grouper is part of the shallow-water grouper aggregate, this alternative results in the aggregate quota being exceeded, and it is the most risk-prone alternative in this section.

Alternative 4, status quo, is the simplest to implement. The entire shallow-water grouper aggregate is managed as a group with all species open or closed. If the grouper quota is exceeded, then management measures can be adopted to change the proportion of red grouper to other groupers in the shallow-water grouper catch.

Alternative 5 is a modification of Alternative 2 suboption (c), and closes the commercial shallow-water grouper fishery when either the commercial quota of red grouper (5.31 MP GW) is reached or the commercial shallow-water grouper aggregate (8.80 MP) is reached; which ever occurs first. The red grouper stock is undergoing overfishing and management measures are needed to end overfishing and rebuild the red grouper stock. Thus, the rebuilding plan seeks to achieve approximately a 9.4% reduction in total red grouper harvest by reducing the red grouper harvest from the 1999-2001 average commercial catch (5.86 MP) to 5.31 MP, and specifies this as an quota for the commercial sector. Closure of the fisheries when either the shallow-water grouper aggregate quota or the red grouper commercial quota is reached may result in one or the other not being filled. However, these actions will reduce the fishing mortality rate on red grouper and perhaps other shallow-water grouper species such as gag; allows the red grouper stock to rebuild; and reduces bycatch mortalities on the shallow-water grouper and red grouper stocks when the fisheries are closed simultaneously.

Socioeconomic Impacts: Alternative 4 is the status quo. This alternative maintains an aggregate shallow-water grouper quota, with closure in the fishery when the quota is reached. Alternatives 1, 2 and 5 essentially specify a separate red grouper commercial quota. Alternative 1 specifies a closure when the red grouper quota is reached but allows the other shallow-water grouper segments to remain open until the aggregate quota is reached. Alternative 2 modifies Alternative 1 by specifying fishing closure for other shallow-water grouper only on certain areas when the red grouper quota is reached. Alternative 3 allows continued harvest of red grouper until its commercial quota is filled even if the aggregate shallow-water grouper quota is already filled. Alternative 5

closes the commercial shallow-water grouper fishery when either the commercial quota of red grouper (5.31 MP) is reached or the commercial shallow-water grouper aggregate quota (8.80 MP) is reached; which ever occurs first.

To the extent that Alternatives 1, 2, 3, 4, and 5 complement the previous section's alternatives, the nature of impacts would be similar to that described in the previous section, with certain additions. Alternative 1 would likely result in more discards of red grouper than Alternative 2, but at the same time it would result in lesser negative short-term socioeconomic impacts on the commercial fishery, since vessels are allowed to move into another closely related fishery. Within Alternative 2, suboption (b) offers a better balance in conserving the red grouper stock and minimizing the negative short-term socioeconomic impacts on the fishery. Alternative 3 would cushion the impacts of a lower shallow-water grouper aggregate quota, but at the same time would allow the aggregate quota to be exceeded. This would happen mainly when there is a significant shift in effort from red grouper to other groupers in the complex.

Assuming that the only major measures adopted are quotas and quota closures and assuming further that the relevant quota alternatives are as enumerated under Section 6.5.1, Alternative 1 would result in short-term revenue losses of $0.82 million at the commercial red grouper quota of 5.31 MP. As noted earlier, a derby condition may develop in the red grouper fishery and thus eventually would increase the revenue loss due to price depression, but this would be partially mitigated by the fact that vessels can still target other species in the grouper complex. The magnitude of this partial mitigation would depend on the level of shallow-water grouper established. That is, the adverse impacts of a red grouper commercial quota closure would be cushioned more under an 8.80 MP than under a 7.43 MP shallow-water grouper quota. Naturally, the cushion would be higher under the status quo aggregate quota of 9.35 MP. Under Alternative 1, a relatively greater proportion of the landings and revenue reductions would be borne by longline fishermen, since they have historically accounted for a greater share of the total commercial red grouper landings.

There are two general scenarios that may happen under Alternative 2, each of which would likely result in exacerbating the negative impacts of Alternative 1. First, the quota for (other than red) all shallow-water groupers would be caught at the same time as, or earlier than, that for red grouper. Second, some other shallow-water grouper quota remains unharvested when the red grouper commercial quota is met. In the first scenario, it appears unlikely that fishermen would harvest other groupers first before red grouper just to keep the fishery open for a longer period since a reduced red grouper commercial quota would induce a race to catch the species, unless it is done with cooperation from most, if not all, red grouper fishermen. The most likely case then under the first scenario is that the quota for all other shallow-water grouper species would be caught at the same time as the commercial quota for red grouper. When this happens, not only will there be a supply glut for red grouper but also for other groupers, thus depressing the prices for all shallow-water groupers. Ironically, price depression under the scenario described would be particularly severe with a higher quota, such as 8.80 MP. In this case, overall revenues from both red grouper and other shallow-water groupers would be depressed. The amount of total revenue reductions cannot be estimated in the absence of actual estimate of the length of the season and price flexibilities for red grouper and other shallow-water groupers.

Under the second scenario for Alternative 2, the amount of additional revenue reductions would depend on, among others, the amount of the other shallow-water grouper quota that

remains unharvested once the red grouper commercial quota is reached. Under a 5.31 MP red grouper commercial quota and a shallow-water grouper quota that ranges from 7.43 MP to 8.8 MP (see Section 6.4.1), the only time the second scenario for Alternative 2 occurs is when the rate of harvest for other shallow-water groupers is significantly lower than that for red grouper. The likelihood of this happening cannot be ascertained. It only remains to state that the potential harvest and revenue reductions would be mitigated if the closures apply only to certain areas in the Gulf, as in Sub-options (a) and (b) of Alternative 2.

Among the alternatives in this section, Alternative 3 has the least short-term negative impacts on fishery participants. In fact, there is a possibility that this alternative would lead to increased harvest beyond the current shallow-water grouper quota of 9.35 MP. This happens if fishermen concentrate their effort first on other shallow-water grouper and later on red grouper.

The impacts of Alternative 4 (status quo) would depend on the established shallow-water grouper quota. These impacts are similar to those discussed in Section 6.4.1.

Under Alternative 5, the red grouper commercial quota is more likely to be reached first than the shallow-water grouper quota. On average for 1999-2001, cumulative landings of red grouper were 5.01 MP by the end of October and 5.52 MP by the end of November (Table 10). Hence, the 5.31 MP for red grouper would be reached by approximately mid-November. Similarly, cumulative landings of all shallow-water groupers were 8.2 MP by the end of November and 9.0 MP by the end of December, and the 8.80 MP quota would be reached in late December. Thus, the proposed commercial quota for red grouper is more restrictive than that for all shallow water groupers; that is, the quota for red grouper, rather than the quota for all shallow water groupers, would trigger a closure.

The economic effect of a mid-November closure of the shallow water grouper fishery is calculated as the change in net operating income, defined as trip revenues minus trip costs exclusive of captain and crew shares. Hence, it is a measure of the combined income to boat owner, captain and crew after payment of shared expenses but prior to payment of fixed costs by the boat owner and any operating costs incurred by owner, captain or crew that were not shared.

Results by primary gear type are presented in Table 11. Fishermen are expected to lose approximately $1.74 million per year, including $1.02 million for boats with bottom longlines, $0.62 million for boats with vertical lines, and $0.11 for boats with other gears. The fishery would close in mid-November, with fishermen landing 5.31 MP of red grouper and approximately 7.9 MP of shallow water groupers. Thus, the estimated reduction in landings would be approximately 1.11 MP of shallow-water groupers, including approximately 0.74 MP of red grouper.

A fishery-wide quota and closure primarily would affect fishermen who use bottom longlines because they account for the largest share of industry landings (Table 11). On average for 1999-2001, fishermen with bottom longlines landed 3.55 MP of red grouper and 4.48 MP of shallow-water groupers. A mid-November closure, based on 1999-2001 average landings, would halt the shallow water grouper fishery after longliners would have landed approximately 3.03 MP of red grouper and 3.84 MP of shallow-water groupers. Therefore, the estimated reduction in landings for bottom longliners would be approximately 0.52 MP of red grouper and 0.64 MP of shallow-water groupers.

Without quota management, boats with bottom longlines landed, on average, 59% of the total red grouper harvest and 50% of the total shallow-water grouper harvest. With the proposed quotas, boats with bottom longlines would land 57% of the total red grouper harvest and 49% of the total shallow-water grouper harvest. Bottom longliners would incur a disproportionate share of the total estimated reduction in landings of shallow-water groupers because monthly landings during the October through December period are greater than average. On the other hand, monthly landings during the October through December period are less than average for boats with vertical lines, fish traps and other gears.

Data averaged for 1999-2001 indicates that boats with bottom longlines normally take approximately 165 trips after the closure date and catch groupers primarily, with only small quantities of other species (Table 12). A closure in mid-November is estimated to eliminate all but 24 trips that generate enough revenue from other species to cover their routine trip costs. As a result, boats with bottom longlines are predicted to lose about 92% of the net operating incomes that would ordinarily be earned during the closed period, and about 11% of total annual net operating incomes.

A fishery-wide quota and seasonal closure also would affect fishermen who use vertical lines (Table11). On average for 1999-2001, fishermen with vertical lines landed 1.58 MP of red grouper, 1.21 MP of gag and 3.48 MP of shallow-water groupers. They would land approximately 3.09 MP of shallow-water groupers, including 1.42 MP of red grouper, before the fishery would close in mid-November, based on average landings from 1999-2001. Therefore, the estimated reduction in landings for fishermen with vertical lines would be approximately 0.39 MP of shallow-water groupers, including 0.16 MP of red grouper.

From mid-November through the end of the year, net revenues to boat owners, captains and crews are predicted to be approximately $1.27 million without quotas and $0.65 million with quotas and closures (Table 12). Hence, boats with vertical lines are predicted to lose about 49% of the net operating incomes that would ordinarily be earned during the closed period, and about 4% of total annual net operating incomes. As a group, boats with vertical lines would be relatively less affected by a mid-November closure than boats with bottom longlines because the closure would occur at a time of year with slightly below average monthly landings of shallow-water groupers, and because the group includes most of the trips that normally catch shallow-water groupers in the northern Gulf where they are not the predominant species. Shallow-water groupers do not represent the primary source of revenue for many of these trips; hence a closure may not cause them to be cancelled. For example, about 72% of trips during the closure with vertical lines would be cancelled, whereas about 85% of trips with bottom longlines would be cancelled. It is assumed that trips taken during the closure would catch shallow-water groupers at the same rate as without a closure, but that they would be discarded.

A fishery-wide quota and seasonal closure would have less of an effect on fishermen who use fish traps and other gears (Table 11). On average for 1999-2001, fishermen with fish traps landed 0.89 MP of red grouper and 0.94 MP of shallow-water groupers, with the bulk of their catches occurring between May and September during the closed season for stone crabs. Fishermen with fish traps would land approximately 0.84 MP of shallow-water groupers before the fishery would close in mid-November, based on average landings from 1999-2001. Therefore, the initial estimated reduction in landings for fishermen with fish traps would be approximately 0.05 MP of shallow-water groupers, or about 5.6% of their 1999-2001 average landings. On average between 1999 and 2001,

fishermen who used other gears landed 0.10 MP of shallow-water groupers, of which approximately 0.09 MP would be landed prior to a mid-November closure. The expected reduction in landings of shallow-water groupers would be 0.01 MP, or approximately 10% of the 1999-2001 average.

Results by area are presented in Tables 13 and 14. Fishermen are expected to lose approximately $1.74 million per year, including $1.26 million for boats in west-central Florida, $0.34 million for boats in northwest Florida, and $0.14 for boats in other areas.

Boats that fish off the west-central coast of Florida would incur the greatest economic effect (about $1.26 million annually) from a mid-November closure of the shallow-water grouper fishery because that is where red grouper primarily exist (Tables 13-14). On average for 1999-2001, fishermen landing their catches between NMFS areas 3 and 6 (approximately Collier through Citrus Counties) landed 6.65 MP of shallow-water groupers, including 5.03 MP of red grouper and 1.08 MP of gag. A mid-November closure, based on 1999-2001 average landings, would reduce landings of shallow-water groupers by approximately 0.81 MP, including 0.59 MP of red grouper. Boats in west-central Florida are predicted to lose about 94% of the net operating incomes that would ordinarily be earned during the closed period, and about 10% of total annual net operating incomes.

Smaller quantities of red grouper, gag and other shallow-water groupers are landed elsewhere in the Gulf of Mexico (Tables 13-14). Fishermen between NMFS areas 7 and 10 (approximately Levy County, Florida through Mobile Bay, Alabama) would lose about $0.34 million per year. They landed, on average from 1999-2001, 1.80 MP of shallow-water groupers. A closure of the shallow-water grouper fishery in mid-November would reduce landings by 0.23 MP. Fishermen in the Florida Keys would lose about $0.08 million per year. They landed, on average, 0.34 MP of shallow-water groupers, of which approximately 0.04 MP normally would be landed after the expected closure date in mid-November. Fishermen in the rest of the Gulf of Mexico would lose about $0.06 million per year. They averaged 0.21 MP of shallow-water groupers, of which 0.3 MP normally would be landed after mid-November.

These estimates assume that fishing patterns with quota management would remain the same as without quota management. However, quota management creates incentives for fishermen to accelerate their fishing activities to maximize their shares of the quota before the fishery is closed. Fishermen know that catches that normally would occur after the expected closure date will be lost. Therefore, they probably will plan trips earlier in the season to beat the closure, which results in an earlier-than-expected closure date and could lead to derby fishing when the fishery opens again. There is no formula with which to quantify the likelihood that a derby fishery will occur. Each individual's response to quota management depends on what he thinks his competitors will do. However, fishermen are capable of fishing more intensively if they believe it necessary to stay competitive. If a derby occurs, fishermen who fail to join the race for fish end up with smaller overall catches before the quota is reached and the season is closed. Fishermen compete in the race for fish by investing in additional electronics and more efficient gear designed to reduce search time and increase catches per day fished. Also, they may fish in poor weather and skimp on regular maintenance and repair schedules, which increases the likelihood of engine and gear breakdowns, accidents and injuries. The result is ever-shorter open seasons, higher harvesting and ownership costs to catch the same overall quantity (as defined by the quota), a deterioration in overall level of safety in fishing operations, market gluts because the entire season's landings are no longer spaced

throughout the year, and lower ex-vessel prices. Consumers benefit from lower fish prices during the derby. However, traditional marketing channels are interrupted by a closure, with the break in supplies of fresh fish mitigated by increased reliance on frozen fish or imports during the closed season.

The economic inefficiencies of quotas will become more acute over time if management is successful biologically in augmenting the stocks of shallow-water groupers. Larger fish populations yield higher catch rates, which enable fishermen to fill the quota more quickly which, in turn, accentuates the need to race for fish before the season is closed. Higher catch rates also tend to attract additional fishing effort from other fisheries, which further exacerbates the likelihood of derby fishing.

6.5 Additional Alternatives to Reduce Fishing Mortality

6.5.1 Commercial Shallow-Water Grouper Closed Seasons

<u>Alternative 1</u>: Set March 1 - May 31 (in place of the February 15-March 15 closed season) as the commercial closed season for

1) red grouper, gag and black grouper; or

2) all shallow-water grouper

impact by weight on commercial catches compared to the 1999-2001 base period is:

Red	Gag	Black	All shallow-water grouper
23%	33%	23%	26%

<u>Alternative 2</u>: Set the commercial closed season for:

1) red grouper, gag and black grouper; or

2) all shallow-water grouper

as some combination of months. The closed months (and percent impact by weight on commercial catches compared to the 1999-2001 base period) are:

		Red	Gag	Black	All shallow-water grouper
a.	January	7%	12%	9%	8%
b.	February	7%	9%	10%	7%
c.	March	7%	9%	7%	7%
d.	April	7%	12%	6%	9%
e.	May	9%	12%	10%	10%
f.	June	11%	8%	8%	10%
g.	July	10%	6%	7%	9%
h.	August	10%	5%	6%	9%
i.	September	6%	4%	6%	6%
j.	October	8%	7%	6%	7%
k.	November	9%	8%	11%	9%
l.	December	9%	9%	14%	9%

<u>Alternative 3</u>: Repeal the February 15-March 15 closed season. Analyses is based on the revised base years of 1999-2001 (the years impacted by the 1996 year-class). A comparison of 1999-2000 (when there was no closed season) with 2001 (closed season in effect) shows that the February-March contribution to the annual red grouper and gag/black grouper harvest was 2% less in the year when the February 15-March 15 closed season was in

effect. This is a smaller impact than previously estimated (8% for red grouper and 10% for gag/black), and likely reflects the impact of effort shifting to the weeks that were open at the beginning of February and end of March. Consequently, after accounting for observed effort shifting, repeal of the closed season could result in a 2% increase in commercial red grouper and gag/black grouper harvest.

Proposed=> **Alternative 4: Status quo - Retain the February 15-March 15 commercial closed season on red grouper, gag, and black grouper. Based on the revised base years of 1999-2001, and a comparison of 1999-2000 (no closed season) with 2001 (closed season in effect), the percent impact by weight on commercial catches:**

Red	Gag	Black	All shallow-water Grouper
2%	2%	2%	2%

Discussion: Spawning seasons for shallow-water and deep-water grouper species are as follows.

Shallow-water grouper spawning seasons:

Species	Peak season	Total season
Red grouper	April-May	December-July
Gag	February-March	December-May
Black grouper	unknown*	October, December-March
Yellowmouth grouper	March-May	January-December
Yellowfin grouper	unknown*	March, May-August
Scamp	unknown*	March-May
Red hind	unknown*	April, June-August
Rock hind	unknown*	January-June

Deep-water grouper spawning seasons:

Species	Peak season	Total season
Yellowedge grouper	May-September	January-October
Warsaw grouper	unknown*	August-September
Snowy grouper	unknown*	April-August
Misty grouper	unknown*	July-November
Speckled hind	unknown*	August

* Little information is available on spawning seasons with an asterisk. The seasons given are best estimates from limited data, peak season is unknown.

Spawning seasons for grouper species caught in the Gulf of Mexico are presented graphically in Figure 4.

The February 15-March 15 closed season took effect in 2001. It was originally projected to reduce red grouper harvest by 8% and gag/black grouper harvest by 10% (based on the relative monthly landings during 1996-1999), and to provide protection for gag spawning aggregations during a portion of their peak spawning season. However, the number of bandit gear vessel trips in February 2001 was double that of February 2000 and 1999, despite the season being open for only half of the month. Bandit trips in April and May were also more than double those of the same months in 2000 and 1999. Longline vessel trips also increased in the months surrounding the closed season, though not to as great an

extent[3]. In addition, landings may be increasing due to the increasing impact of the 1996 red grouper year-class, of which individual fish started to become large enough to enter the fishery about 1999.

Biological Impacts: In Alternatives 1 to 3, the percent harvest values given represent the recent historical (1999-2001) proportion of the catch during each period. This is a period that is impacted by entry of the strong 1996 red grouper year-class into the fishery. Since the 1996 year-class is expected to continue to make its presence felt for several more years, using this period as a baseline for evaluating management actions over the next few years makes more sense than using the previous 1996-1999 baseline, which did not include a strong year-class for most of the time period. These years can serve as guidelines for estimating reductions in harvest from closed seasons. However, effort shifting to the open season will reduce the overall impact of a closed season. Therefore, the numbers in Alternatives 1 and 2 should be regarded as high-end estimates of the actual reduction that will be achieved. Many species form aggregations and are more vulnerable to fishing during the spawning season, spawning seasons are often a proposed time for setting closures. These are frequently the months when there is increased harvest, though that is not always the case (e.g., red grouper). One conservation group, Reefkeeper International, has recommended that the Council consider a spawning season closure for the shallow-water grouper aggregate of February-March (2 months), February-May (4 months), or January-June (6 months).

Lengthening the closed season (Alternatives 1 and 2) may increase its effectiveness, since it would be more difficult for fishermen to shift the entire displaced effort. However, since some effort shifting will occur, the monthly percent impacts in Alternative 2 are still likely overestimates

Observations of harvest during February-March after the closed season was implemented in 2001 compared with 1999-2000 (no closed season) suggest that red grouper harvest during the February-March period decreased 44% during the February-March period (from a 1999-2000 average of 504.6 metric tons whole weight to 281.5 in February-March 2001). However, total annual commercial red grouper landings were nearly unchanged (from an annual average of 3162 MT whole weight in 1999-2000 to 3160 MT whole weight in 2001). The February-March contribution to the annual red grouper harvest was 16% in 1999-2000, and 14% in 2001. Thus relative catch was only 2% less in the year when the February 15-March 15 closed season was in effect.

Part of the reason for implementing the February 15-March 15 closed season was to reduce fishing mortality on gag. Gag/black grouper harvest during the February-March period actually increased 3% during the February-March period (from a 1999-2000 average of 238.2 metric tons whole weight to 244.5 in February-March 2001). Part of this increase may be due to one or more strong year-classes entering the fishery. A comparison of 1999-2000 (when there was no closed season) with 2001 (closed season in effect) shows that the February-March contribution to the annual gag/black grouper harvest was 20% in 1999-2000, and 18% in 2001. Thus relative catch was only 2% less in the year when the February 15-March 15 closed season was in effect. This is a smaller impact than previously estimated (8% for red grouper and 10% for gag/black), and likely reflects the impact of effort shifting to the weeks that were open at the beginning of

[3] Trip estimates are from Tables “Figure Effort 1" and “Figure Effort 2" in the NMFS August 2001 Supplemental Analyses and Updated Information in Support of Draft Amendment 18 to the Gulf Reef Fish Fishery Management Plan.

February and end of March.

It should be noted, however, that whether these reductions in catch in red/gag/black grouper fisheries accurately depicts the effects of the closed season is difficult to ascertain. Reductions or increases in harvest levels are also influenced by external factors including the magnitude of imports, local market conditions, cost of fuel and weather, all of which could have affected fishing effort in the commercial sector.

Additionally, repealing the February 15-March 15 closed season (Alternative 3) will result in loss of protection for spawning aggregations of gag, which peak in February and March. The commercial closed season on red grouper, gag and black grouper was first implemented in the 2001 fishing season to provide protection for the spawning stock and reduce harvest of these species. Gag in the Gulf of Mexico spawn from December through mid-May, with a peak in February through March (Koening et al. 1996). Koening et al (1996) suggested that fishing activities on the spawning aggregations may be responsible for changes in the population size and sex-ratio. This suggestion is supported by observations of other researchers who reported that hook-and-line fishing on gag (and scamp) spawning aggregations tended to select males before females (Gilmore and Jones 1992; C. Koening, personal communications, 1996). Red and black grouper spawning stock will also receive some protection. Peak spawning for black grouper occurs from December to March (Crabtree and Bullock 1998). While peak spawning of red grouper (April and May) occurs after the proposed closure period, some red grouper are in spawning condition as early as March (Bullock and Smith 1991).

The Florida Fish and Wildlife Conservation Commission (FWCC) has expressed concern that the closing and re-opening dates for the status quo commercial closed season of February 15-March 15 creates confusion and enforcement problems, since a similar closed season on the Atlantic coast starts at the beginning of a month, rather than the middle. If a one-month closed season is retained, FWCC recommended that the dates be changed to March 1-March 31 (i.e., Alternative 2(2)(c)).

Further red grouper are classified as undergoing overfishing NMFS. Gag were classified as approaching an overfished condition, but based on analyses in 2001 that suggested that gag were no longer approaching an overfished condition, gag were reclassified in 2002 to be neither overfished nor undergoing overfishing. However, OY is not yet being achieved for gag, and will require a reduction in fishing mortality. Reductions in harvest are needed to stop overfishing in red grouper, achieve OY in gag, and to begin a red grouper recovery program. Alternatives 1, 2 and 4 will reduce harvest of red grouper, gag, and other shallow-water grouper. The percentages for Alternatives 1 and 2 provide high-end estimates of the potential reduction for any combination of sub-options. The percentages in Alternatives 3 and 4 are based on actual observations of the impact of the February 15-March 15 closed season, and as such incorporate the effect of effort shifting. However, the observed impacts are based on just a single year of the closed season being in effect, and due to changing effort and stock size, changes in annual harvest are not readily apparent from the closed season.

Selecting the sub-option for "all shallow-water grouper" over "red grouper, gag, and black grouper" will apply the closed season to a broader range of species, and may reduce bycatch mortality of red grouper, gag, and black grouper from fishermen targeting the remaining shallow-water groupers. Closed seasons that correspond to all or part of the spawning seasons could, for some species, improve spawning success by avoiding the disruption of spawning behavior. Since many species aggregate and are more vulnerable

to fishing during spawning season, these are often the months when the greatest reduction in harvest can be achieved through closures. Alternative 3 (no closed season) would eliminate any reduction (minimum 2%) in harvest achieved though the existing one-month closed season. For this alternative to be viable, given the requirement to develop a red grouper rebuilding plan, reductions in harvest would need to be accomplished though other management measures.

The red grouper TAC and management measures are to be re-evaluated every three years under the proposed rebuilding strategy. This means that subsequent assessments will be able to evaluate the actual impact of the closed season and other actions and adjust the TAC for the next three years accordingly. Therefore, over the course of the entire rebuilding plan, effort shifting will be accommodated in the management actions.

Socioeconomic Impacts: Table 6.7 provides some information on monthly operations of reef fish vessels landing red grouper, gag, or black grouper. Trips are number of trips landing any of the three species; lbs. are thousand pounds (GW) landed of the combined three species; and, $ are the dockside revenues in thousand dollars for the three species combined.

Table 6.7 shows the number of trips, pounds landed, and dockside revenues that would be lost to the reef fish vessels if certain months of the year are closed to commercial shallow-water grouper fishing, in the absence of effort shifting. In the case for example of Alternative 1, which closes the fishery for the months of March through May, reef fish vessels would stand to lose about 1.7 MP of red grouper, gag, and black grouper valued at about $3.7 million in dockside revenues. About 2,926 trips would be affected. For longline vessels only, the losses would be about 878 thousand pounds of the three species valued at $1.9 million, and 368 trips would be affected. For vertical line vessels only, the losses would be about 672 thousand pounds valued at $1.5 million, and about 2,290 trips would be affected. Since a February 15-March 15 closure is now in place, losses from this closure should be subtracted from those of the March-May closure. Assuming that losses from this one-month closure can be approximated by the average of February and March figures, net losses from the March-May closure would be about 1.2 MP in landings, $2.6 million in dockside revenues and 1,975 in trips for all reef fish vessels. Corresponding net losses to longline vessels only would be about 581 thousand pounds, $1.3 million, and 252 trips. Corresponding net losses to the vertical line vessels would be 480 thousand pounds in landings, $1.05 million in dockside revenues, and 1,520 in trips.

If effort is to be shifted from the closed months to the open months, about 2,926 vessel trips (or about 1,975 net trips) would have to be spread around. In the event that effort is successfully shifted in terms of offsetting most, if not all, of forgone landings, there is a high likelihood that prices in those open months would decline. Thus, even in the case where total landings are effectively maintained at levels before the closure, it would be unlikely for the forgone dockside revenues to be fully recouped. During the closed months, prices for groupers may be expected to increase. The extent of such price increase would depend partly on the supply of substitutes, particularly imports. It has been reported, partly through public testimonies before the Council, that during the February 15-March 15 red grouper and gag closure, local supply was augmented by imports.

Table 6.11 presents some information on monthly importation of snappers and groupers (all species combined) into the southeastern U.S. Grouper imports range from approximately 600 thousand pounds to a little over 1 MP and peak in March and April,

but remain relatively high from January to July. Snapper imports are about twice the grouper imports each month of the year and remain relatively high throughout the year, with peaks in March and July. By far the single largest supplier of groupers imported by the U.S. is Mexico, which in 2000 supplied 6.3 MP of groupers worth $12.4 million. The second largest supplier is Panama, but it supplied only 941 thousand pounds of grouper worth $1.3 million. Mexico is also the largest supplier of snappers at 6.4 MP in 2000. But other countries such as Panama and Brazil, each of which supplied about 5 MP, are not too far behind. Although domestic harvests are not totally comparable to imports in product form and quality, the high level of imports, even just for groupers, appear to dominate domestic production. For red grouper, gag, and black grouper combined, domestic production stood at about 500 thousand pounds to 700 thousand pounds on a monthly basis. As they currently stand, imports may be considered to stabilize prices during short-term disruptions in domestic production. Longer-term disruptions, such as a March 1-May 31 closure, can have some impacts on domestic prices, unless imports adjust accordingly. In the absence of information regarding the availability of grouper stock in foreign countries, it is readily evident what the reactions would be of foreign exporters if domestic producers of groupers are faced with longer fishing closures. Noting that there is only one country (Mexico) that largely dominates the supply of imported groupers, it is likely that longer closure in the domestic grouper fishery can create relatively severe disruptions in grouper supply that would lead to increases in prices. Other countries would probably have to step up their production of groupers for export to the U.S. to mitigate the disruptions in local supply due to longer closed seasons.

Possible combinations for closures under Alternative 2 are simply too numerous to be analyzed. At any rate, Table 6.7 provides some information on the potential economic impacts of any possible combination. Alternative 3 is very unlikely to change the landings reductions that may result from closures, especially if the species is subject to quota closures, but it could affect the revenues and profits of commercial fishing vessels.

The economic implications of closures on the commercial sector are further explored in Section 7.6.3.1.

6.5.2 Commercial Grouper Trip Limits

<u>Alternative 1</u>: Establish separate shallow-water grouper possession (trip) limits for longlines for fish traps, and for vertical line and other gears to achieve approximately a 9.4% reduction in commercial red grouper harvest. Vessels with multiple gear types on board will be subject to the lowest possession limit The limits will be[4]:

Longlines	**6,000 pounds GW**
Fish traps	**4,000 pounds GW**
Other gear	**2,000 pounds GW**

<u>Alternative 2</u>: Establish a single commercial possession (trip) limit for shallow-water grouper in aggregate to achieve approximately a 9.4% reduction in commercial red grouper harvest. The limit will be 5,200 pounds GW.

[4] If the reduction in harvest is applied entirely to the commercial sector and the recreational sector is left at status quo (see discussion on commercial-to-recreational allocation under Section 6.3.2 - Rebuilding Scenarios), an 11.75% harvest reduction would be needed in the commercial harvest. This would result in the following GW gear trip limits: Longlines - 5,500 lbs.; Fish traps - 3,800 lbs.; Other gear - 1,700 lbs.

Proposed=> **<u>Alternative 3</u>: Status quo - Do not establish a commercial trip limit for grouper.**

<u>Alternative 4</u>: Establish a single commercial possession (trip) limit of 7,000 pounds (GW) for shallow-water grouper in aggregate.

<u>Alternative 5</u>: Establish a single commercial possession (trip) limit for shallow-water grouper if 75% of the shallow-water grouper aggregate quota is reached by September 30. The limits will be: (a) 4,000 pounds GW; (b) 5,000 pounds GW; (c) 6,000 pounds GW; or, (d) 7,000 pounds GW.

<u>Discussion</u>: In an earlier draft of this Secretarial Amendment, trip limits were proposed to achieve both the required 9.4% reduction in fishing effort for red grouper and to slow the commercial harvest, thus providing for an extended open season. Landings data for the commercial shallow-water grouper fishery using the 1.18 conversion factor (GW to whole weight) indicated that the shallow-water grouper quota had been exceeded in 2000 and 2001. Thus, trip limits were proposed as a management measure that would achieve both the required reduction in fishing mortality and control fishing effort to allow for an extended season. However, the SEFSC has recently recalculated the shallow-water grouper landings using the 1.05 conversion factor (GW to whole weight) with the subsequent determination that the shallow-water grouper quota had been exceeded in 2001 by only 6,500 pounds, and was not exceeded in any other year. Therefore, most alternatives for year-round trip limits were determined to be unnecessary to ensure an expanded season, as the quota has only been exceeded once. Further, if a red grouper or shallow-water grouper quota is approved as a method of reducing fishing mortality, trip limits would serve only to slow down but not actually reduce overall fishing mortality, per se, as additional trips may be made with an accompanying increase in fishing effort. Thus, the need for quotas to fully constrain harvest. Trip limits, however, may be useful to prolong part of an annual fishing season once a "quota trigger" such as the one proposed in the commercial scenario, has been reached. Further, trip limits may also be useful if a derby fishery for either the shallow-water grouper or red grouper fisheries results from establishment of their respective quotas.

The commercial rebuilding scenario in the revised rebuilding plan relies on a 9.4% reduction in total red grouper harvest by reducing the red grouper harvest from the 1999-2001 average commercial catch (5.86 MP) to 5.31 MP, and specifies this as an quota for the commercial sector. However, if the fishery is subject to quota closure, trip limits offer the ability for the fishery to remain open longer than without trip limits as long as the trip limit is not set too high.

Trip limit analyses were conducted by NMFS (Poffenberger 2003) in whole weight units. However, most commercially harvested grouper are landed gutted. Council staff converted the NMFS analyses to GW, and further weighted the results of the “trip limit by gear” analyses using the proportion of catch by gear type in Table 6.5. Interpolation was used to determine the trip limits and percent reductions, and those results were rounded to the nearest 100 pounds. The results are in Tables 6.12a-d.

Effort shifting could reduce the impact of the trip limits in all of the alternatives as it is possible that vessels affected might increase the number of trips made.

Alternative 1 establishes separate possession (trip) limits for longlines, fish traps, and other gears. In order to discourage vessels from having high trip limit gear onboard

simply to qualify for the higher limit, the alternative applies the lowest trip limit to vessels that have multiple gear types. When the Council, at its January 2003 meeting, proposed using possession (trip) limits to control commercial harvest rates, it asked that NMFS consider fairness and equatability among different fisheries in applying this alternative. The concern was raised that a single limit might be unfair to all sectors of the red grouper fishery, i.e., a 5,200 pound GW trip limit would possibly help reduce harvest in both the handline gear fishery by less than 1% (Table 6.12b), in the longline fishery by nearly 15% (Table 6.12c), and in the fish trap fishery by 6% (Table 6.12d). The intent of the request was to suggest an average of the sector's landings be considered and then reduce their landings by a percentage that would equate to a trip limit, i.e., different sector trip limits. The trip limits in Alternative 1 are projected to possibly reduce each gear sector's red grouper harvest by 9.4% in the absence of effort shifting, based on Tables 6.12b-d. These trip limits are also projected to possibly reduce commercial gag/black grouper harvest by about 10%, and to reduce total commercial shallow-water grouper harvest by about 10%. (Note that this alternative produces a greater reduction in gag/black grouper harvest than Alternative 2 because it has a greater impact on handline gear, which catches a larger proportion of gag than longline gear.) In considering this alternative, NMFS felt that multiple trip limits would increase the complexity of the regulation which would decrease compliance and enforceability. In addition, NMFS felt that multiple trip limits would encourage fishermen to convert their vessels to the gear with the highest possession (trip) limits and would ultimately increase rather than decrease harvest. Therefore, NMFS rejected this alternative.

Alternative 2 sets a single possession (trip) limit for all commercial reef fish vessels at a level projected to possibly reduce commercial red grouper harvest by 9.4%, based on Table 6.12a. This trip limit is also projected to reduce gag/black grouper harvest by 6%, and to reduce total shallow-water grouper harvest by 9%. These projected harvest reductions do not include deep-water groupers (misty, snowy, yellowedge, warsaw, speckled hind (plus scamp after the shallow-water grouper quota is filled). The larger vessels that will be primarily impacted by this trip limit are also those that are most capable of fishing further offshore for deep-water grouper, which could increase fishing mortality on that sector and on tilefish. Section 6.6 in this amendment proposes a precautionary reduction in the deep-water grouper quota and setting a tilefish quota. These new deep-water reef fish quotas and no deep-water reef fish limits, could lead to an early quota closure of the deep-water grouper or tilefish fisheries. However, because this alternative is less complex than multiple gear limits, and because the deep-water reef fish will be protected from excessive harvest by the new proposed quotas, NMFS felt that this alternative provided the best approach to implementing a possession (trip) limit on shallow-water grouper.

Alternative 3 (status quo) will not produce any reduction in harvest. The harvest of red grouper (and all shallow-water grouper) will be constrained by the shallow-water grouper quota, but without trip limits, size limit increase, closed seasons, gear restrictions or other measures to reduce the rate of harvest, the likelihood of an early quota closure is increased. The expectation of a quota closure may lead to a derby type fishery, which would exacerbate the early closure. Further maintaining the status quo would not achieve the required rebuilding target for red grouper.

Alternative 4 sets a single possession (trip) limit for all commercial reef fish vessels at a level projected to possibly reduce commercial red grouper harvest by 6.0%, based on Table 6.12a. This trip limit is also projected to reduce gag/black grouper harvest by 4%, and to reduce total shallow-water grouper harvest by 6%. The 7000-pound trip limit is

expected to reduce landings of shallow-water grouper by 6.5% for longlines, 0.8% for vertical lines, and 1.7% for fish trap vessels. These projected harvest reductions do not include deep-water groupers (misty, snowy, yellowedge, warsaw, speckled hind (plus scamp after the shallow-water grouper quota is filled). The larger vessels that will be primarily impacted by this trip limit are also those that are most capable of fishing further offshore for deep-water grouper, which could increase fishing mortality on that sector and on tilefish.

Alternative 5 combines quota management with trip limits. A commercial trip limit would be implemented from the beginning of October until the fishery was closed if at least 75% of the 8.80 million pound quota for shallow water groupers (i.e., 6.60 MP) had been filled by September 30. The intent of the trip limit is to slow the industry's rate of harvest to keep the fishery open as long as possible

Biological Impacts: If a red grouper or shallow-water grouper quota is approved as a method of reducing fishing mortality, trip limits would serve only to slow down but not actually reduce overall fishing mortality, per se, as additional trips may be made with an accompanying increase in fishing effort. Thus, the need for quotas to fully constrain harvest. Trip limits, however, may be useful to prolong part of an annual fishing season once a "quota trigger" such as the one proposed in the commercial scenario, has been reached. Further, trip limits may also be useful if a derby fishery for either the shallow-water grouper or red grouper fisheries results from establishment of their respective quotas. Additionally, trip limits can minimize problems such as release mortality that are encountered with other management measures such as increased size limits, assuming that fishermen stop fishing when they reach their limit.

Alternatives 1 and 2 have equal impact on reducing red grouper harvest, but have different impacts on other grouper species such as gag and black grouper. Alternative 1 reduces harvest among the gear sectors proportionately, whereas Alternative 2 reduces harvest in the longline fishery by a greater percentage than in the other gears. Gag make up a larger proportion of the catch composition in the handline fishery than in the longline fishery. Consequently, Alternative 1 has a greater impact on reducing harvest of other shallow-water grouper species than Alternative 2. Alternative 3, statu quo, will not contribute to any reduction in harvest of red grouper or any other shallow-water grouper. Although the stock biomass has improved in recent years even in the absence of new regulations, this increase is due in part to a single strong 1996 year-class. As this year-class is fished out, stock biomass may again decrease unless fishing mortality is reduced sufficiently to allow rebuilding of the red grouper stock. Alternative 4, similar to Alternative 2 except the trip limit is greater, reduces harvest in the longline fishery by a greater percentage than in the other gears. Gag make up a larger proportion of the catch composition in the handline fishery than in the longline fishery. Alternative 5 reduces harvest among the gear sectors proportionately once the shallow-water grouper aggregate quota is reached. The intent of the trip limit is to slow the industry's rate of harvest to keep the fishery open as long as possible.

Socioeconomic Impacts: A single trip limit is likely to have greater impacts on high-volume vessels than on low-volume vessels. In the red grouper fishery, a single trip limit is likely to affect more longline vessels than either vertical line or fish trap vessels.

Alternative 1 is estimated to affect about the same percent reduction in red grouper harvest as Alternative 2 below, but it would distribute the burden about evenly among the three major gear types in the fishery. In the present case, the gear-specific trip limit would

reduce the red grouper harvest of each gear type by about 9.4%. However, in terms of magnitude of reductions in harvest and revenues, the bulk of the reductions would still be borne by longline vessels because they account for most of the red grouper landings. With respect to reductions in gag landings, the vertical line vessels would bear more gag harvest reductions under Alternative 2 than under Alternative 1. In addition, vertical line vessels, to the extent that they account for most of gag landings, would shoulder more of the gag harvest reductions than longline vessels.

Alternative 2 imposes a 5,200-pound trip limit for all commercial vessels participating in the red grouper fishery. This trip limit alternative is estimated to result in a 9.4% reduction in red grouper landings and 6% reduction in gag and black grouper landings, or 8.5% reduction in shallow-water grouper landings. Based on 1999-2001 average landings, these percent reductions translate to reductions of 556 thousand pounds or $1.33 million for red grouper only, 130 thousand pounds or $312 thousand for gag only, or 754 thousand pounds or $1.8 million for the entire shallow water grouper. Assuming that the 1999-2001 average distribution of landings by gear types remains the same, longline vessels would bear approximately 90% of red grouper reductions and 83% of gag reductions, or 89% of all shallow-water grouper reductions. Vertical line vessels would bear none of the red grouper reductions and 17% of the gag reductions, or 5.5% of all shallow-water grouper reductions. Fish trap vessels would bear 10% of red grouper reductions and none of the gag reductions, or 5.5% of all shallow-water grouper reductions.

The impacts of Alternative 4 are similar in nature to those of Alternative 2, but the magnitude involved differs. A 7000-pound trip limit is expected to reduce landings of shallow-water grouper by 6.5% for longlines, 0.8% for vertical lines, and 1.7% for fish trap vessels. More detailed discussion of the impacts of this limit are provided in Section 7.6.5.2.

Alternative 5 combines quota management with trip limits. A commercial trip limit would be implemented from the beginning of October until the fishery was closed if at least 75% of the 8.80 million pound quota for shallow water groupers (i.e., 6.60 MP) had been filled by September 30. The intent of the trip limit is to slow the industry's rate of harvest to keep the fishery open as long as possible. Four alternative trip limits are proposed, ranging from 4,000 to 7,000 pounds.

The overall level of harvest varies annually, and would have triggered implementation of a trip limit in 1999 and 2001, but not in 2000. On average for 1999-2001, approximately 6.72 MP of shallow-water groupers were landed by the end of September. Hence, on average, a trip limit would be implemented during the 4th quarter of the calendar year.

On average for 1999-2001, 32 boats made 52 trips that landed 0.13 MP of shallow-water groupers in excess of a 7000 pound trip limit. In contrast, 80 boats made 160 trips that landed 0.43 MP of shallow-water groupers in excess of a more restrictive 4000 pound trip limit. Thus, if the fishery were to remain open throughout the 4th quarter, a 7000 pound trip limit would affect approximately 2.1% of total annual trips and potentially reduce landings by up to 5.9%, whereas a 4000 pound trip limit would affect 6.4% of trips and potentially reduce landings by up to 18.8%. However, the fishery would not remain open with any of the trip limits that have been proposed for the 4th quarter. With an expected closure date in mid-November, a 5.31 MP commercial quota for red grouper or 8.80 million pound quota for all shallow-water groupers combined would result in a potential reduction in shallow-water grouper landings of approximately 1.11 MP. The maximum

potential reduction in landings from a 4th quarter trip limit would be approximately 0.43 MP with a 4000 thousand pound trip limit. More detailed discussion of the impacts of this limit are provided in Section 7.6.5.2.

As higher trip limits are imposed, fewer vessels would be negatively affected, and this would favor the longline vessels. On the other hand, as lower trip limits are adopted, most of the negative effects would be borne by longline vessels, particularly the high-volume ones. These vessels would experience reductions in harvest and revenues for any given cost, or higher cost for any given harvest and revenues.

Trip limits would reduce the availability of shallow-water grouper throughout the season. However, if the fishery is subject to quota closure, trip limits offer the ability for the fishery to remain open longer than without trip limits as long as the trip limit is not set too high. This would result in relatively steady supply of grouper throughout the open season and possibly for a short period during the closed period in the event a quota closure did occur. With the fishery remaining open for a longer period, support industries would not be as adversely affected as when there is a shorter season due to quota closure.

In general, a seasonal closure does not necessarily bring about similar economic effects as trip limits. A trip limit can lead to unchanged total harvest as more trips are taken, thus increasing costs and decreasing net revenues. On the other hand, a seasonal closure might result in redirection of effort, with potentially stable revenues, but a disruption in the supply of grouper may ensue.

In and by itself, a trip limit would not be sufficient to effect a stock rebuilding plan, because trips can increase over time as fishermen adopt to the measure particularly in the face of an increasing stock size. An increasing stock biomass can result in an increase in catch per trip so as to shorten the number of days per trip. With shorter fishing days, an increase in the number of trips may not necessarily result in an increase in the total number of days fished. Under this condition, the commercial fishery may maintain the total number of days fished while increasing the number of trips so that fishing cost may not increase in the same proportion as the increase in the number of trips. The profit incentive is therefore present, and it would encourage fishermen to undertake more trips as to possibly slow down the stock recovery.

Further discussions on the economic impacts of certain trip limits are presented in Section 6.3.2, Section 7.6.3.1 and Section 7.6.5.2.

6.5.3. Recreational Grouper Closed Seasons

<u>Alternative 1</u>: Set the recreational closed season for:
1) red grouper, gag and black grouper; or
2) all shallow-water grouper
as March 1 - May 31 (coinciding with the commercial greater amberjack closed season). The percent impact by weight on recreational catches compared to the 1999-2001 base period is:

Red	Gag	Black	All shallow-water grouper
26%	35%	29%	29%

<u>Alternative 2</u>: Set the recreational closed season for:
1) red grouper, gag, and black grouper; or
2) all shallow-water grouper

as some combination of months. The closed months (and percent impact by weight on recreational catches compared to the 1999-2001 base period) are:

		Red	Gag	Black	All shallow-water grouper
a.	**January**	**5%**	**7%**	**15%**	**7%**
b.	**February**	**5%**	**7%**	**15%**	**7%**
c.	**March**	**6%**	**11%**	**13%**	**8%**
d.	**April**	**6%**	**11%**	**13%**	**8%**
e.	**May**	**14%**	**13%**	**3%**	**13%**
f.	**June**	**14%**	**13%**	**3%**	**13%**
g.	**July**	**17%**	**5%**	**0%**	**8%**
h.	**August**	**17%**	**5%**	**0%**	**8%**
i.	**September**	**5%**	**5%**	**10%**	**6%**
j.	**October**	**5%**	**5%**	**10%**	**6%**
k.	**November**	**3%**	**9%**	**9%**	**8%**
l.	**December**	**3%**	**9%**	**9%**	**8%**

Alternative 3: Set the recreational closed season as February 15-March 15 on:

1) red grouper, gag and black grouper (coinciding with the status quo commercial closed season); or
2) all shallow-water grouper.

The percent impact by weight on recreational catches compared to the 1999-2001 base period is:

Red	Gag	Black	All shallow-water grouper
6%	**9%**	**14%**	**8%**

Alternative 4: The recreational closed season selected above applies only to waters south and east of Cape San Blas, Florida.

Proposed => **Alternative 5: Status quo - Do not have a recreational closed season for grouper. This will produce no change in impact from the base years of 1999-2001.**

Discussion: Discussion of the Proposed Alternative as part of the Proposed Recreational Scenario is contained in Section 6.3.2 A closed season of from less than one month to two+ months (depending upon the months selected and other recreational management measures) would be needed in order to provide the 9.4% reduction needed in red grouper harvest in the absence of other management measures. However, a closed season would have created disruption in the recreational fishery, even if limited to the geographic region where red grouper are most abundant. During the July 2001 Amendment 18 public hearings, the February 2002 Secretarial Amendment 1 public hearings, and at Council testimony during the May and July 2002 Council meetings, fishermen asked the Council to consider raising the red grouper minimum size limit as an alternate measure in order to shorten or eliminate any closed seasons. Size limit increases had not been initially considered because the red grouper size limit is already set at the level that produces maximum yield-per-recruit. Subsequent analyses by NMFS concluded that, on the assumption of a 10% release mortality for recreational fishing, a size limit increase to 22

inches TL could provide a 32% reduction in recreational harvest with minimal negative impact on yield-per-recruit. At the time, a harvest reduction of 45% was being sought based on the 1999 red grouper assessment and 2001 supplemental analyses. However, analyses based on the more recent 2002 red grouper assessment showed that the stock was in an improved condition, and only a 9.4% reduction was needed to effect a recovery to the B_{MSY} level within 10 years. This level of harvest reduction could be achieved through bag limits alone. Consequently, this plan proposes a harvest reduction scenario that did not include closed seasons or a minimum size limit increase.

The percent reductions in harvest given in the above alternatives represent the proportion of the catch during each period during recent years (1999-2001) when red grouper harvest is affected by the strong 1996 year-class. The MRFSS reports recreational catches in two-month waves, so monthly percentages are half of a wave. These can serve as guidelines for estimating reductions in harvest from closed seasons. However, effort shifting to the open season and increased release mortality during the closed season from fishermen targeting other species will reduce the overall impact of a closed season. Therefore, these numbers should be regarded as high-end estimates of the actual reduction that will be achieved. Since many species form aggregations and are more vulnerable to fishing during spawning season, spawning seasons are often a proposed time for setting closures. These are frequently the months when there is increased harvest. The estimated spawning seasons for groupers are listed in the discussion for commercial closed seasons, along with closed spawning season options recommended by ReefKeeper International.

Biological Impacts: Red grouper were classified by NMFS as overfished in October 2001, based on the 1999 stock assessment, which indicated that the stock biomass was below the minimum stock size threshold (MSST) of 80% B_{MSY} in 1997. A new stock assessment in 2002 concluded that the stock biomass as of 2001 was above MSST but not yet to B_{MSY}. The 2002 assessment confirmed the previous finding that the stock was below MSST in 1997. Therefore, the requirement to rebuild the stock to B_{MSY} in 10 years or less remained, although less rebuilding was now needed. Gag were classified as approaching an overfished condition in 1998. New regulations to increase the gag minimum size limit, establish closed areas in two locations where gag spawn, and close commercial harvest for one month of the peak pawning season were implemented in 2000. Analyses in 2001 suggested that gag are no longer approaching an overfished condition but are not yet at optimum yield. Reductions in harvest are needed to stop overfishing in red grouper, and to begin a red grouper recovery program and attain gag optimum yield. All of the alternatives except the Proposed Alternative 5 (status quo - no closed season) are projected to reduce harvest of red grouper, gag, and other shallow-water grouper provided there is no effort shifting by fishermen to the open seasons. Since effort shifting may occur, the percentages indicated provide high-end estimates of the potential reduction for any combination of sub-options. The Proposed Alternative results in no change to recreational harvest, and relies on other management measures to achieve the desired reductions.

If a closed season had been proposed, selecting the sub-option “for all shallow-water grouper” over “red grouper, gag, and black grouper” will apply the closed season to a broader range of species, and may reduce bycatch mortality of red grouper, gag, and black grouper from fishermen targeting the remaining shallow-water groupers. Closed seasons that correspond to all or part of the spawning seasons could, for some species, improve spawning success by avoiding the disruption of spawning behavior. Since many species aggregate and are more vulnerable to fishing during spawning season, these are often the months when the greatest reduction in harvest can be achieved through closures.

Socioeconomic Impacts: Table 6.8 provides some information, by wave, on recreational activities for red grouper, gag, and black grouper. The information is based on MRFSS data only. Fish landed is the number of fish caught and landed for each of the three species. Catch and effort are averages for the years 1996-1999. Catch trips are those trips that caught a subject species, regardless of target behavior or disposition of fish (i.e., kept or released). Target trips are those trips for which anglers indicated species preference, either as primary or secondary target species, regardless of success rate (i.e., caught fish or did not catch fish).

A March 1 - May 31 closure may be considered to affect recreational catch and effort for the March-April wave and half of the May-June wave. It should be emphasized, however, that although catches across species may be additive, those for catch and target trips may not be the case since a single trip may catch any combination of the three species within the aggregate bag limit. With this caveat and assuming no effort shifting, a March 1- May 31 closure would reduce recreational red grouper catch by 23,727 fish, catch trips by 78,597, and target trips by 12,629. However, effort shifting is likely to occur and these reductions would be less. Additionally, it should be noted that the reduction in catch trips and target trips would be an overestimate since catch and release and targeting practices can still occur during the closed period. The corresponding reductions for gag would be 110,132 fish, 175,968 catch trips, and 60,441 target trips and those for black grouper would be 5,096 fish, 11,033 catch trips, and 1,533 target trips.

A February 15-March 15 closure, considered as one-quarter of each of the January-February and March-April wave, would reduce recreational red grouper catch by 5,179, catch trips by 22,087, and target trips by 3,352. The corresponding reductions for gag would be 32,339 fish, 47,946 catch trips, and 17,102 target trips and those for black grouper would be 2,547 fish, 5,150 catch trips, and 489 target trips.

Assuming the absence of shifting effort from the closed to the open season, the estimated reductions in recreational catch and trips would translate into reductions in consumer surplus and profits of for-hire vessels. However, effort shifting is likely to occur and these reductions would be less. Further, assuming that the value of a grouper target trip is worth $213 in consumer surplus (as discussed in the RIR section) and also assuming that the number of gag target trips accounts for all grouper target trips (since the recreational sector harvests more gag than the commercial sector), the loss in consumer surplus would amount to $12.8 million for a March 1-May 31 closure, or $3.6 million for a February 15-March 15 closure. The value per trip is based on the equivalent value for a red snapper trip (see the RIR for additional discussion). Target trip is chosen as the relevant trip variable since this type of trip is more susceptible to changes in regulations than catch trips. Closures are likely to bring about trip cancellations based on the expectations of anglers. Such expectation is likely to be revealed more through target trips than catch trips.

Angler trip reductions due to closures would also affect the financial status of the for-hire fishery. Holland et al. (1999) reported that the base fee for a charter trip in the Gulf averaged around $308 for half-day trips (for an average of 6 passengers), $527 for full-day trips (for an average of 5 passengers), and $1,349 for overnight trips (for an average of 6 passengers). Revenue losses to the charter fishery would depend on how many of the cancelled trips are half-day, full-day or overnight trips.

6.5.4 Recreational Grouper Bag Limits

Proposed => **<u>Alternative 1</u>: Out of the five-grouper aggregate bag limit, the maximum number that can be red grouper is:**

a. 1 (28% red grouper reduction)

Proposed => **b. 2 (9% red grouper reduction)**

c. 3 (3% red grouper reduction)

d. 4 (1% red grouper reduction)

<u>Alternative 2</u>: Out of the five-grouper aggregate bag limit, the maximum number that can be gag is:

a. 1 (35% gag reduction)

b. 2 (16% gag reduction)

c. 3 (7% gag reduction)

d. 4 (2% gag reduction)

<u>Alternative 3</u>: Reduce the recreational aggregate grouper bag limit from 5 fish to:

a. 1 (37% aggregate reduction)

b. 2 (17% aggregate reduction)

c. 3 (7% aggregate reduction)

d. 4 (2% aggregate reduction)

<u>Alternative 4</u>: Status quo - do not change the recreational grouper bag limit.

<u>Discussion</u>: Discussion of the Proposed Alternative as part of the Proposed Recreational Scenario is contained in Section 6.3.2. The Proposed Alternative bag limit reduction on red grouper will provide approximately a 9.0% reduction in red grouper harvest. The bag limit will impact only a small number of fishermen who might otherwise catch more than two red grouper on a trip. MRFSS data provided to the Council in January 2001, indicated that only 6% of the interview intercepts where red grouper were harvested had more than two red grouper. Most recreational fishermen testified that they were willing to accept reduced red grouper bag limits, however, for-hire vessel operators were concerned that reducing the bag limit to less than two would make it difficult to attract customers.

All three of the action alternatives can be adopted simultaneously, provided the sub-options are consistent. If Alternative 1 (sub-bag limit on red grouper) or Alternative 2 (sub-bag limit on gag) is adopted, it may be necessary to adopt both alternatives to prevent effort shifting from one species to the other.

Percent reductions were estimated from analyses provided to the Council by NMFS in January 2001[5]. For each bag limit estimate, the number of fish landed per catch category for 0 to five fish was set to the lesser of the new bag limit of the actual catch. Catch categories of six or more grouper were assumed to be from multi-day charter trips where a two-bag limit is allowed, and these catch categories were set to the lesser of two new bag limits or the actual catch. Landings for each catch category were calculated as (N * No. of fish). The total number of landed fish for each bag limit was summed, and then compared to the total under status quo.

[5] Letter with attachments dated January 12, 2001 from Joseph E. Powers to Wayne Swingle regarding analyses of potential red grouper management options, tables 137, 138, and 141 in the attachments.

Biological Impacts: Most recreational fishermen do not fill their grouper bag limit. Therefore, bag limit reductions to four, three or even two fish will impact only a relatively small number of anglers, but at two red grouper or less there will be a significant reduction in harvest. A two red grouper bag limit alone is sufficient to achieve the recreational reduction needed, or a less restrictive bag limit can be used in combination with other management measures to achieve a sufficient reduction. However, a species bag limit on red grouper without a corresponding bag limit on gag may result in an increase in recreational gag harvest. The gag fishing mortality rate is currently only slightly below the overfishing threshold, or maximum fishing mortality rate, and requires an additional 24% reduction to reach the optimum yield harvest rate, based on the results of the 2001 gag stock assessment. Gag harvest will need to be carefully monitored to assure that it does not reenter a state of overfishing.

Socioeconomic Impacts: Any reduction in bag limit that is effectively binding would translate into reductions in consumer surplus, and to the extent that trips would also be reduced, such reduction in bag limit would reduce the profitability of for-hire vessels. It should be noted that bag limit reductions are not as likely to result in cancelled trips than closed seasons that achieve the same reductions in harvest.

In the recreational red snapper fishery, a reduction in the bag limit from five fish per angler per day to four fish in 1998 was followed by an apparent shift in red snapper target effort from the for-hire sector to the private angler sector (Table 6.13). From 1996-1998, approximately 130,000 trips, or 53% of total red snapper target trips, were taken by for-hire anglers, compared to 115,000 trips, or 47%, by private anglers. For 1999-2000, however, the for-hire sector had declined to 94,700 trips, or 30%, with the private sector increasing to 220,000 trips, or 70% of total red snapper target trips. This could be an indication that the more restrictive bag limit was determined to be insufficient to justify the expenditure of the for-hire experience of that type. It is important to note, however, that these figures represent target trips and not absolute for-hire trips. Thus, although for-hire effort has declined in general from 1997-2000, any decline in effort cannot be specifically attributed to a cancellation of trips due to declines in the target effort for a given species. While it is logical to expect that the decline in red snapper target effort resulted in outright cancellation of for-hire activity, some trips may have continued to be taken in other areas and/or targeting different species.

While a bag limit may affect the target intent of an angler, it directly affects the ability to retain caught fish. Table 6.14 presents the number of individual angler trips estimated to be affected by the various bag limit alternatives. These estimates are based on the proportion of trips that catch the species and land/harvest the specific bag limit. While direct linkage between harvest rates and trip demand have not been identified for these species, theory and logic hold that reducing the amount of harvestable fish will diminish the benefits associated with the fishing trip. Alternative 1, which applies only to red grouper, would affect angler catch trips ranging from 1,600 trips to 20,500 trips. The Proposed Alternative of reducing the red grouper bag limit to two fish out of the five shallow-water grouper bag limit would affect 6,100 trips. Alternative 2, which applies only to gag, would affect angler catch trips ranging from 11,300 to 78,000 trips. The affected trips are higher under Alternative 2 than those under Alternative 1, since anglers catch more gag than red grouper. Alternative 3, which applies to all shallow-water groupers, would affect angler catch trips ranging from 19,800 to 149,000 trips. As can be expected, the number of angler catch trips affected is higher under Alternative 3 than that under either Alternative 1 or Alternative 2.

6.5.5 Red Grouper Minimum Size Limits

<u>Alternative 1</u>: Increase the recreational minimum size limit for red grouper from 20 inches total length to:

a. 21 inches total length
b. 22 inches total length
c. 23 inches total length
d. 24 inches total length

<u>Alternative 2</u>: Increase the commercial minimum size limit for red grouper from 20 inches total length to:

a. 21 inches total length
b. 22 inches total length
c. 23 inches total length
d. 24 inches total length

Proposed==> **Alternative 3: Commercial size limit status quo. Keep the commercial red grouper minimum size limit at 20 inches total length.**

Proposed==> **Alternative 4: Recreational size limit status quo. Keep the recreational red grouper minimum size limit at 20 inches total length.**

<u>Discussion</u>: Although minimum size limit changes were not originally included in the red grouper rebuilding plan as explicit alternatives, they are specified as allowable actions under the Reef Fish FMP's framework procedure for setting total allowable catch. (This amendment was being developed as a framework regulatory amendment prior to the determination by NMFS that it would need to be submitted as a Secretarial Amendment). In an earlier version of this Secretarial Amendment, when a 45% harvest reduction was being sought rather than the 9.4% now needed, both commercial and recreational fishermen asked that size limit increases be considered in lieu of extended closed seasons. In addition, support for raising the size limit was voiced by representatives of commercial and recreational fishing organizations, including the Destin Fishermen's Cooperative, CCA Florida, Destin Charterboat Association, Florida Skin Divers Association, Florida Sportsman magazine, Marco Island Fisherman's Association, Panama City Boatman's Association, and St. Petersburg Underwater Club. However, with the new biological information from the 2002 red grouper assessment indicating that only a 9.4% harvest reduction (from 1999-2001 average annual landings) is needed to implement a rebuilding plan, minimum size limits are no longer under consideration.

Raising the red grouper minimum size limit to 22 inches would be projected to result in a 10.8% reduction from the handline/powerline component of the commercial (assuming a 30% release mortality of undersized fish), and a 9.4% reduction from the longline fishery (assuming a 30% release mortality). However, a 22 inch minimum size limit would produce a projected 32% reduction from the recreational fishery (assuming a 10% release mortality). For the recreational fishery, even the smallest size limit increase that could be considered, 21 inches (a 1-inch increase) would reduce harvest by over 20%, more than double the 9.4% reduction needed. If the actual release mortality is higher than assumed, then the effective harvest reduction will be less. Table 6.15 provides the estimated reductions at various release mortality levels for minimum size limits of 21, 22, 23, and 24 inches total length.

Size limit alternatives of 21, 22, 23, and 24 inches total length (Alternatives 1 and 2) were

analyzed. As would be expected, harvest reductions were greater at higher minimum size limits (Table 6.15). At the status quo 20 inch minimum size limit (Alternatives 3 and 4), there is no reduction in harvest. A 22-inch minimum size limit for the commercial fishery would achieve the desired harvest reductions, but would also increase the amount undersized fish caught and the resulting bycatch mortality. The recreational sector generally fishes closer to shore and in shallower water on average, so release mortality is less of a factor. However, even the smallest, one-inch, size limit increase would produce a reduction in harvest more than double that needed. For the recreational sector, a minimum size limit increase cannot be used to achieve just a 9.4% reduction.

Biological Impacts: A yield-per-recruit analyses for red grouper was last conducted in the 1993 stock assessment (Goodyear and Schirripa 1993). Based on this assessment, red grouper yield-per-recruit is maximized at about 18 inches with a 33% release mortality. Although the yield-per-recruit was not calculated for a 10% release mortality, the maximum yield-per-recruit was estimated at 25 inches at 0% and 19 inches at 20%, thus, at 10% yield-per-recruit is likely maximized at about 22 inches. Increasing the minimum size limit will increase the total regulatory discards (both alive and dead). Additionally, increasing the size limit may slightly reduce the yield-per-recruit in the commercial sector due to a release mortality of 33%, but may increase the yield-per-recruit in the recreational sector due to its lower release mortality. Since most of the red grouper harvest is commercial, the net effect of increasing the minimum size limit is to reduce yield-per-recruit.

Maintaining status quo (Preferred Alternatives 3 and 4) will leave yield-per-recruit at its present level, which is near but not at maximum. Reducing the minimum size limit to 18 inches would increase yield-per-recruit slightly, but would also increase the total harvest, leading to a greater likelihood of quota closures and longer closures.

Socioeconomic Impacts: Table 6.15 presents the expected recreational and commercial reductions in harvest associated with the four minimum size limit options. Under Alternative 1 with 10% discard mortality, the expected reduction in the recreational sector's red grouper harvest ranges from 20.7% at 21 inches minimum size limit to 51% at 24 minimum size limit. Under Alternative 2 with 30% discard mortality, the expected reduction in the commercial handline fleet's red grouper harvest ranges from 4.8% at 21 inches minimum size limit to 22.2% at 24 minimum size limit. The corresponding reduction for the commercial longline fleet ranges from 3.9% to 20.8%. Lower reductions are expected under higher discard mortality rates for both the recreational and commercial sectors.

For the recreational sector, an increase in the minimum size limit that results in harvest reductions may be expected to reduce angler consumer surplus, but unless the reductions are substantial, trip cancellations are not likely to ensue. In this case, the financial condition of the for-hire vessels may not be affected. At relatively higher harvest reductions, such as may occur with a 23- or 24-inch minimum size limit, trip cancellations are more likely so as to also reduce the revenue and profitability of the for-hire vessels.

For the purpose of determining some general estimates on the magnitude of impacts of raising the minimum size limit for the recreational sector, it is assumed that the reduction in harvest due to the increase in minimum size limit is comparable to reductions in target trips. The reductions in angler consumer surplus under Alternative 1 can range from $1.2 million to $2.9 million.

For the commercial sector, an increase in size limit may not necessarily result in harvest reductions. Commercial fishermen have relatively more flexibility in either changing fishing locations to target for bigger fish or fish harder in the same areas. The more immediate impacts on the commercial sector is an increase in fishing costs and/or reductions in revenues if smaller fish command higher prices than bigger ones. Some fishermen in previous testimonies indicated that the imposition of the 20-inch size limit drove them out of the relatively higher priced smaller fish market. Apparently, imports filled the market gap. From a revenue standpoint alone, the estimated reductions in commercial harvest of red grouper under Alternative 2 can range from $300 thousand to $1.5 million for vertical line vessels and from $105 thousand to $250 thousand for longline vessels. Alternatives 3 and 4 maintain the current minimum sizes in both the recreational and commercial fisheries. Therefore, harvest levels and the accompanying angler consumer surplus would not be reduced.

One important consideration with minimum size limit is that as the stock rebuilds more fish would be available for harvesting at the higher size limits. This can potentially restrain the achievement of a rebuilding strategy if minimum size limits were the only measures adopted for both the commercial and recreational sectors of the red grouper fishery.

6.5.6 Combined vs. Separate Fixed Season and Quota Closures

Alternative 1: For any reef fish fishery with a fixed commercial closed season, the fishing year begins on the first open day after the fixed closed season (quota closure and fixed closed season run consecutively).

Alternative 2: For the grouper fishery with a fixed commercial closed season, the fishing year begins on the first open day after the fixed closed season (quota closure and fixed closed season run consecutively).

Proposed => **Alternative 3: Status quo - the fishing year for all reef fish begins on January 1 (quota closure and fixed closed seasons may occur separately).**

Discussion: The Proposed Alternative (Alternative 3) (status quo) keeps the existing January 1 to December 31 fishing year for all reef fish. This is a simple approach that avoids the confusion of having to keep track of different fishing seasons for different reef fish. For stocks with both a fixed closed season and a quota, this could result in having two closed seasons in a year. However, it may be less disruptive to fishermen and to markets to have two shorter closed seasons rather than one long season.

Alternative 1 modifies the fishing year for a stock to begin immediately after a commercial fixed closed season, if one is set. Currently, the fishing year for all reef fish begins on January 1. If a fishery is closed due to the quota, it is closed until December 31 (or for red snapper, the opening of the second sub-season), reopens on January 1, then closes a second time for the fixed closed season, and finally reopens until and if the quota is again reached. The effect of this action for stocks under a quota is to create a single long closed season instead of two shorter closures, if a quota closure is implemented. Under existing commercial closed seasons, the fishing years for the following stocks would be modified:

Stock	New Fishing Year
Red snapper	February 1
Greater amberjack	June 1
Red grouper, gag, black grouper	March 16

There would be no effect on red snapper, since the fixed closed season is at the beginning of the calendar year (January 1-31), and the commercial red snapper season is already regulated through two sub-seasons and monthly closures within each sub-season. There would be no immediate impact on greater amberjack, since there is currently no greater amberjack quota. However, greater amberjack were classified in February 2001 as overfished, and a 10-year rebuilding plan has been submitted by the Council and approved by NMFS. The greater amberjack rebuilding plan does not initially include a commercial quota, but it could in the future if the commercial fixed closed season, minimum size limits, and recreational bag limit prove inadequate for the rebuilding plan. The shallow-water grouper quota has been reached in 2001. The deep-water grouper quota has not been filled, but has come close in recent years. Section 6.6 of this amendment contains alternatives to modify the deep-water grouper quota. There is currently no deep-water grouper closed season, but such action may be considered in draft Reef Fish Amendment 18 (which is being developed at this time).

Alternative 2 is similar to Alternative 1, except that it applies only to grouper fishing. The other reef fish stocks would remain status quo. This narrows the scope of the action to just groupers, which is the focus of this amendment.

Biological Impacts: Alternative 1 will create one longer closed season instead of two shorter closures in years when there is a quota closure on stocks that also have a fixed closed season. Longer closed seasons are considered to be more effective than short closed seasons because it is more difficult for fishermen to compensate for the closure though additional harvest during the open season. If a fixed closed season is selected because it includes a portion of the spawning season, this alternative may increase spawning season protection in years when quota closures are applied. For this reason, Alternative 1 is expected to have beneficial biological impacts.

Alternative 2 will have impacts similar to Alternative 1, but where Alternative 1 applies to all reef fish with fixed seasons and possible quota closures, in Alternative 2 the scope is narrowed to just grouper fisheries, and effectively to just shallow-water grouper, since deep-water grouper do not have a fixed closed season at this time.

The Proposed Alternative (Alternative 3) will also accrue benefits to the resource from reduced fishing pressure, but, as explained above, the reductions achieved by two shorter seasons may not be as great as those achieved by one longer season, due to increases in fishing effort before and after the closures. However, status quo is an easier to understand action, which should result in higher voluntary compliance.

Socioeconomic Impacts: Alternative 1 or 2 would ensure that no more than one closure in a fishing year would apply to a fishery, especially if the fishery is also potentially subject to quota closures. Although this may allow fishermen to have one longer break for planning purposes, the experience with the red snapper commercial fishery appears to negate the benefits from a longer quota closure.

In a more recent report, Antozzi (2001) noted that the recent change from a 15-day to a 10-day a month open red snapper season appears to indicate some improvement in

commercial operation, at least from a revenue standpoint. If fishing costs remain about the same, profits would increase. It may be noted, however, that in the red snapper case, fixed open mini-seasons are in place, and this may have partly cushioned the negative effects of a derby in that fishery.

In the absence of fixed mini-seasons for other fisheries, such as the grouper fishery, the full effect of a derby mentality may be experienced, especially in the second open sub-season. To illustrate this point, take the case of the red grouper fishery. Under status quo (Alternative 3), the fishing season for red grouper opens on January 1, closes on February 15, and re-opens on March 16. Unless a commercial quota for red grouper is set at very low levels, the participating vessels are unlikely to take the entire quota in the January 1-February 14 season so the fishery is likely to re-open on March 16. If a commercial quota for red grouper is set and is fully taken during the second sub-season, it is very likely that in the succeeding years, the second sub-season would gradually become shorter as it is but reasonable for fishermen to increase their effort to get their "fair" share of the quota. This shortening of the second season may even filter into the first sub-season so as to eliminate entirely the second sub-season.

6.6 Deep-Water Grouper and Tilefish Quotas

The current deep-water grouper quota is 1.6 MP whole weight. The deep-water grouper fishery has never had a quota closure, but current ALS data indicates that the quota was exceeded in 2000 with landings of 1.66 MP whole weight.

In 2002, NMFS conducted a stock assessment on yellowedge grouper, which is the dominant species in the deep-water commercial grouper harvest. This was the first time that a stock assessment was conducted on this species. Due to limited data, the assessment did not produce conclusive results. However, otolith age analyses revealed that the species can live for 85 years, far longer than the 35 years previously believed. Due to its longevity, the RFSAP felt that yellowedge grouper may be particularly susceptible to fishing, and they recommended that commercial yellowedge grouper yields not exceed 1986-2001 average of 840 thousand pounds GW. The RFSAP noted that yellowedge grouper historically average 73% of deep-water grouper landings. At this ratio, the current deep-water grouper quota of 1.35 MP GW (1.6 MP whole weight) could result in the recommended yellowedge grouper harvest being exceeded. The proposed 1.02 MP deep-water grouper quota should ensure that historical average yield of 840 thousand pounds is not exceeded. However, the proportion of yellowedge grouper in the deep-water grouper catch should be closely monitored (RFSAP 2002).

There is currently no tilefish quota, nor any stock assessments.

Proposed=> **<u>Alternative 1</u>: Establish a GW quota for tilefish (all tilefish species in aggregate), which can be subsequently adjusted through the framework procedure for setting total allowable catch. The initial quota will be set at:**

a. 0.39 MP (90% of average annual harvest 1996-2000)

Proposed sub-option=> **b. 0.44 MP (average annual harvest 1996-2000)**

c. 0.55 MP (highest annual harvest 1996-2000)

d. Other

Proposed=> **<u>Alternative 2</u>: Reduce the quota for deep-water grouper from 1.35 MP GW to a GW quota of:**

a. 0.92 MP (90% of average annual harvest 1996-2000)

Proposed sub-option=>**b. 1.02 MP (average annual harvest 1996-2000)**
c. 1.41 MP (highest annual harvest 1996-2000)
d. Other

<u>Alternative 3</u>: Combine tilefish and deep-water grouper into a new deep-water reef fish aggregate, and set the new deep-water reef fish GW quota at:

a. 0.39 + 0.92 = 1.31 MP (90% of annual harvest 1996-2000)
b. 0.44 + 1.02 = 1.46 MP (average annual harvest 1996-2000)
c. 0.55 + 1.41 = 1.96 MP (highest annual harvest 1996-2000)
d. 0.39 + 1.35 = 1.74 MP (90% of tilefish + deep-water grouper)
e. 0.44 + 1.35 = 1.79 MP (average of tilefish + deep-water grouper)
f. 0.55 + 1.35 = 1.90 MP (highest tilefish + deep-water grouper)
g. Other

<u>Alternative 4</u>: If Alternatives 1 and 2 are selected (individual tilefish and deep-water grouper quotas), the fishing seasons for both aggregates will close when either one of the quotas is reached.

<u>Alternative 5</u>: Status quo - do not add tilefish to the deep-water grouper aggregate or establish a quota for tilefish, and keep the deep-water grouper quota at 1.6 MP whole weight, (but restate it in the regulations as the equivalent 1.35 MP GW).

<u>Discussion</u>: Other Proposed Alternatives in this amendment to reduce the red grouper commercial quota, and to reduce the shallow-water grouper quota (which could result in closed seasons), could result in commercial fishermen shifting part of their effort to deep-water reef fish species. Deep-water species are often slow growing and may be more susceptible to overfishing than shallow-water species. Deep-water grouper have a quota, but that quota has never been met and it is unknown whether the deep-water grouper complex can sustain an increase in fishing effort. If the current deep-water grouper quota (1.35 MP GW) were to be filled, yellowedge grouper harvest would likely exceed the 840,000 pound GW limit (1986-2001 average landings) recommended by the RFSAP. Tilefish have no quota and have not previously been targeted in the Gulf of Mexico to any extent. However, actions in this amendment combined with newly implemented restrictions on the overfished Atlantic tilefish fishery could result in increased fishing pressure on Gulf tilefish. In order to limit effort shifting to the deep-water reef fish stocks until stock assessments can be done, the Proposed Alternative will keep harvest at the recent average level.

The deep-water grouper aggregate includes misty grouper, snowy grouper, yellowedge grouper, warsaw grouper, and speckled hind. Scamp are also included as deep-water grouper when the shallow-water grouper quota is filled. The commercial harvest of deep-water grouper is dominated by yellowedge grouper, with an annual average of 721 thousand pounds, or 73% of the commercial deep-water grouper harvest, from 1996-2000. Reported recreational landings of deep-water grouper are small, with no reported landings of some species in some years. Until 1999, warsaw grouper was the dominant species in the recreational harvest. In 1986, 469,000 pounds of warsaw grouper recreational landings were reported by the MRFSS, and in 1990, 313 thousand pounds were reported. In more recent years, recreational harvest have declined, with 49 and 52 thousand pounds reported in 1998 and 1999. These two years were the highest reported recreational landings of warsaw grouper since 1991, but several of the intervening years have no data

on recreational landings.

On July 14, 1997, the NMFS Office of Protected Resources published a revised list of candidate species for endangered or threatened species status, which added speckled hind and warsaw grouper to the list. Inclusion in the candidate list does not mean that a species is threatened or endangered; however, it does mean that NMFS has documented evidence that the biological status of a species has declined and that the species faces a high degree of threat. Inclusion in the candidate species list is intended to stimulate voluntary conservation efforts, which, if effective, can result in a lower likelihood of the species being listed as threatened or endangered. In response to this listing, the recreational bag limit for warsaw grouper and speckled hind was reduced to one each per vessel (not per person) through Amendment 16b, which was implemented in November 1999. This action was intended to discourage targeting of these species by recreational fishermen, but also to avoid wasting fish that might be caught inadvertently while targeting other species. The Council did not take any action to restrict commercial harvest, based on testimony that commercial fishermen do not target these species, and any that are caught while targeting other species would have a low probability of survival due to the deep depths where they were caught.

Tables 6.21 and 6.22 show commercial landings for tilefish and deep-water grouper for 1996-1999. There are several reasons to be concerned about a potential increase in the harvest of deep-water groupers and tilefish:

1) Action is taken to limit harvest of shallow-water grouper by reducing the commercial red grouper quota or reducing the shallow-water grouper quota (which would increase the possibility of a quota closure), effort on deep-water reef fish species could increase.

2) Effort-shifting from the Atlantic to Gulf of Mexico tilefish and deep-water grouper could occur as a consequence of new restrictions in the Atlantic, where golden tilefish and snowy grouper are overfished.

3) It has been suggested that Gulf of Mexico tilefish serve as a source of recruits to the South Atlantic area (Hightower and Grossman 1988), or that the Gulf of Mexico and South Atlantic populations are a single stock (Katz et al. 1983).

4) Two species of deep-water grouper are on the candidate list for possible listing under the Endangered Species Act (warsaw grouper and speckled hind).

5) Yellowedge grouper are a long-lived species (85 years), and long-lived species are often more susceptible to overfishing. Consequently, the RFSAP, after reviewing a 2002 yellowedge grouper stock assessment, recommended that yellowedge grouper harvest not be allowed to exceed the 1986-2001 average annual landings of 840,000 pounds GW. If the current quota were to be filled, yellowedge grouper landings, at 73% of the deep-water grouper harvest, would be 985,500 pounds.

Several of the deep-water reef fish species play a role in altering their habitat through burrowing, including tilefish, blueline tilefish, and yellowedge grouper. These species, known as ecosystem engineers, may create refuge habitat for other organisms, and may help to speed up organic recycling by increasing the surface area of the bottom sediment (Coleman and Williams 2002). Until more is known about how removal of these species affects the constructed habitat and organisms dependent on the habitat, a precautionary approach to prevent expansion of the offshore fishery is warranted.

Alternative 1 provides pro-active protection for tilefish by establishing a tilefish quota based on recent years landings. Tilefish landings during 1996-2000 ranged from 255 thousand pounds GW to 508 thousand pounds GW. There currently is no quota and no information on what a sustainable harvest might be. The most conservative sub-option (90% of the baseline average) would provide a pro-active protection for tilefish, and could allow for some rebuilding of the tilefish stocks to occur. However, this is the most likely to trigger quota closures. During the baseline 1996-2000 period, this proposed quota was exceeded 80% of the time. Under sub-option b (100% of the baseline average), the proposed quota was exceeded 40% of the time, and under sub-option c, (highest landing in baseline), the proposed quota has not been exceeded.

Alternative 2 modifies the existing 1.35 MP GW deep-water grouper quota to a more conservative level. The deep-water grouper quota was originally part of a total grouper quota set in 1990 in Amendment 1 as 90% of the aggregate grouper landings from 1985-1987. One would expect that, at 90% of historical landings, the quota should have been met periodically, however the quota has never been reached. This suggests that either stock levels or fishing effort has declined, or that the quota was set too high initially. The most conservative sub-option (90% of the baseline average) would provide a more conservative protection for deep-water grouper, and could allow for some rebuilding of the deep-water grouper stocks to occur. However, this is the most likely to trigger quota closures. During the baseline 1996-2000 period, this proposed quota was reached once and exceeded 60% of the time. Under sub-option b (100% of the baseline average), the proposed quota was exceeded 40% of the time, and under sub-option c, (highest landing in baseline), the proposed quota has not been exceeded. All of the sub-options are more conservative than the existing quota, and would prevent expansion of the deep-water grouper fishery.

Alternative 3 combines deep-water grouper and tilefish into a single deep-water reef fish quota. As with the previous alternatives, a range of options is provided from the most conservative (90% of baseline) to the least conservative (current deep-water grouper quota plus highest baseline tilefish landings). Tilefishes are burrowing fish and are found in mud/clay bottoms. Groupers are associated with hard substrate and high relief, but yellowedge grouper have also been observed in mud bottoms utilizing burrows. It is uncertain whether these are burrows excavated by the grouper or burrows taken over from tilefish (Jones at al. 1989). Since tilefishes and deep-water grouper may occupy the same habitats, a quota closure on one group could lead to increased incidental release mortality by vessel fishing for the other group. This would simplify the quota for vessels that fish for both aggregates. However, tilefish have a lower ex-vessel value than grouper, and this alternative may allow higher landings of deep-water grouper than intended if the tilefish portion of the quota is used for grouper instead. For this reason, this alternative, which was initially a Preferred Alternative, was rejected by the Council.

Alternative 4 works in conjunction with Alternatives 1 and 2 (separate quotas for tilefish and deep-water grouper) by closing both fisheries when either quota is met. This alternative will eliminate bycatch and bycatch mortality of the closed season species from vessels fishing the remaining open fishery.

Alternative 5 (status quo) would leave the existing 1.6 MP whole weight deep-water grouper quota and no quota on tilefish, but would restate the deep-water grouper quota as 1.35 MP GW to avoid confusion over the appropriate gutted to whole weight conversion factor. This would provide some protection for deep-water grouper by capping harvest at 90% of the 1985-1987 landings, but would allow landings to increase over recent years. It

would provide no protection for tilefish.

Biological Impacts: Sub-option (a) in Alternatives 1 and 2 would likely result in occasional quota closures and would reduce harvest of tilefish and deep-water grouper from current levels and would keep yellowedge grouper harvest within the limits recommended by the RFSAP (2002). Sub-option (b) would also likely lower harvest levels somewhat since it would allow annual tilefish and deep-water grouper harvests below the recent average but not above it. Sub-option (c) might allow some increase in average harvest from recent levels if effort expands in the deep-water grouper or tilefish fishery. Alternative 3, could allow increases in the deep-water grouper fishery if the portion of the quota derived from tilefish is used to harvest grouper under any of the sub-options except sub-option a, which has a combined grouper-tilefish quota less than the existing deep-water grouper quota. The reverse could also happen but is less likely, since grouper have a higher value than tilefish. The Alternative 3 Sub-option, (b), sets a combined grouper-tilefish quota at just 8% above the current deep-water grouper quota. Deep-water grouper harvest has come close to or slightly exceeded the quota in recent years, so this sub-option will likely keep the deep-water grouper harvest near its current level. If Alternatives 1 and 2 are implemented, bycatch mortality could occur when one quota is filled and the other quota is open. Alternative 4 eliminates the bycatch issue by closing both fisheries when either quota is met. This also means that one fishery will always be harvesting less than its quota. Alternative 5, status quo, retains the existing deep-water grouper quota, which allows a small increase in deep-water grouper harvest. However, it will cap landings at the 1985-1987 level.

Socioeconomic Impacts: The impacts from these alternatives would mainly be to reduce landings and revenues from alternative species for fishermen who primarily fish for shallow-water grouper or other species. For example, a 10% reduction in commercial landings would result from Alternative 1(a) for tilefish, from Alternative 2(a) for deepwater groupers, and from Alternative 3(a) each for tilefish and deepwater grouper.

Logbook information (Waters 2002) indicates that in 2000 about 544 vessels reported having landed one or more species of deepwater groupers. Of this number, 444 vessels were from Florida and 136 from other Gulf states. These vessels took 4,022 trips, with 2,703 trips accounted for by Florida boats and 1,319 accounted for by boats in other Gulf states. Together, these vessels landed about 1.617 MP of deepwater groupers with an ex-vessel value of $3.9 million. Approximately 475 vessels, or 87% of all vessels, landed less than 5,000 pounds per vessel, 36 vessels (6%) landed between 5,000 pounds and 14,999 pounds per vessel, and the remainder (7%) landed higher amounts. Also in 2000, approximately 182 vessels landed tilefish, of which 143 were from Florida and 54 from other Gulf states. These vessels took 889 trips, of which 634 were taken by Florida boats and 255 by boats in other Gulf states. Together, these vessels landed 570 thousand pounds of tilefish with an ex-vessel value of $876 thousand. Of all these vessels, 155 (85%) landed less than 5,000 pounds per vessel, 14 vessels (8%) landed between 5,000 pounds and 14,999 pounds, and the remainder (7%) landed higher amounts. One important issue to note here is that the number of vessels landing deepwater groupers and that landing tilefish are not additive as the same vessels can be harvesting both groups of species.

Given the information on vessel participation in the deepwater grouper and tilefish fisheries, the likely impact of a reduced quota for deepwater groupers and a quota on tilefish would befall on a few vessels that appear to account for most of the landings of these two groups of species. The following information on economic demand for Gulf

tilefish was provided by Bill Antozzi, NMFS:

"One way to measure the demand and supply situation is to look at prices. Since 90% of the Gulf landings are golden tilefish, I'll concentrate on golden. In 1998, 300 thousand pounds were landed in the Gulf, valued at $361 thousand, an average of $1.20 per pound. In the Atlantic, 3.3 MP were landed, valued at $5.5 million, an average of $1.65 per pound. This places the value for golden tilefish below that for groupers.

In fact tilefish have been substituted for grouper. The meat is not as firm as grouper but the flavor is good. Gulf tilefish usually does not command as high an ex-vessel price as Atlantic fish. There is a perception that the Gulf fish are not as firm. There is ongoing debate that this may be due to a prejudice in favor of the bigger suppliers on the mid- and north Atlantic.

Prices in the Gulf are not very stable and appear to be influenced by supply, which mainly comes from the mid-Atlantic. If there is good production in the Atlantic, prices can easily drop $1.00 per pound overnight. This is because tilefish are traditionally sold fresh and the market is sensitive to oversupply. Tilefish are usually graded into three or four categories: small - less than 4 pounds., medium - 4 to 8 pounds, large - 8 and up. Sometimes there is a jumbo category of 12 or 15 pounds and up.

Local ex-vessel prices (in April 2000) were $2.00, $2.20, and $2.60 for small, medium, and large, respectively. Due to a spurt of production on the Atlantic side, prices were expected to drop to $1.40, $1.60, and $2.00 per pound.

The major markets for tilefish are in New York and New Jersey, and in Canada. The New York Fulton Fish Market takes a lot of the production."

Considering that for a given demand the price structure for tilefish is more a function of production in the Atlantic, a 10% reduction in tilefish harvest as in Alternative 1(a) or Alternative 3(a) would not significantly raise the prices for Gulf-caught tilefish. In this sense, most of the negative impacts of a quota for tilefish that is lower than historical landings would be borne by the vessels. This would become very important if many of the restrictions for shallow-water grouper considered in this amendment were to be adopted.

7.0 REGULATORY IMPACT REVIEW

7.1 Introduction

NMFS requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem; and, (3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost-effective way.

The RIR also serves as the basis for determining whether the proposed regulation is a "significant regulatory action" under certain criteria provided in Executive Order 12866, and provides the general basis in determining whether the proposed regulation will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA).

This RIR analyzes the potential impacts that the alternatives in this Secretarial Amendment to the Reef Fish FMP would have on participants in the reef fish fishery.

7.2 Problems and Issues in the Fishery

The specific problems addressed in this proposed Secretarial Amendment are enumerated and discussed in Section 3.0 and are incorporated here by reference. The major issues identified for this plan amendment are: (1) red grouper biological reference points and stock status determination criteria, (2) rebuilding overfished stock, (3) red grouper quota; (4) shallow-water grouper quota, (5) commercial shallow-water grouper closed seasons and trip limits, (6) recreational shallow-water grouper closed seasons and bag limits, (7) commercial and recreational red grouper minimum size limits, (8) combined vs. separate fixed season and quota closures, and (9) deepwater grouper and tilefish quotas.

7.3 Objectives

Section 3.0 discusses the specific need for this Secretarial Amendment and is incorporated here by reference.

7.4 Description of the Fishery

A description of the fishery is contained in various sections of this amendment. Specifically, the following are relevant sections and are incorporated here by reference: Section 5.0, Section 6.0, Section 8.4, Section 9.2.1.1.3, Section 9.2.1.1.4, and Section 9.3.

7.5 Economic Impacts of Management Measures

7.5.1 Introduction

The discussions under the “Socioeconomic Impacts” sub-heading in Section 6.0 comprise part of the impact analysis for RIR purposes and are incorporated here by reference.

In rebuilding the red grouper stock, the Council’s main control instruments are TAC and

associated regulatory measures to constrain harvests to the chosen TAC. In developing a TAC, the Council may adopt either a constant catch or constant F strategy. Under a constant catch strategy, TAC is generally maintained at the same level over the rebuilding period whereas under a constant F, TAC is generally set at lower level at first and gradually adjusted upwards. In addition, the estimated TAC may be considered explicit or implicit. An explicit TAC is binding in the sense that the commercial or recreational sector may be closed once their quota is reached. If the TAC is implicit, neither the commercial nor the recreational fishery is closed once their respective quota is reached. An implicit TAC requires only an adjustment of regulatory measures that are deemed to effectively constrain both the commercial and recreational sectors to their respective allocations.

The general approach in this amendment is to select an explicit commercial quota for red grouper. It should be noted that an explicit 9.8 MP quota (9.35 MP GW) currently exists for the commercial shallow-water grouper complex. If either the red grouper commercial quota or the shallow-water grouper quota is reached then the entire shallow-water grouper fishery (including the red grouper fishery) will be closed.

Over the rebuilding period, the economic issue for the red grouper fishery may be characterized as a tradeoff in value of catches over time. A larger TAC now would yield greater commercial and recreational benefits in the short-term, but at the likely expense of a slower stock recovery. Conversely, a smaller TAC now would generate fewer short-term benefits, but likely would also lead to a faster realization of the benefits of a larger red grouper resource in the future made possible by a faster recovery of the fish stock. The net present value approach is useful in this particular situation.

Net present value is calculated as a weighted sum of annual net benefits expected to be received over time. The weighting factor is determined by the discount rate and declines exponentially over time. The choice of a discount rate plays an important role, especially when net present valuation is done over a longer period. A higher discount rate would favor a rebuilding period that generates more short-term benefits. Conversely, a lower discount rate would favor a rebuilding period with larger benefits in the long-term. In general, a 7% discount rate is used for net present valuation in U.S. fisheries, and it is the one used for the current purpose.

In order to quantify the economic implications of a rebuilding strategy for red grouper, a red grouper TAC has to be established and allocated to the commercial and recreational sectors. Although there is presently an implicit TAC (and explicit commercial quota) for the shallow-water grouper complex, there is none specific to red grouper. However, ABC ranges have been estimated (RFSAP 2001, 2002) that may be considered as possible TACs for purposes of estimating economic impacts. It should be pointed out at this stage that there is a significant difference between the 2001 and 2002 stock assessments with respect to the determination of the "current" status of the stock. The 2002 stock assessment showed a much improved "current" stock status than the 2001 assessment. The two assessments, however, are consistent in their determination of the stock status in 1997, which is the "current" year in the 2001 assessment. The improved condition of the stock allows the required harvest reduction to be scaled down substantially from 45% to about 10% to start off the rebuilding schedule for the red grouper stock. Current estimates of F range from 0.315 (steepness = 0.7) to 0.316 (steepness = 0.8), and F_{1997}/F_{msy} range from 1.031 to 0.869 and F_{1997}/F_{oy} range from 1.374 to 1.159, respectively, with the different values of steepness, thus necessitating the need for only modest harvest reductions if the actual steepness value is assumed to be closer to 0.7.

As for the commercial/recreational allocation, one possible choice is that provided under Amendment 1 which would use the landings history of both sectors for the period 1979-1987, although reporting of grouper landings by species in the commercial fishery started only in 1986. Other choices (to be included in Amendment 18) may also be used for estimation purposes. In an earlier version of this analysis the commercial/recreational allocation used was based on the proportional 1990-2000 average catch of red grouper by each sector. This base period was chosen in order to be consistent with the rest of the document that provide for regulatory measures to control the commercial and recreational sectors to their respective allocation. On this basis, the resulting allocation was 76% of TAC to the commercial sector and 24% to the recreational sector. Currently, the proposed measures in this amendment are based on a different base period, namely, 1999-2001. Using this new base period results in a different sectoral allocation of 81% commercial and 19% recreational. It should be noted that while different allocation ratios provide different magnitudes of impacts on both the commercial and recreational sectors, they do not affect the comparative impacts of the various rebuilding paths within each sector. Also, no attempt is made in this part of the document to estimate the economic impacts during the rebuilding period of any suballocation among various segments within the commercial and recreational sectors. However, the economic implications of sub-allocations within the commercial sector are discussed as part of determining the impacts of alternatives that would immediately change the allocation among the various segments of the commercial fishery.

7.5.2 Analytical Approach

The main analytical tool used here is a bioeconomic simulation model, called LEM model, developed by Dr. Lee Anderson (2000). This model has been adapted to the Gulf red grouper fishery for the purpose of analyzing the economic implications of the various rebuilding strategies and associated regulatory measures (see SEP Report, 2002a, 2002b). A more detailed description of the model, including the various parameters and assumptions, is contained in the SEP report (2002a, 2002b). This modeling approach is supplemented by a qualitative analysis particularly of some measures that cannot be properly analyzed by the model. In addition, some of the previous analyses partly based on the works of Waters (2001) and Holiman (2001) are maintained in order to present the economic implications of some measures that cannot be analyzed using the LEM model as well as to supplement the information generated by the LEM model. In its current form, the LEM model cannot analyze the impacts of changes in minimum size limit, quotas on species other than red grouper such as those for tilefish and deepwater groupers, specific monthly closures such as March versus October closure, changes in bag limits, and quotas and closures involving the entire shallow-water grouper complex.

The LEM model combines biological information about the red grouper stock with economic information about the fishery. The simulation models the joint commercial and recreational exploitation of a fish stock with 12 cohorts where recruitment is a function of spawning stock biomass. The basic parameters of the model are the initial stock size and composition, the initial number of boats and recreational participants, the coefficients on the recruitment and individual growth equations, the age of sexual maturity, the catchability and natural mortality coefficients by cohort, values for prices and costs. There are two harvesting sectors, a commercial fleet and recreational participants. The commercial sector has two fleets, longline and vertical line vessels. Both sectors produce fishing effort that imposes fishing mortality on the stock. The regulations affect the amount of fishing effort that one of the sectors can produce in any year. The effort and the resultant fishing mortality produces harvest for the two sectors. The size of the

commercial harvest determines vessel profits.

The biological parameters used in the LEM model are based on information provided by stock assessment experts at the SEFSC (Scott 2002) while the economic parameters are based on information provided by SERO economists (Waters and Holiman 2002). Values for the economic parameters were modified based on suggestions from participants of a modeling workshop held on May 22-24, 2002, in Tampa, Florida (Modeling Workshop).

Before analyzing the various rebuilding measures, the LEM model was first calibrated to match the predicted (per stock assessment) 2001 commercial and recreational harvest and discards. Model calibration involved changing the catchability coefficients for the commercial sector and changing the number of participants for the recreational sector. The absence of an estimated mean willingness to pay function forced the adoption of a surrogate relation that considered mean willingness to pay as a function only of the number of days fished. Thus, model calibration for the recreational sector involved changing the number of participants instead of changing the catchability coefficients as was the case for the commercial sector. One major implication of this treatment of the mean willingness to pay is that net present values for the recreational sector of rebuilding the stock cannot be estimated. It is then implicitly assumed that more economic benefits accrue to the recreational sector by rebuilding the stock. Another important limitation of the model affect the net present valuation for the commercial sector. Profits are calculated as net operating profits and thus do not account for fixed costs. In addition, ex-vessel prices and the number of vessels for each of the two fleets are held constant for the entire 25-year period. Price and vessel changes are introduced only exogenously when analyzing some of the regulatory measures for which those changes are deemed to be likely.

The calibration results, using the 2001 stock assessment parameters, matched perfectly well with the estimated total commercial and recreational harvests but overshot the total discards. The overall results (harvests plus discards), however, were only about 3% off the mark (see the report of the SEP (2002a) for more details). When using the 2002 stock assessment results, the calibration was done such that the predicted 2001 catch match the actual 2001 catch instead of the predicted (per stock assessment) 2001 catch (see the SEP (2002b) report for more details). One major implication of this slightly different approach is that for non-TAC regulations the LEM model will predict higher levels of catch and give a more pessimistic assessment of the biological consequences of the regulation.

7.5.3 Potential TACs

Table 7.1 presents four basic possible red grouper TACs during the rebuilding period – two for constant catch strategy and two for constant F strategy. The two TACs under constant F or constant catch are differentiated by the assumed steepness value of the spawner/recruit function. For a constant catch or constant F strategy, the two possible TACs represent the lower and upper limit of ABC. Other possible TACs would be any combination of these four TACs and the status quo. It should be noted at this juncture that while the status quo is an alternative, it will not achieve the required rebuilding target. After the stock is rebuilt to the target spawning stock biomass (SSB), TACs under each rebuilding strategies are assumed to equal MSY. Although TACs are generally expressed in whole weights, the approach taken here is to express them in gutted form so as to conform to the convention adopted in this document to express landings and harvests in gutted form.

Due to the potentially numerous scenarios that can be generated with a simulation model, TAC options for the rebuilding strategies used in the LEM model are limited to three sets (see Table 7.2). The first (TAC 1) is a constant catch strategy at steepness of 0.7; the second (TAC 2) is a constant F strategy at steepness of 0.7; and, the third (TAC 3) is a stepwise TAC strategy using three-year averages of constant F yield streams at steepness of 0.7. The status quo TACs are projected catches over the entire rebuilding period. Except for the status quo, the assumed TAC after the rebuilding period is the currently estimated MSY of 7.56 MP at steepness of 0.7. This is also the MSY level proposed in this amendment. These TAC options are deemed sufficient to quantify the economic impacts of rebuilding the red grouper stock especially that most of the regulatory measures considered in this amendment take the approach of employing management measures to control commercial and recreational harvests to the implicit TACs. In addition, the impacts of TAC 2 and TAC 3 are almost identical in all scenarios examined so that only TAC 2 is used in examining the economic implications of the various measures.

Simulation runs cover 25 years, i.e., 15 years beyond the 10-year rebuilding period, in order to provide some insights on long-term economic results of rebuilding the stock. This longer period enables the explicit consideration of the fact that losses are incurred in the short-term and benefits accrue in the long-term, with the values subjected to discounting. As noted above, a 7% discounting rate is used.

The rebuilding target level is SSB at MSY. Since there are two possible steepness values, two SSB targets are possible. The higher steepness value of 0.8 provides for a lower SSB target than the 0.7 steepness value. Although only the 0.7 steepness value is considered in this amendment, model runs are shown with SSB targets corresponding to the two steepness values. However, a rebuilding strategy (inclusive of the regulatory measures) is considered successful if it meets the SSB target at 0.7 steepness value of the spawner-recruit curve.

7.5.4 Baseline Model Runs

The baseline model runs show comparative biological status of the stock and economic status of the fishery with respect to the three TAC paths. The basis for comparison in this case is the status quo, which shows declining harvests over time. The status quo TAC, i.e., projected landings in the absence of any regulatory changes, consistently exceeds that of any of the rebuilding strategies every year during the rebuilding period but falls below MSY after the rebuilding period. For these model runs, total harvests are forced to not exceed a given TAC in each year of the 25-year period. This also means that both the commercial and recreational sectors do not exceed their respective allocations.

Constraining harvests to TAC does not necessarily mean adopting a explicit TAC, although some alternatives considered in this amendment provides for a explicit TAC for the commercial sector (see Section 6.4.2). In the present case, controlling harvests to TAC is interpreted as controlling harvests either by a explicit TAC or some regulatory means such that the harvest performance in each of the 10-year period matches with the chosen TAC.

Since LEM model provides economic impacts that pertain mainly to the commercial sector of the red grouper fishery, it is instructive at this stage to briefly describe the commercial fleet characteristics. For purposes of the model, the commercial fleet is composed of two types of vessels, longlines and vertical lines. Based on the Florida trip

ticket information, the two fleets have the following characteristics:

	No. of Vessels	Trip Cost	Trips/Year	Days/Trip
Longlines	138	$1,742.37	10.15	7.92
Vertical lines	408	$ 428.95	15.95	2.86

Participants at the Modeling Workshop contended that these numbers do not accurately depict the fleet currently operating in the fishery. It was thought that the more appropriate fleet description should be that of vessels that consistently participate in the fishery on a more full-time basis. It was decided that the following fleet characteristics would be more appropriate and are therefore the ones used in the LEM model:

	No. of Vessels	Trip Cost	Trips/Year	Days/Trip
Longlines	105	$2,200	10.15	12.0
Vertical lines	200	$ 650	18.00	7.0

Table 7.3 summarizes the overall results of the baseline model runs for the three sets of TACs. Figures 13, 14 and 15 provide more details. Under status quo, stock biomass declines over time so that even if both commercial and recreational sectors remain open year round, harvests subsequently fall. Keeping the status quo would not achieve the target SSB, but any of the rebuilding paths would do the job. For the commercial sector, total net present value stands at $100 million under status quo. Any of the rebuilding paths would raise the net present value to around $120 million, or a 20% increase. Longline vessels fishing for red grouper generate about $30 million more in net present value than vertical lines. The open season during the rebuilding period for either the commercial or recreational sector does not vary substantially from that after the rebuilding period. In the post-rebuilding period, however, the number of open fishing days does not fluctuate as widely as that during the rebuilding period partly due to the stability of stock size and TAC in the post-rebuilding period.

It is worth pointing out that under a constant catch path, the open season for both sectors monotonically declines from the first to the 10^{th} year of the rebuilding period, although the decline in the commercial sector is more steep than that in the recreational sector. The open season toward the later part of the rebuilding period under a constant catch strategy becomes shorter than the shortest open season under the stepwise TAC or constant F strategy. This situation raises the seeming irony that, under a constant catch strategy, success in rebuilding the stock requires more stringent measures to constrain harvest to TAC. A similar situation does not arise in the other two rebuilding strategies. Thus, although the biological outcome in terms of achieving the SSB target and the economic outcome in terms of net present values are about identical for the various rebuilding strategies, the social disruption attendant to the adoption of a rebuilding strategy could very well vary among the various rebuilding strategies.

Results from the baseline model runs provide at least five conclusions. First, any of the rebuilding paths can achieve the target SSB whereas the status quo cannot. Second, any of the rebuilding paths can provide economic gains relative to the status quo. Third, the economic outcome, at least from the commercial sector standpoint, appears not to significantly differ from one rebuilding strategy to another. Fourth, the stepwise and constant F strategies appear to be superior to the constant catch strategy in terms of introducing less disruption into the fishery as they do not necessarily require the adoption of more restrictive regulations as the stock rebuilds. Fifth, the fishing season for both the commercial and recreational sectors under any of the rebuilding strategy is shorter than

that of the status quo, even after the stock is fully rebuilt.

Although the biological gain from a rebuilding strategy can be preserved as long as harvests are effectively controlled so as not to exceed TAC, the economic outcome depends on other factors that may arise as a result of controlling harvest to match the TAC. One problem identified by participants at the Modeling Workshop is that closed seasons, or short open seasons, can lead to some loss in the market for red grouper because of the inability of domestic producers to provide continuous supply. A market loss can result in reductions in overall ex-vessel price. For the present purpose, a 33% reduction in ex-vessel price throughout the 25-year period, as suggested by participants at the Modeling Workshop, is modeled. Another problem discussed by the SEP (2002) is the possibility that (in the absence of price reductions) an increasing profit in the fishery, as illustrated in Figures 13, 14 and 15, tends to attract more entrants into the fishery.

Table 7.4 presents the results of modifying the baseline model by introducing a 33% reduction in price and a 1% annual increase in fleet size. Only a stepwise TAC strategy is used for this purpose, but similar results would come out using the other rebuilding strategies. The results show that a 33% price reduction due to market loss brings about a 36% reduction in overall net present values. This is in sharp contrast to the positive gain in net present values from a rebuilding strategy with the price kept constant. Further simulations show that a 5% decrease in price reduces the net present value gain to only 6% and that negative changes occur at price reductions of 10% or more (SEP 2002).

If prices remain constant and increasing profitability attracts new entrants into the fishery, reductions in net present values will ensue. A mere 1% increase in fleet size results in a steep decline in net present value although the net result is still positive. In terms of the number of vessels, a 1% increase in fleet size means one to two longline vessels and two to three vertical line vessels entering the fishery each year. This would increase the number of vessels from 105 longlines and 200 vertical lines at the start of the rebuilding period to 133 longlines and 254 vertical lines at the end of the 25-year period. It should be noted that current record systems indicate about 138 longline vessels and 408 vertical line vessels are landing red grouper, although as the Modeling Workshop participants concluded only about 105 longline vessels and 200 vertical line vessels (the numbers used in the simulation model) may be considered to harvest red grouper on a more consistent basis (SEP 2002). Given then the existence of more vessels that have experience in harvesting red grouper, vessel entry into the fishery is a likely event if profits rise.

7.6 Analysis of Specific Management Measures Alternatives

7.6.1 Red Grouper Sustainable Fishing Parameters, Minimum Stock Size Threshold, Maximum Fishing Mortality Threshold, and Optimum Yield

Red grouper minimum stock size threshold (MSST) and maximum fishing mortality threshold (MFMT) are discussed in Sections 6.2.2 and 6.2.3. Both of are basically a biological concept, but the current choices for either have significantly different socioeconomic implications when taking into account their potentially associated management measures. For purposes of economic impact analysis, these sets of measures have more relevance by way of affecting the choice of MSY and OY.

In terms of harvest yields, the choices for MSY are: (1) 7.264 - 7.560 MP; (2) 7.560 MP; and, (3) 7.264 MP. The second is the upper bound of the estimated MSY range and is the Proposed Alternative. Alternative 1 comprises the range of MSY while Alternative 3 is

the lower bound of the MSY range. For OY, the following are the three alternatives: (1) 6.803 MP; (2) 7.560 MP; (3) 7.385 MP. The third is the Proposed Alternative and it corresponds to 98% of MSY; the second corresponds to 100% of MSY; and, the third, 90% of MSY. Status quo MSY and OY are not explicitly defined.

Comparisons of the various MSY and OY levels may be inferred from the results of the LEM baseline runs. Although in the baseline model runs, the MSY level is kept constant for the three TAC paths, it can be inferred that the overall net present values would be higher with higher MSY or OY. The relatively similar results for all three paths indicate that regardless of the rebuilding path chosen, the higher the MSY or OY the higher will be the resulting net present values. It is also likely that a higher MSY or OY will be accompanied by longer post-rebuilding fishing season regardless of the rebuilding path adopted.

7.6.2 Red Grouper Rebuilding Strategy Alternatives

There are two basic rebuilding strategy alternatives, namely, constant catch and constant F alternatives. All the other three alternatives enumerated in Section 6.3.1 are variations or combinations of these two basic alternatives. Referring to the LEM model baseline runs, the stepwise approach is one possible option under the Proposed Alternative, the constant catch approach corresponds to one possible option under Alternative 1, and the constant F approach corresponds to one possible option under Alternative 2. Under the assumption of effectively controlling both the commercial and recreational sectors to their implicit allocations of TAC, the LEM baseline model runs provide a comparison of the various alternatives. In terms of overall results, all rebuilding alternatives can achieve the target SSB within 10 years or less and the net present values appear not to significantly differ from one rebuilding strategy to another. As can be gleaned from Figures 13, 14 and 15, the SSB target can be achieved within six years by the stepwise and constant F strategies and seven to eight years by the constant catch strategy. The Proposed Alternative for rebuilding the red grouper stock is similar to the stepwise approach, and thus may be adjudged at least better than the constant catch approach in terms of achieving the SSB target and of generating gains in net present values to the commercial sector. If, as noted above, price reductions of 10% or more occur due to the loss of market, all rebuilding strategies will result in net present value losses relative to the status quo.

Although the overall results in terms of achieving the SSB target and generating gains in net present values do not significantly differ from one rebuilding strategy to another, the short-term impacts differ among the five rebuilding alternatives. Table 7.5 presents the TACs and required harvest reductions (with respect to status quo) under the five rebuilding alternatives. The five alternatives (see Section 6.3.1) are specified as follows: Alternative 1 uses the constant catch TAC; Alternative 2 uses the constant F TAC; Alternative 3 uses three-year averages of the constant F TACs; Alternative 4 uses TACs of Alternative 1 for the first five years and TACs of Alternative 2 for the next five years (as partly shown in Table 6.4); and, Alternative 5 uses 5/6 of TAC under Alternative 1 for 9 years (Alternative 5f) and MSY on the 10^{th} year. This specification of each of the five alternatives is only one of several possibilities under each alternative, but it does provide enough information for comparing the short-term impacts of the various alternatives.

During the rebuilding period, projected harvests under status quo remain at relatively high levels and are greater than those of any of the rebuilding alternatives. This means that adoption of any of the five rebuilding alternatives will incur losses during the rebuilding period, but benefits in the post-rebuilding period will outweigh such losses as earlier

shown with the LEM model baseline runs. For the entire rebuilding period, the required harvest reductions are about the same for all rebuilding alternatives, except Alternative 5, which requires the highest overall harvest reduction. The required harvest reduction remains steady, except the last year, under Alternative 5 (a variation of constant catch), slowly declines under Alternative 1 (constant catch), and steeply declines under Alternative 2 (constant F). Alternative 3 (Proposed Alternative) shows steady reductions within each three-year interval, but steeply declining reductions from one three-year interval to another while Alternative 4 shows slowly declining reductions in the first five years and steeply declining reductions in the next five years. Alternatives 1 and 4 provide the least adverse impacts for the first three years of the rebuilding period while Alternative 2 and Alternative 3 (Proposed Alternative) provide slightly larger adverse impacts on fishery participants. Alternative 5 requires the largest reduction every year of the rebuilding period, except the very last year. In terms then of minimizing short-term adverse impacts, Alternatives 1 and 4 may be adjudged the best alternatives. It should be recalled, however, that Alternative 1 is a constant catch strategy while Alternative 4 is close to being a constant catch strategy, and thus these two alternatives would require more restrictive regulations in subsequent years when the stock is recovering so as to control harvests to TACs.

7.6.3 Rebuilding Scenarios

All the rebuilding scenarios under Sections 6.3.1, 6.4.1 and 6.5.1 would reduce commercial and recreational harvest by about the same proportion, ranging from approximately 9 to 48%. The general economic impacts of these scenarios relative to red grouper can be approximated by the estimated economic impacts under the LEM model baseline runs (Table 7.3 and Figures 13, 14, and 15). However, there are certain features of the various alternatives that may disproportionately impact certain segments of both the commercial and recreational sectors of the fishery. In addition, the scenarios affect not only red grouper but all shallow-water grouper fishing.

7.6.3.1 Commercial Sector

There are two potential management measures for the commercial sector of the shallow-water grouper fishery. For numbering consistency with Section 6, the scenario is numbered 1.

Scenario 1: Reduce the shallow-water grouper quota from 9.35 MP to 8.80 MP GW..

The Proposed Commercial Scenarios reduces the shallow-water grouper quota and represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest. The proposed quota reduction alternative is estimated to result in a 9.4% reduction in red grouper landings and 6% reduction in gag and black grouper landings, or 8.5% reduction in shallow-water grouper landings. Based on 1999-2001 average landings, these percent reductions translate to reductions of 556 thousand pounds or $1.33 million for red grouper only, 130 thousand pounds or $312 thousand for gag only, or 754 thousand pounds or $1.8 million for the entire shallow water grouper. Assuming the 1999-2001 average distribution of catches by gear type remains the same, longline vessels would bear approximately 90% of red grouper reductions and 83% of gag reductions, or 89% of all shallow-water grouper reductions. Vertical line vessels would bear none of the red grouper reductions and 17% of the gag reductions, or 5.5% of all shallow-water grouper reductions. Fish trap vessels would bear 10% of red grouper reductions and none of the

gag reductions, or 5.5% of all shallow-water grouper reductions.

As noted above, the LEM model can analyze the impacts of management measures on the red grouper fishery only, and thus the following analysis pertains only to the red grouper fishery. The February 15-March 15 closure is modeled as a 1-month closure so that eliminating it is modeled as allowing the fishery to remain open for the entire year. The proposed alternative which reduces the commercial quota for red grouper with the subsequent reduction in the shallow-water quota was not analyzed by the LEM model as this alternative was developed after the LEM analysis was completed. The previous version of this amendment proposed to: 1) set a shallow-water grouper trip limit of 5,200 pounds; 2) repeal the February 15-March 15 closed season on red, gag, and black grouper; and 3) reduce the shallow-water grouper quota to 8.80 MP GW. Alternatives 1 and 2 are no longer being considered a potential management measure for the commercial sector.

7.6.3.2 Recreational Sector

There is one potential management measures for the recreational sector of the shallow-water grouper fishery. For numbering consistency with Section 6, the scenario is numbered 1.

Scenario 1: Reduce the allowable bag limit for red grouper to two fish of the five fish grouper aggregate.

The two-fish red grouper out of five-fish aggregate grouper bag limit is expected to reduce recreational harvest by 9%. This alternative is specific to red grouper such that the reaction of anglers to potential reduction in red grouper harvest may not be in terms of outright trip cancellations. Anglers can switch to other species on a trip once the bag limit is met. In any event, certain reductions in consumer surplus may still arise from this management action, since angler flexibility is being constrained.

For the purpose of determining some general estimates on the magnitude of impacts of Scenario 1, it is assumed that the reduction in harvest due to the reduced bag limit is comparable to reductions in target trips. Considering, however, that trip cancellations are unlikely, the consumer surplus reduction under a bag limit change may be deemed less than that under closed seasons, even if the harvest reduction happens to be the same. A 9% reduction in harvest that translates to an equal percent reduction in target trips would result in a $2.2 million loss in consumer surplus. A comparable reduction in for-hire vessel revenues cannot be estimated for the reason that the bag limit change may not result in trip cancellations. Anglers may lose some benefits from the bag limit change but are still likely to take charter or headboat trips.

7.6.4 Shallow-Water Grouper Quota

7.6.4.1 Shallow-Water Grouper Quota Adjustments

Alternative 4 is the status quo, which specifies a commercial shallow-water grouper quota of 9.35 MP. Alternative 1 would reduce this quota to 7.77 MP while Alternative 2 would reduce the quota to 8.16 MP. Alternative 3 would reduce the quota to as low as 7.43 MP to as high as 8.80 MP. Alternative 3, Sub-option a, which provides for an 8.80 MP quota is the Proposed Alternative.

Relative to the current shallow-water grouper quota of 9.35 MP, the various quota

alternatives would result in the following reductions: 17% (from high end of 1993 allocation = 6.89 MP) under Alternative 1, 13% under Alternative 2 (from low end of 1993 allocation = 6.50 MP), 6% under Alternative 3-a (from 1999-2001 average red grouper harvest; Proposed Alternative), 14% under Sub-option b(i) of Alternative 3 (set gag to the 1999-2001 average harvest), 21% under Sub-option b(ii) of Alternative 3 (set gag to commercial allocation 31% of 5 MP recommended by RFSAP; 1986-1989 average), 16% under Sub-option b(iii) of Alternative 3 (set gag to commercial allocation 39% of 5 MP recommended by RFSAP; 1999-2001 average), and 17% under Sub-option c of Alternative 3 (set gag to commercial allocation 39% of 5 MP recommended by RFSAP; 1999-2001 average). However, relative to average commercial landings of shallow-water grouper in the 1999-2001 period, these reduced quotas would amount to a 10% reduction for Alternative 1, 5% reduction for Alternative 2, and 0% reduction for the Council's proposed sub-option under Alternative 3. The other sub-options for Alternative 3 would reduce landings ranging from 5% to 14%.

Over the short-run, the relevant reductions are more likely those with respect to landings in the last 3 years (1999-2001). Thus, the potential reductions in landings would range from zero to 14% under the various alternatives. The Proposed Alternative is very close to the average landings in the last three years so that it may not result in any landings reductions of shallow-water grouper. Using these percent reductions, Alternative 1 would reduce total landings by 0.84 MP or $2.0 million of ex-vessel revenues while Alternative 2 would reduce total landings by 0.45 MP or $1.1 million in ex-vessel revenues. Reductions under Alternative 3 range from zero under the Proposed Alternative to 1.18 MP or $2.8 million in ex-vessel revenues under Alternative 3(b)(ii).

Of particular importance in any quota reductions that would actually be binding in terms of actual landings being projected to exceed the quota, is the possibility of an early closure. Faced with an early closure in one year, fishermen may be expected to fish hard and fast in subsequent fishing years, resulting into an ever shortening season. This derby-like attitude was experienced in the commercial red snapper fishery when the quota was initially lowered in 1991 from 3.1 MP to 2.04 MP. Fishing days dropped from 365 in 1990 to 236 in 1991, and to 52 in 1992 before a quota increase through an emergency action allowed 42 additional fishing days. Subsequent quota increases somewhat mitigated the derby effect, but as fishermen adopted to higher quotas, additional regulatory fixes had to be adopted to address the derby issue. To this day, no effective solution to the derby problem in the red snapper fishery has been instituted although an IFQ-type solution is currently being considered for the red snapper fishery. The derby in the red snapper resulted, among others, in supply glut over a short period and low ex-vessel prices. Waters (2002) estimated that for the period 1996-1999, commercial red snapper fishermen generated $35.6 million in revenues and might have forgone an additional $17.3 million due to the derby condition in the fishery.

The impacts of the various quota alternatives would partly depend on the type of measures adopted to control the harvest of red grouper to the commercial allocation of the TAC. If the red grouper commercial quota is explicitly specified as a quota and thus the fishery is closed upon reaching the quota, a derby in the red grouper fishery may ensue. If only the red grouper fishery is closed by then, fishermen can shift part of their effort to target other groupers. This may not necessarily result in early closure of the shallow-water grouper if the extra effort expended on red grouper during the open season were originally directed at other groupers. If closure of the red grouper segment also means closure of the entire shallow-water grouper fishery, then a derby may be expected in both the red grouper and other grouper fisheries, along with a subsequent reduction in vessel revenues and profits.

Another scenario that may happen is that the red grouper quota is not explicitly specified so that no red grouper quota closures occur. But to control the harvest of red grouper other measures considered in this amendment, such as red grouper seasonal closures, and red grouper trip limits may have to be adopted. If these measures force fishermen to target other grouper species, then early closures in the other grouper fishery may occur, eventually leading to a derby in that fishery. Thus, it is possible that a derby in the other grouper fishery may occur even if there is no derby in the red grouper fishery.

Considering that the other (than quotas) proposed actions in this amendment, such as the shallow-water grouper trip limit, would affect the harvest of all shallow-water groupers, the occurrence of a derby would depend on the level of total shallow-water grouper established relative to the expected harvest under the proposed actions in this amendment. In the particular case of the shallow-water grouper trip limit, the expected harvest reduction is approximately equal to the proposed reduction in the shallow-water grouper quota. If this measure were truly effective, the potential for the reduced quota to be exceeded appears to be less likely.

In terms of initial impacts, quota adjustment and closures, unlike a uniform trip limit would not impose a regulatory bias in negatively affecting the various commercial participants. The eventual outcome during the rebuilding period would depend on the ability of various commercial fishing entities to adapt to the reduced quota and other measures proposed in this amendment.

7.6.4.2 Shallow-Water Grouper Quota Actions

Alternative 4 is the status quo. This alternative maintains an aggregate shallow-water grouper quota, with closure in the fishery when the quota is reached. Alternatives 1 and 2 essentially specify a separate red grouper quota. Alternative 1 specifies a closure when the red grouper quota is reached but allows the other shallow-water grouper segments to remain open until the aggregate quota is reached. Alternative 2 modifies Alternative 1 by specifying fishing closure for other shallow-water grouper only on certain areas when the red grouper quota is reached. Alternative 3 allows continued harvest of red grouper until its commercial allocation is filled even if the aggregate shallow-water grouper quota is already filled. Alternative 5 is the Proposed Alternative and closes the commercial shallow-water grouper fishery when the commercial quota of red grouper is reached or the shallow-water aggregate quota is reached, whichever comes first.

To the extent that Alternatives 1, 2, 3, 4 and 5 complement the previous section's alternatives, the nature of impacts would be similar to that described in the previous section, with certain additions. Alternative 1 would likely result in more discards of red grouper than Alternative 2, but at the same time it would result in lesser negative short-term socioeconomic impacts on the commercial fishery, since vessels are allowed to move into another closely related fishery. Within Alternative 2, suboption (b) offers a better balance in conserving the red grouper stock and minimizing the negative short-term socioeconomic impacts on the fishery. Alternative 3 would cushion the impacts of a lower shallow-water grouper aggregate quota, but at the same time would allow the aggregate quota to be exceeded. This would happen mainly when there is a significant shift in effort from red grouper to other groupers in the complex. Alternative 5 would have similar impacts as Alternative 2 and Alternative 4 combined, but the characteristic effects would depend on the historical level of catches of red grouper or shallow-water grouper and potential reactions of fishermen to closures based on reaching the red grouper or shallow-water grouper quota. A more lengthy discussion of this alternative is presented

below.

Fishery closures compel fishermen to switch to another fishery during the closed season or temporarily stop fishing entirely. Short-term economic losses to commercial fishermen are determined as the difference between how much they would have earned by fishing for shallow water groupers during the closed period and their opportunity costs, defined as their potential earnings in another fishery or in their next-best occupation, if any. In addition, the short-term effects of fishery-wide quotas and seasonal closures depends on how fishermen change their fishing strategies and patterns in response to the regulation. The longer-term effects of fishery-wide quotas and seasonal closures depend on changes in fishing strategies and the potential increases over time in fish stock abundance due to regulatory protection.

Alternatives exist for individual fishermen if they wished to switch from shallow-water grouper trips to other kinds of fishing trips. However, a fishery-wide quota and closure would induce mass switching. Fishing pressure is high on most species throughout the Gulf of Mexico, and most of the alternative species probably cannot support the extra fishing pressure that would result from mass switching. In the northern Gulf, the primary alternative species are red and vermilion snappers. Red snapper are overfished. The red snapper fishery is already heavily regulated, and regulations are likely for the vermilion snapper fishery. Shallow-water groupers support the bulk of the commercial fishing opportunities in west-central Florida. Individual fishermen with bottom longlines could switch to deep-water groupers, but the abundance of the deep-water groupers does not appear sufficient to support mass switching of fishing effort displaced by a closure of the shallow-water grouper fishery. Similarly, individual fishermen with vertical lines could switch to greater amberjack, a variety of snappers, triggerfish and king mackerel, but these species probably cannot support mass switching of fishing effort either. Fishermen will attempt to switch fisheries in response to closure of the shallow-water grouper fishery, but the adverse biological effects of additional fishing pressure on these species could result in additional regulations that preclude them as viable alternatives to the shallow-water grouper fishery. Therefore, in this analysis, fishermen are assumed to stop fishing during the closure unless their existing trips include catches of species other than shallow-water groupers that are sufficiently valuable to cover the costs of fishing.

Assuming that the only major measures adopted are quotas and quota closures and assuming further that the relevant quota alternatives are as enumerated under Section 6.4.2, Alternative 1 would result in short-term revenue losses of $0.82 million at the commercial red grouper quota of 5.31 MP. As noted earlier, a derby condition may develop in the red grouper fishery and thus eventually would increase the revenue loss due to price depression, but this would be partially mitigated by the fact that vessels can still target other species in the grouper complex. The magnitude of this partial mitigation would depend on the level of shallow-water grouper established. That is, the adverse impacts of a red grouper quota closure would be cushioned more under an 8.80 MP than under a 7.43 MP shallow-water grouper quota. Naturally, the cushion would be higher under the status quo aggregate quota of 9.35 MP. Under Alternative 1, a relatively greater proportion of the landings and revenue reductions would be borne by longline fishermen, since they have historically accounted for a greater share of the total commercial red grouper landings.

There are two general scenarios that may happen under Alternative 2, each of which would likely result in exacerbating the negative impacts of Alternative 1. First, the quota for other (than red) shallow-water groupers would be caught at the same time as, or earlier

than, that for red grouper. Second, some other shallow-water quota remains unharvested when the red grouper quota is met. In the first scenario, it appears unlikely that fishermen would harvest other groupers first before red grouper just to keep the fishery open for a longer period since a reduced red grouper quota would induce a race to catch the species, unless it is done with cooperation from most, if not all, red grouper fishermen. The most likely case then under the first scenario is that the quota for all other shallow-water grouper species would be caught at the same time as that for red grouper. When this happens, not only will there be a supply glut for red grouper but also for other groupers, thus depressing the prices for all shallow-water groupers. Ironically, price depression under the scenario described would be particularly severe with a higher quota, such as 8.80 MP. In this case, overall revenues from both red grouper and other shallow-water groupers would be depressed. The amount of total revenue reductions cannot be estimated in the absence of actual estimate of the length of the season and price flexibilities for red grouper and other shallow-water groupers.

Under the second scenario for Alternative 2, the amount of additional revenue reductions would depend on, among others, the amount of the other shallow-water grouper quota that remains unharvested once the red grouper quota is reached. Under a 5.31 MP red grouper quota and shallow-water grouper quotas that range from 7.43 MP to 8.8 MP (see Section 6.4.1), the only time the second scenario for Alternative 2 occurs is when the rate of harvest for other shallow-water groupers is significantly lower than that for red grouper. The likelihood of this happening cannot be ascertained. It only remains to state that the potential harvest and revenue reductions would be mitigated if the closures apply only to certain areas in the Gulf, as in Sub-options (a) and (b) of Alternative 2.

Among the alternatives in this section, Alternative 3 has the least short-term negative impacts on fishery participants. In fact, there is a possibility that this alternative would lead to increased harvest beyond the current shallow-water grouper quota of 9.35 MP. This happens if fishermen concentrate their effort first on other shallow-water grouper and later on red grouper. Naturally the relative abundance of other shallow-water groupers play an important in this situation.

The impacts of Alternative 4 (status quo) would depend on the established shallow-water grouper quota. These impacts are essentially similar to those discussed in Section 6.4.1.

The potential impacts of Alternative 5 (Proposed Alternative) can be further analyzed using historical monthly landings of red grouper and shallow-water grouper. Table 10 summarizes the recent history of landings for red grouper, gag and all shallow water groupers combined. Data averaged over the 1999-2001 period indicate that commercial fishermen landed 9.00 MP of shallow water groupers, including 6.05 MP of red grouper. On average for 1999-2001, cumulative landings of red grouper were 5.01 MP by the end of October and 5.52 MP by the end of November. Hence, the 5.31 million pound quota for red grouper would be reached by approximately mid-November. Similarly, cumulative landings of all shallow water groupers were 8.2 MP by the end of November and 9.0 MP by the end of December, and the 8.80 million pound quota would be reached in late December. Thus, the proposed quota for red grouper is more restrictive than that for all shallow- water groupers; that is, the commercial quota for red grouper, rather than the quota for all shallow- water groupers, would trigger a closure.

The seasonal pattern of commercial landings for individual years deviates slightly from the average. Annual data for 1999, 2000 and 2001 indicate that the red grouper quota would have been reached as early as the end of October in 1999 and as late as the end of

November in 2001. The shallow-water grouper quota would have been reached in early December in 2001, and would not have been reached at all in 1999. In all three years, the quota for red grouper, rather than the quota for shallow-water groupers, would have triggered a closure.

Logbook trip reports submitted by fishermen to the NMFS were examined for the 1999-2001 period and used to calculate average annual short-term losses to commercial fishermen due to a mid-November closure date for the shallow-water grouper fishery. For each trip with bottom longlines or vertical lines, trip revenues earned from species other than shallow-water groupers was compared with average trip costs obtained from information provided by grouper fishermen at a workshop held in May 2002. Average trip costs for trips with fish traps were obtained from a 1993 survey (Waters 1996[6]) and updated to 2001 price levels with the Producer Price Index for #2 diesel fuel. If revenues without shallow-water groupers exceeded average trip costs, then it is assumed that the trip would be taken despite the closure for shallow-water groupers, and that economic losses due to the closure would be determined as the value of shallow-water groupers that otherwise would be landed. If revenues without shallow-water groupers were less than average trip costs, then it is assumed that the trip would not be taken. If a trip is not taken, then fishermen lose revenues from all species, including those not in the shallow- water grouper complex. However, if a trip is not taken, then fishermen also do not incur the cost of fishing. Hence, economic losses for trips not taken due to the closure would be determined as the difference between trip revenues for all species and average trip costs. An estimate of total short-term economic losses to commercial fishermen during the closed season is calculated as the sum of trip losses for all trips landed after mid-November. This method of estimation is an approximation because future fishing trips may not land the same species composition and quantities as during 1999-2001, and because not all fishermen incur costs equal to the averages used here.

The economic effect of a mid-November closure of the shallow-water grouper fishery is calculated as the change in net operating income, defined as trip revenues minus trip costs exclusive of captain and crew shares. Hence, it is a measure of the combined income to boat owner, captain and crew after payment of shared expenses but prior to payment of fixed costs by the boat owner and any operating costs incurred by owner, captain or crew that were not shared.

Results by primary gear type are presented in Table 11. Fishermen are expected to lose approximately $1.74 million per year, including $1.02 million for boats with bottom longlines, $0.62 million for boats with vertical lines, and $0.11 for boats with other gears. The fishery would close in mid-November, with fishermen landing 5.31 MP of red grouper and approximately 7.9 MP of shallow-water groupers. Thus, the estimated reduction in landings would be approximately 1.11 MP of shallow-water groupers, including approximately 0.74 MP of red grouper.

A fishery-wide quota and closure primarily would affect fishermen who use bottom longlines because they account for the largest share of industry landings (Table 11). On average for 1999-2001, fishermen with bottom longlines landed 3.55 MP of red grouper and 4.48 MP of shallow-water groupers. A mid-November closure, based on 1999-2001 average landings, would halt the shallow-water grouper fishery after longliners would have landed approximately 3.03 MP of red grouper and 3.84 MP of shallow-water

[6]Waters, James R. 1996. An economic survey of commercial reef fish vessels in the U.S. Gulf of Mexico. National Marine Fisheries Service, 101 Pivers Island Road, Beaufort, NC 28516.

groupers. Therefore, the estimated reduction in landings for bottom longliners would be approximately 0.52 MP of red grouper and 0.64 MP of shallow-water groupers.

Without quota management, boats with bottom longlines landed, on average, 59% of the total red grouper harvest and 50% of the total shallow-water grouper harvest. With the proposed red grouper quota and shallow-water grouper quota, boats with bottom longlines would land 57% of the total red grouper harvest and 49% of the total shallow- water grouper harvest. Bottom longliners would incur a disproportionate share of the total estimated reduction in landings of shallow-water groupers because monthly landings during the October through December period are greater than average. On the other hand, monthly landings during the October through December period are less than average for boats with vertical lines, fish traps and other gears.

Data averaged for 1999-2001 indicates that boats with bottom longlines normally take approximately 165 trips after the closure date and catch groupers primarily, with only small quantities of other species (Table 12). A closure in mid-November is estimated to eliminate all but 24 trips that generate enough revenue from other species to cover their routine trip costs. As a result, boats with bottom longlines are predicted to lose about 92% of the net operating incomes that would ordinarily be earned during the closed period, and about 11% of total annual net operating incomes.

A fishery-wide quota and seasonal closure also would affect fishermen who use vertical lines (Table 11). On average for 1999-2001, fishermen with vertical lines landed 1.58 MP of red grouper, 1.21 MP of gag and 3.48 MP of shallow-water groupers. They would land approximately 3.09 MP of shallow-water groupers, including 1.42 MP of red grouper, before the fishery would close in mid-November, based on average landings from 1999-2001. Therefore, the estimated reduction in landings for fishermen with vertical lines would be approximately 0.39 MP of shallow-water groupers, including 0.16 MP of red grouper.

From mid-November through the end of the year, net revenues to boat owners, captains and crews are predicted to be approximately $1.27 million without quotas and $0.65 million with quotas and closures (Table 12). Hence, boats with vertical lines are predicted to lose about 49% of the net operating incomes that would ordinarily be earned during the closed period, and about 4% of total annual net operating incomes. As a group, boats with vertical lines would be relatively less affected by a mid-November closure than boats with bottom longlines because the closure would occur at a time of year with slightly below average monthly landings of shallow-water groupers, and because the group includes most of the trips that normally catch shallow-water groupers in the northern Gulf where they are not the predominant species. Shallow-water groupers do not represent the primary source of revenue for many of these trips; hence a closure may not cause them to be cancelled. For example, about 72% of trips during the closure with vertical lines would be cancelled, whereas about 85% of trips with bottom longlines would be cancelled. It is assumed that trips taken during the closure would catch shallow-water groupers at the same rate as without a closure, but that they would be discarded.

A fishery-wide quota and seasonal closure would have less of an effect on fishermen who use fish traps and other gears (Table 11). On average for 1999-2001, fishermen with fish traps landed 0.89 MP of red grouper and 0.94 MP of shallow water groupers, with the bulk of their catches occurring between May and September during the closed season for stone crabs. Fishermen with fish traps would land approximately 0.84 MP of shallow-water groupers before the fishery would close in mid-November, based on average

landings from 1999-2001. Therefore, the initial estimated reduction in landings for fishermen with fish traps would be approximately 0.05 MP of shallow-water groupers, or about 5.6% of their 1999-2001 average landings. On average between 1999 and 2001, fishermen who used other gears landed 0.10 MP of shallow-water groupers, of which approximately 0.09 MP would be landed prior to a mid-November closure. The expected reduction in landings of shallow-water groupers would be 0.01 MP, or approximately 10% of the 1999-2001 average.

Results by area are presented in Tables 13 and 14. Fishermen are expected to lose approximately $1.74 million per year, including $1.26 million for boats in west-central Florida, $0.34 million for boats in northwest Florida, and $0.14 for boats in other areas.

Boats that fish off the west-central coast of Florida would incur the greatest economic effect (about $1.26 million annually) from a mid-November closure of the shallow-water grouper fishery because that is where red grouper primarily exist (Tables 13-14). On average for 1999-2001, fishermen landing their catches between NMFS areas 3 and 6 (approximately Collier through Citrus Counties) landed 6.65 MP of shallow-water groupers, including 5.03 MP of red grouper and 1.08 MP of gag. A mid-November closure, based on 1999-2001 average landings, would reduce landings of shallow-water groupers by approximately 0.81 MP, including 0.59 MP of red grouper. Boats in west-central Florida are predicted to lose about 94% of the net operating incomes that would ordinarily be earned during the closed period, and about 10% of total annual net operating incomes.

Smaller quantities of red grouper, gag and other shallow-water groupers are landed elsewhere in the Gulf of Mexico (Tables 13-14). Fishermen between NMFS areas 7 and 10 (approximately Levy County, Florida through Mobile Bay, Alabama) would lose about $0.34 million per year. They landed, on average from 1999-2001, 1.80 MP of shallow-water groupers. A closure of the shallow-water grouper fishery in mid-November would reduce landings by 0.23 MP. Fishermen in the Florida Keys would lose about $0.08 million per year. They landed, on average, 0.34 MP of shallow-water groupers, of which approximately 0.04 MP normally would be landed after the expected closure date in mid-November. Fishermen in the rest of the Gulf of Mexico would lose about $0.06 million per year. They averaged 0.21 MP of shallow-water groupers, of which 0.3 MP normally would be landed after mid-November.

These estimates assume that fishing patterns with quota management would remain the same as without quota management. However, quota management creates incentives for fishermen to accelerate their fishing activities to maximize their shares of the quota before the fishery is closed. Fishermen know that catches that normally would occur after the expected closure date will be lost. Therefore, they probably will plan trips earlier in the season to beat the closure, which results in an earlier-than-expected closure date and could lead to derby fishing when the fishery opens again. There is no formula with which to quantify the likelihood that a derby fishery will occur. Each individual's response to quota management depends on what he thinks his competitors will do. However, fishermen are capable of fishing more intensively if they believe it necessary to stay competitive. If a derby occurs, fishermen who fail to join the race for fish end up with smaller overall catches before the quota is reached and the season is closed. Fishermen compete in the race for fish by investing in additional electronics and more efficient gear designed to reduce search time and increase catches per day fished. Also, they may fish in poor weather and skimp on regular maintenance and repair schedules, which increases the likelihood of engine and gear breakdowns, accidents and injuries. The result is ever-

shorter open seasons, higher harvesting and ownership costs to catch the same overall quantity (as defined by the quota), a deterioration in overall level of safety in fishing operations, market gluts because the entire season's landings are no longer spaced throughout the year, and lower ex-vessel prices. Consumers benefit from lower fish prices during the derby. However, traditional marketing channels are interrupted by a closure, with the break in supplies of fresh fish mitigated by increased reliance on frozen fish or imports during the closed season.

The economic inefficiencies of quotas will become more acute over time if management is successful biologically in augmenting the stocks of shallow-water groupers. Larger fish populations yield higher catch rates, which enable fishermen to fill the quota more quickly which, in turn, accentuates the need to race for fish before the season is closed. Higher catch rates also tend to attract additional fishing effort from other fisheries, which further exacerbates the likelihood of derby fishing.

7.6.5 Additional Alternatives to Reduce Fishing Mortality

7.6.5.1 Commercial Shallow-Water Grouper Closed Seasons

Table 6.7 provides some information on monthly operations of reef fish vessels landing red grouper, gag, or black grouper. Trips are number of trips landing any of the three species; lbs. are thousand pounds (GW) landed of the combined three species; and, $ are the dockside revenues in thousand dollars for the three species combined.

Table 6.7 shows the number of trips, pounds landed, and dockside revenues that would be lost to the reef fish vessels if certain months of the year are closed to commercial fishing. In the case for example of Alternative 1, which closes the fishery for the months of March through May, reef fish vessels would stand to lose about 1.7 MP of red grouper, gag, and black grouper valued at about $3.7 million in dockside revenues. About 2,926 trips would be affected. For longline vessels only, the losses would be about 878 thousand pounds of the three species valued at $1.9 million, and 368 trips would be affected. For vertical line vessels only, the losses would be about 672 thousand pounds valued at $1.5 million, and about 2,290 trips would be affected. For fish trap vessels only, the losses would be about 145 thousand pounds valued at $288 thousand, and about 164 trips would be affected. Since a February 15-March 15 closure is now in place, losses from this closure should be subtracted from those of the March-May closure. Assuming that losses from this one-month closure can be approximated by the average of February and March figures, net losses from the March-May closure would be about 1.2 MP in landings, $2.6 million in dockside revenues and 1,975 in trips for all reef fish vessels. Corresponding net losses to longline vessels only would be about 581 thousand pounds, $1.3 million, and 252 trips. Corresponding net losses to the vertical line vessels would be 480 thousand pounds in landings, $1.05 million in dockside revenues, and 1,520 in trips. Corresponding net losses to the fish trap vessels would be 121 thousand pounds in landings, $237 thousand in dockside revenues, and 125 in trips.

If effort were shifted from the closed months to the open months, about 2,926 vessel trips (or about 1,975 net trips) would have to be spread around. In the event that effort is successfully shifted in terms of offsetting most, if not all, of forgone landings, there is a high likelihood that prices in those open months would decline. Thus, even in the case where total landings are effectively maintained at levels before the closure, it would be unlikely for the forgone dockside revenues to be fully recouped. During the closed months, prices for groupers may be expected to increase. The extent of such price

increase would depend partly on the supply of substitutes, particularly imports. It has been reported, partly through public testimonies before the Council, that during the February 15-March 15 red grouper and gag closure, local supply was augmented by imports.

Table 6.11 presents some information on monthly importation of snappers and groupers (all species combined) into the southeastern U.S. Grouper imports range from around 600 thousand pounds to a little over 1 MP. They peak in March and April, but remain relatively high from January to July. Snapper imports are about twice the grouper imports each month of the year. They remain relatively high throughout the year, with peaks in March and July. By far the single largest supplier of groupers imported by the U.S. is Mexico, which in 2000 supplied 6.3 MP of groupers worth $12.4 million. The second largest supplier is Panama, but it supplied only 941 thousand pounds of grouper worth $1.3 million. Mexico is also the largest supplier of snappers at 6.4 MP in 2000. But other countries such as Panama and Brazil, each of which supplied about 5 MP, are not too far behind. Although domestic harvests are not totally comparable to imports in product form and quality, the high level of imports, even just for groupers, appear to dominate domestic production. For red grouper, gag, and black grouper combined, domestic production stood at about 500 thousand pounds to 700 thousand pounds on a monthly basis. As they currently stand, imports may be considered to stabilize prices during short-term disruptions in domestic production. Longer-term disruptions, such as a March 1-May 31 closure, can have some impacts on domestic prices, unless imports adjust accordingly. In the absence of information regarding the availability of grouper stock in foreign countries, it is readily evident what the reactions would be of foreign exporters if domestic producers of groupers are faced with longer fishing closures. Noting that there is only one country (Mexico) that largely dominates the supply of imported groupers, it is likely that longer closure in the domestic grouper fishery can create relatively severe disruptions in grouper supply that would lead to increases in prices. Other countries would probably have to step up their production of groupers for export to the U.S. to mitigate the disruptions in local supply due to longer closed seasons.

With regard to the specific alternatives in Section 6.5.1, Table 6.7 provides some information on the potential economic impacts of any possible combination. Alternative 3 is very unlikely to change the landings reductions that may result from closures, especially if the species is subject to quota closures, but it could affect the revenues and profits of commercial fishing vessels.

7.6.5.2 Commercial Grouper Trip Limits

Inclusive of the status quo (Alternative 3), which does not impose a trip limit, there are five alternatives considered. Alternative 1 imposes gear-specific shallow-water grouper trip limits of 6,000 pounds for longlines, 4,000 pounds for fish traps, and 2,000 pounds for other gear. Alternative 2, imposes a uniform shallow-water grouper trip limit of 5,200 pounds for all gear types. Alternative 4 imposes a uniform shallow-water grouper trip limit of 7,000 pounds for all gear types. Alternative 5 imposes a uniform shallow-water grouper trip limit only if 75% of the shallow-water grouper quota is reached by September 30, with the trip limit being either 4,000 pounds, 5,000 pounds, 6,000 pounds or 7,000 pounds in GW.

Due to the limitations of the LEM model, Alternatives 1, 2 and 3 are considered identical for modeling purposes, and thus earlier discussions on the modeling results for Scenario 1-3 for the commercial sector are deemed sufficient for the current purpose. The

following discussion is provided to evaluate the basic differential impacts of the various alternatives for shallow-water grouper trip limits that cannot be captured by the current specification of the LEM model.

Trip limits prohibit fishermen from landing quantities in excess of the legal limit. Fishermen who normally would catch more than the trip limit can terminate the fishing trip prematurely and return to port. Hence, trip limits, when they constrain landings per trip, reduce revenues per trip and encourage fishermen to take shorter and more frequent fishing trips, which increases overall fuel costs and the amount of non-fishing time spent traveling from port to fishing grounds and back. This outcome is likely when a trip limit is established for species, such as the shallow-water groupers, that are the main target species of a trip. Alternatively, fishermen could continue fishing for other species and discard any additional shallow-water groupers caught, which reduces revenues per trip and increases fuel consumption for fishermen who change fishing locations to avoid concentrations of the protected species. This outcome is likely when a trip limit is established for a secondary species on a multi-species fishing trip. Trip limits have no economic effects when fishermen catch less than the legal maximum.

Although Alternative 1 and Alternative 2 are each expected to reduce red grouper landings by 9.4%, the two alternatives differ in the distribution of impacts on the various gear types. Under Alternative 1, the expected reduction in red grouper landings is about evenly distributed among the three gear types, but under Alternative 2 such expected reduction in red grouper landings is mostly borne by the longline vessels. Alternative 2 is estimated to result in a 9.4% reduction in red grouper landings and 6% reduction in gag and black grouper landings, or 8.5% reduction in shallow-water grouper landings. Based on 1999-2001 average landings, these percent reductions translate to reductions of 556 thousand pounds or $1.33 million for red grouper only, 130 thousand pounds or $312 thousand for gag only, or 754 thousand pounds or $1.8 million for the entire shallow water grouper. Longline vessels would bear approximately 90% of red grouper reductions and 83% of gag reductions, or 89% of all shallow-water grouper reductions. Vertical line vessels would bear none of the red grouper reductions and 17% of the gag reductions, or 5.5% of all shallow-water grouper reductions. Fish trap vessels would bear 10% of red grouper reductions and none of the gag reductions, or 5.5% of all shallow-water grouper reductions. Under Alternative 1, longline vessels are expected to give up 9.4% of their red grouper landings, 16% of their gag landings, or 9.4% of their shallow-water grouper landings. Vertical line vessels are expected to lose 9.4% of their red grouper landings, 8.5% of their gag landings, or 10% of their shallow-water grouper landings. Landings by fish trap vessels are expected to be reduced by 9.4% for red grouper, 0% for gag, or 9% for shallow-water grouper. Although the percentage reductions for red grouper are equal for all gear types, longlines will still lose more than other gear types in terms of pounds of red grouper, because longlines account for most of red grouper landings. Also, vertical line vessels will lose more gag in terms of pounds, although their percentage reduction is only half that of longline vessels, because vertical line vessels account for most of gag landings.

Table 15 summarizes the recent history of landings for shallow-water groupers with respect to the proposed 7,000 pound trip limit (Alternative 4). Data averaged over the 1999-2001 period indicate that 995 boats landed approximately 9.00 MP of shallow water groupers on a total of 10,836 trips. On average, 56 boats reported 153 trips per year with more than 7,000 pounds of shallow-water groupers. Approximately 344 thousand pounds of shallow-water groupers were landed in excess of the proposed 7,000 pound trip limit.

Table 16 indicates that boats with bottom longlines make relatively high-volume trips, and hence are more likely than boats with other gears to be affected by the proposed 7,000 pound trip limit. On average for 1999-2001, boats with bottom longlines landed nearly 4.49 MP of shallow-water groupers, of which 290 thousand pounds (6.5%) were in excess of the proposed 7,000 pound trip limit. In contrast, boats with vertical lines landed 3.48 MP of shallow-water groupers, of which 27 thousand pounds (0.8%) were in excess of the trip limit. Approximately 16 thousand pounds (1.7%) of shallow-water groupers were landed in excess of the trip limit by boats with fish traps.

Table 17 indicates that fishermen off the west-central coast of Florida averaged 6.65 MP of shallow-water groupers per year, of which 0.30 MP were landed in excess of a 7,000 pound trip limit. Fishermen in all other areas of the Gulf of Mexico landed 0.04 MP of shallow-water groupers in excess of a 7,000 pound trip limit.

Logbook trip reports submitted by fishermen to the NMFS were examined for the 1999-2001 period and used to calculate average annual short-term losses to commercial fishermen due to a 7,000 pound trip limit for shallow water groupers. No short-term losses were recorded for trips that landed less than the 7,000 pound trip limit. When reported catches of shallow-water groupers exceeded 7,000 pounds, revenues were calculated based on the restricted catch and compared with average trip costs. Average costs for trips with bottom longlines and vertical lines were provided by grouper fishermen at a workshop held in May 2002. Average trip costs for trips with fish traps were obtained from a 1993 survey (Waters 1996) and updated to 2001 price levels with the Producer Price Index for #2 diesel fuel. If revenues based on the trip limit exceeded average trip costs, then it is assumed that the trip would be taken despite the trip limit, and that short-term losses would be determined as the difference between the unrestricted and restricted revenues. That is, losses would be calculated as the value of fish that otherwise would be landed in excess of the trip limit. However, if reported landings were multiples of the trip limit and if it would be profitable to fish at the trip limit, then it is assumed that one trip with 14,000 pounds of shallow-water groupers would become two trips at 7,000 pounds each, for example. Short-term losses would be determined as the extra harvesting cost required to take the extra trips. If the trip limit would cause revenues to fall below average trip costs, then it is assumed that the trip would not occur and that short-term economic losses would be determined as the difference between trip revenues and average trip costs. An estimate of total short-term economic losses to commercial fishermen is calculated as the sum of trip losses for all trips that landed shallow-water groupers in excess of the 7,000 pound trip limit, averaged annually over the 1999-2001 period.

The economic effect of a 7,000 pound trip limit for shallow-water groupers is calculated as the change in net operating income, defined as trip revenues minus trip costs exclusive of captain and crew shares. Hence, it is a measure of the combined income to boat owner, captain and crew after payment of shared expenses but prior to payment of fixed costs by the boat owner and any operating costs incurred by owner, captain or crew that were not shared.

Results by primary gear type are presented in Table 18 for the case when fishermen cannot take extra trips to make up for catches lost due to the trip limit, perhaps due to physical constraints regarding the number of trips that can be taken per week or month, or due to limited periods of time when fish are available in commercial abundance. Boats with bottom longlines are predicted to lose about $0.66 million per year, or 7.4% of the net operating incomes that they would ordinarily earn without a trip limit. Fishermen with other gears infrequently reported trips with more than 7,000 pounds of shallow-water

groupers, and hence were predicted to incur relatively minor losses due to a 7,000 pound trip limit. Overall, landings of shallow-water groupers would decline by 0.34 MP, and fishermen are predicted to incur a net loss in incomes of approximately $0.79 million. No trips would have been cancelled due to the trip limit.

Trip limits are not as costly to fishermen when it is profitable and feasible for them to take additional trips. Table 19 presents the effects of trip limits for the case when fishermen are able to take one additional trip, if profitable, when the original trip is constrained to a 7000 pound trip limit. Boats with bottom longlines are predicted to lose about $0.32 million, or 3.6% of the net operating incomes that would ordinarily be earned without a trip limit. Losses are less than in Table 19 because the analysis presumed that fishermen would take shorter and more frequent trips in response to the trip limit. On average for 1999-2001, fishermen were found to have made 136 trips per year with landings in excess of the 7,000 pound trip limit (Table 16). Table 19 indicates that fishermen could take approximately 83 extra trips per year to minimize the potential reduction in landings due to the trip limit. Most of the predicted loss in net incomes is due to the extra harvesting costs required to take extra trips. Fishermen with other gears infrequently reported trips with more than 7,000 pounds of shallow-water groupers, and hence were predicted to incur relatively minor losses due to a 7,000 pound trip limit. Overall, fishermen were predicted to take approximately 100 more trips per year than without a 7,000 pound trip limit, and incur a net loss in incomes of approximately $0.39 million per year. Landings of shallow-water groupers would decline by approximately 0.08 MP.

Results by area are presented in Table 20 for the case when fishermen cannot take more frequent trips in response to the trip limit. Boats that fish off the west-central coast of Florida would incur a loss of $0.69 million in net incomes to boat owners, captains and crew members due to a 7,000 pound trip limit for shallow water groupers. Fishermen in the Florida Keys would lose about $0.03 million, while fishermen in northwest Florida would lose $0.06 million. Losses would be minimized if fishermen were to take shorter and more frequent trips in response to the trip limit.

These results are approximations. A limitation of the analysis is the use of average trip costs for all trips reported to the logbook program during 1999-2001. Actually, trip costs vary among boats and by duration of trip, with the expectation that larger boats would incur higher trip costs than smaller boats, and that longer trips would incur higher trip costs than shorter trips. This type of analysis would be improved if better data were available about trip costs for individual trips.

The economic effects of trip limits become more acute over time if management is successful biologically in augmenting the stocks of shallow water groupers. Larger fish populations yield higher catch rates. Hence, the fraction of trips constrained by the trip limit would increase, which increases the likelihood for additional boats to adopt a strategy of shorter and more frequent trips. Higher catch rates also tend to attract additional fishing effort from other fisheries.

Alternative 5 combines quota management with trip limits, and would close the commercial shallow-water grouper fishery when either the red grouper or shallow-water grouper quota is reached, whichever occurs first. It differs from Quota Alternative 5 in that a commercial trip limit would be implemented from the beginning of October until the fishery was closed if at least 75% of the 8.80 million pound quota for shallow-water groupers (i.e., 6.60 MP) had been filled by September 30. The intent of the trip limit is to slow the industry's rate of harvest to keep the fishery open as long as possible. Four

alternative trip limits are proposed, ranging from 4,000 to 7,000 pounds.

Table 10 summarizes the monthly distribution of landings for shallow-water groupers. The overall level of harvest varies annually, and would have triggered implementation of a trip limit in 1999 and 2001, but not in 2000. On average for 1999-2001, approximately 6.72 MP of shallow-water groupers were landed by the end of September. Hence, on average, a trip limit would be implemented during the 4th quarter of the calendar year.

Table 21 summarizes fishing effort and landings of shallow-water groupers with respect to 4th quarter trip limits of 7000 pounds, 6000 pounds, 5000 pounds and 4000 pounds. The 7000 pound trip limit is the least restrictive. On average for 1999-2001, 32 boats made 52 trips that landed 0.13 MP of shallow-water groupers in excess of a 7000 pound trip limit. In contrast, 80 boats made 160 trips that landed 0.43 MP of shallow-water groupers in excess of a more restrictive 4000 pound trip limit. Thus, if the fishery were to remain open throughout the 4th quarter, a 7000 pound trip limit would affect approximately 2.1% of total annual trips and potentially reduce landings by up to 5.9%, whereas a 4000 pound trip limit would affect 6.4% of trips and potentially reduce landings by up to 18.8%.

However, the fishery would not remain open with any of the trip limits that have been proposed for the 4th quarter. With an expected closure date in mid-November, a 5.31 million pound quota for red grouper or 8.80 million pound quota for all shallow-water groupers combined would result in a potential reduction in shallow-water grouper landings of approximately 1.11 MP (Table 11). The maximum potential reduction in landings from a 4th quarter trip limit would be approximately 0.43 MP with a 4000 thousand pound trip limit.

Logbook data were examined for the 1999-2001 period and used to calculate average annual short-term losses to commercial fishermen due to the combination of management by quota and various 4th quarter trip limits. The analytical method is similar to that used previously. If revenues based on a 4th quarter trip limit exceeded average trip costs, then it is assumed that the trip would be taken despite the trip limit, and that short-term losses would be determined as the difference between the unrestricted and restricted revenues. If the trip limit would cause revenues to fall below average trip costs, then it is assumed that the trip would not occur and that short-term economic losses would be determined as the difference between trip revenues and average trip costs. In addition, the accumulated landings of red grouper and all shallow-water groupers were calculated and the fishery closed when the more restrictive quota was filled. Short-term losses for trips that would have occurred after the closure date were determined as the difference between trip revenues and average trip costs. An estimate of total short-term economic losses to commercial fishermen is calculated as the sum of trip losses for all trips that would have been affected by either the 4th quarter trip limit or the closure, averaged annually over the 1999-2001 period.

Results by primary gear type are presented in Tables 22-25 for the case when fishermen cannot take more frequent trips in response to the trip limit. Overall losses would be approximately $1.79-$1.80 million per year regardless of the level of trip limit because the quota would restrict the overall quantity landed. Fishermen with bottom longlines would incur greater losses than fishermen with other gears. With quotas and a 7000 pound trip limit in the 4th quarter, fishermen with bottom longlines would incur a $1.11 million loss in net revenues to owners, captains and crews, whereas fishermen with other gears would incur combined losses of approximately $0.68 million (Table 22). With quotas and a 4000 pound trip limit in the 4th quarter, fishermen with bottom longlines

would incur a $1.30 million loss in net revenues to owners, captains and crews, whereas fishermen with other gears would incur combined losses of $0.50 million (Table 25). Although the level of trip limit does not affect overall losses in the fishery, as the 4th quarter trip limit becomes more restrictive, there would be a redistribution of losses from boats with vertical lines, fish traps and other gears to boats with bottom longlines. The redistribution occurs because trips with bottom longlines are more likely than other trips to be constrained by a trip limit, and additional trips would be constrained as the trip limit declines from 7000 pounds to 4000 pounds. As the trip limit becomes more restrictive and additional longline trips are constrained, the duration of the open season lengthens and allows boats with other gears to take additional trips. The expected closing date would have ranged from November 7 in 1999 to December 3 in 2001 with a 7000 pound trip limit, and from November 14 in 1999 to December 9 in 2001 with a 4000 pound trip limit. These dates were based on harvesting practices from 1999-2001. If quota management creates a race for fish, then more trips would be taken earlier in the year, and the quota would be filled and the fishery closed earlier than predicted here.

Quota management creates incentives for fishermen to accelerate their fishing activities to maximize their shares of the quota before the fishery is closed. Fishermen compete in the race for fish by investing in additional electronics and more efficient gear designed to reduce search time and increase catches per day fished. Also, they may fish in poor weather and skimp on regular maintenance and repair schedules, which increases the likelihood of engine and gear breakdowns, accidents and injuries. The result is ever-shorter open seasons, higher harvesting and ownership costs to catch the same overall quantity (as defined by the quota), a deterioration in overall level of safety in fishing operations, market gluts because the entire season's landings are no longer spaced throughout the year, and lower ex-vessel prices. Consumers benefit from lower fish prices during the derby. However, traditional marketing channels are interrupted by a closure, with the break in supplies of fresh fish mitigated by increased reliance on frozen fish or imports during the closed season.

Management with trip limits creates incentives for fishermen to take shorter and more frequent fishing trips. When trip limits are implemented without quotas, these incentives enable fishermen to minimize the adverse effects of management (e.g., compare Tables 18 and 19). However, the opposite outcome occurs when quotas and trip limits are implemented simultaneously. Fishermen still have an incentive to take more frequent trips, but by doing so, they cause the quota to be filled and the season to be closed more quickly. In aggregate, fishermen would take slightly fewer trips because the open season would be shorter (Table 26). For example, with a 7000 pound trip limit and the ability to take one additional trip, if profitable when the trip limit is constraining, fishermen with all gears and in all areas combined would take approximately 10,015 trips (Table 26), whereas they would take approximately 10,061 trips (Table 22) when they are unable to take more frequent trips.

The economic inefficiencies of quotas and trip limits will become more acute over time if management is successful biologically in augmenting the stocks of shallow-water groupers. Larger fish populations yield higher catch rates, which enable fishermen to fill trip limits and quotas more quickly which, in turn, accentuates the need to race for fish before the season is closed. Higher catch rates also tend to attract additional fishing effort from other fisheries, which further exacerbates the likelihood of derby fishing.

7.6.5.3 Recreational Grouper Closed Seasons

Inclusive of the status quo, which provides for no recreational closed season, there are four alternatives considered. The closed season for the recreational fishery would be March 1-May 31 under Alternative 1, numerous options under Alternative 2, and February 15-March 15 under Alternative 3. Under each of the non-status quo alternatives, the closed season is made to apply only to red grouper, black grouper and gag or to all shallow-water groupers.

In addition to the analyses presented in Section 6.5.3, the economic implications of the various alternatives for the red grouper rebuilding plan are addressed here. A March 1-May 31 closure (Alternative 1) is estimated to result in an 18% reduction in the recreational catch of red grouper. In and by itself, this measure would exceed the required reduction under the proposed rebuilding path. A February 15-March 15 closure (Alternative 3) would only reduce recreational harvest of red grouper by 4% so that it would fall short of the required reduction under the proposed rebuilding path. For Alternative 2 to meet the required minimum reduction under the proposed rebuilding strategy, at least a two-month closure that excludes May, June, July and August would be necessary. Closure of any of these four months would exceed the required red grouper harvest reduction under the proposed rebuilding strategy.

As with the commercial closed season, the estimated reductions from a seasonal closure of the recreational fishery may not be realized, particularly over a 10-year period, since effort shifting is likely to occur. In addition, an increasing red grouper biomass during the rebuilding period would result in an increase in catch per trip or in the number of trips.

7.6.5.4 Recreational Grouper Bag Limits

The status quo (Alternative 4) provides for a five-grouper aggregate bag limit which can be of any combination of grouper, except goliath grouper and Nassau grouper. Alternative 1 would limit the red grouper component of the aggregate shallow-water grouper five-fish bag limit to four fish or less. A similar limitation for gag is imposed under Alternative 2 for gag. Alternative 3 would reduce the aggregate shallow-water grouper bag limit to four fish or less.

The general economic implications of these alternatives are discussed in Section 6.5.4. In the particular case of red grouper, the various sub-options under Alternative 1 show that a two-fish or less bag limit can allow the achievement of the red grouper rebuilding path. The only negating factor present here is the possibility that the number of trips or catch per trip increase as the stock rebuilds during the rebuilding period. If, however, it happens that bag limits are reached faster over time, the possibility exists that target trips for red grouper would fall, since it would not be worth the angler's cost to undertake more trips when the bag limit is reached after only a short time of fishing. This is different from that of the commercial sector participants who sell their fish that are harvested at lower cost as catch per trip increases.

7.6.5.5 Red Grouper Minimum Size Limits

In addition to the status quo for the commercial sector (Alternative 3) and recreational sector (Alternative 4), there are 2 alternatives considered for red grouper minimum size limit, one for the commercial sector and the other for the recreational sector. Each alternative contains 4 sub-options, with the minimum size limits at 21, 22, 23, and 24

inches total length.

Table 6.15 presents the expected recreational and commercial reductions in harvest associated with the four minimum size limit options. Under Alternative 1 with 10% discard mortality, the expected reduction in the recreational sector's red grouper harvest ranges from 20.7% at 21 inches minimum size limit to 51% at 24 minimum size limit. Under Alternative 2 with 30% discard mortality, the expected reduction in the commercial handline fleet's red grouper harvest ranges from 4.8% at 21 inches minimum size limit to 22.2% at 24 minimum size limit. The corresponding reduction for the commercial longline fleet ranges from 3.9% to 20.8%. Lower reductions are expected under higher discard mortality rates for both the recreational and commercial sectors.

For the recreational sector, an increase in the minimum size limit that results in harvest reductions may be expected to reduce angler consumer surplus, but unless the reductions are substantial, trip cancellations are not bound to ensue. In this case, the financial condition of the for-hire vessels may not be affected. At relatively higher harvest reductions, such as may occur with a 23- or 24-inch minimum size limit, trip cancellations can happen so as to also reduce the revenue and profitability of the for-hire vessels.

For the purpose of determining some general estimates on the magnitude of impacts of raising the minimum size limit for the recreational sector, it is assumed that the reduction in harvest due to the increase in minimum size limit is comparable to reductions in target trips. As can be gathered from the analysis of Scenario 4 or Scenario 6 for the rebuilding strategy, a 41 to 42% reduction in red grouper harvest is associated with a 37% reduction in target trips for red grouper, or that the reduction in target trips is about 90% of the reduction in harvests. Given this consideration, the reductions in angler consumer surplus under Alternative 1 can range from $1.2 million to $2.9 million. A comparable reduction in for-hire vessel revenues cannot be estimated for the reason that the minimum size limit change may not result in trip cancellations.

For the commercial sector, an increase in size limit may not necessarily result in harvest reductions. Commercial fishermen have relatively more flexibility in either changing fishing locations to target for bigger fish or fish harder in the same areas. The more immediate impacts on the commercial sector are an increase in fishing costs and/or reductions in revenues if smaller fish command higher prices than bigger ones. Some fishermen in previous testimonies indicated that the imposition of the 20-inch size limit drove them out of the relatively higher priced smaller fish market. Apparently, imports filled the market gap. From a revenue standpoint alone, the estimated reductions in commercial harvest of red grouper under Alternative 2 can range from $300 thousand to $1.5 million for vertical line vessels and from $105 thousand to $250 thousand for longline vessels.

One important consideration with minimum size limit is that as the stock rebuilds more fish would be available for harvesting at the higher size limits. This can potentially restrain the achievement of a rebuilding strategy if minimum size limits were the only measures adopted for both the commercial and recreational sectors of the red grouper fishery.

7.6.5.6 Combined vs. Separate Fixed Season and Quota Closures

Under existing rules (Alternative 3), the commercial fishing season for reef fish, including red grouper, begins on January 1. Alternative 1 or 2 would potentially change the start of

the fishing year to the first open day after a fixed closed season, resulting in just one long closed period for any reef fish (Alternative 1) or for grouper only (Alternative 2) instead of two under Alternative 3. Given the existing one-month closure in the commercial red, black and gag grouper fishery, the fishing year under Alternative 2 begins on March 16. Only red snapper and greater amberjack are the other reef fish species subject to seasonal closures. Under Alternative 1, the fishing year begins on February 1 for red snapper and June 1 for greater amberjack.

To provide some idea on the length of the season for the commercial red grouper fishery, some information from the analysis of the various rebuilding paths may be helpful. As long as the management measure for the commercial fishery does not include a explicit TAC, any of the rebuilding strategies can result in the commercial sector exceeding its allocation over time. A similar claim can also be made with respect to the recreational sector when not managed under an explicit TAC. Under a constant catch strategy, the ratio of the quota to the unconstrained (by explicit TAC) harvest would be as follows:

Year:	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Ratio:	0.81	0.71	0.63	0.57	0.53	0.57	0.54	0.51	0.49	0.48

The ratio falls over time primarily because catch per trip increases with the increase in red grouper biomass. If the quota constrained fishery remains open for the entire season, the ratios imply that the commercial red grouper fishery, (assuming it is subject to quota closure) not effectively constrained to its quota by other means, would face an ever shortening season. The season would be 81% of the full season in 2002, falling down to 48% of the full season by 2011. If the full season is 11 months, which takes into account the February 15-March 15 closure, then the fishery would remain open for only 8.9 months in 2002 and eventually shortened to 5.3 months by 2011.

Given the foregoing scenario and assuming quota closures, the following would be the approximate open and closed fishing seasons in 2002 and 2011 under the two alternatives:

2002 Fishing Year

Alternative 2: Open March 16-December 14; closed December 15-February 14 (2003)
Alternative 3: Open January 1-February 14; closed February 15-March 15; open March 16-October 27; closed October 28-December 31

2011 Fishing Year

Alternative 2: Open March 16-August 25; closed August 26-February 14 (2012)
Alternative 3: Open January 1-February 14; closed February 15-March 15; open March 16-July 9; closed July 10-December 31

Neither of these two alternatives would affect the commercial red grouper quota under any of the rebuilding paths, but they may have different effects on vessel revenues. Under a relatively open access fishery, quota closure, and low quotas under any of the rebuilding paths, a derby mentality may be expected to arise. Although it cannot be exactly ascertained as to which of the two alternatives would lead to a more intense derby mentality, the experience in the red snapper fishery can possibly shed some light on this issue. Antozzi (2002) reported that the shortening of the monthly red snapper mini-season from 15 to 10 days resulted in increased revenues to the fishery. This could mean that many shorter open seasons may benefit the fishing industry more than few longer seasons. In this light, there is some possibility that Alternative 2 may result in less intense derby mentality than Alternative 1, although it should be noted that the red snapper mini-seasons

are fixed mini-seasons. Under Alternative 2, the only fixed mini-season is the January 1-March 14 open season. The second open season is only known to start on March 16 but its closing date would depend on how fast the remaining quota is taken. It is possible that prior knowledge of the remaining portion of the quota may lead fishermen to harvest as fast as they can during the second open season, but this appears to be not the case with the red snapper fishery.

At present, Alternative 1 would have no effects on participants of the red snapper and greater amberjack fisheries. The fishing season would remain the same for the red snapper fishery. Although the fishing season for greater amberjack would change, no other closure in addition to the fixed seasonal closure would ensue since there is currently no quota (and quota closure) for greater amberjacks.

7.6.5.7 Deep-water Grouper and Tilefish Quotas

No fishermen have testified or provided information indicating that they can make a living fully dependent on deep-water reef fish. Therefore, the impacts would mainly be to reduce landings and revenues from alternative species for fishermen who primarily fish for shallow-water grouper or other species. For example, a 10% reduction in commercial landings would result from Alternative 1(a) for tilefish, from Alternative 2(a) for deepwater groupers, from Alternative 3(a) each for tilefish and deepwater grouper.

The following information on economic demand for Gulf tilefish was provided by Bill Antozzi, NMFS:

> "One way to measure the demand and supply situation is to look at prices. Since 90% of the Gulf landings are golden tilefish, I'll concentrate on golden. In 1998, 300 thousand lbs. were landed in the Gulf, valued at 361 thousand dollars, an average of $1.20 per pound. In the Atlantic, 3.3 MP were landed, valued at 5.5 million dollars, an average of $1.65 per pound. This places golden tilefish a little below the groupers. In fact tilefish have been substituted for grouper. The meat is not as firm as grouper but the flavor is good. Gulf tilefish usually does not command as high an ex-vessel price as Atlantic fish. There is a perception that the Gulf fish are not as firm. There is ongoing debate that this may be due to a prejudice in favor of the bigger suppliers on the mid and N Atlantic.
>
> Prices in the Gulf are not very stable and appear to be influenced by supply, which mainly comes from the mid-Atlantic. If there is good production on the Atlantic, prices can easily drop $1.00 per pound overnight. This is because tilefish are traditionally sold fresh and the market is sensitive to oversupply. Tilefish are usually graded into three or four categories: small - less than 4 lbs., medium - 4 to 8 lbs., large - 8 and up. Sometimes there is a jumbo category of 12 or 15 lbs. and up.
>
> Local ex-vessel prices (in April 2000) were $2.00, 2.20, and 2.60 for small, med., and large respectively. Due to a spurt of production on the Atlantic side, prices were expected to drop to $1.40, 1.60, and 2.00.
>
> The major markets for tilefish are in New York and New Jersey, and in Canada. The NY Fulton Fish Market takes a lot of the production."

Considering that for a given demand the price structure for tilefish is more a function of production in the Atlantic, a 10% reduction in tilefish harvest as in Alternative 1(a) or

Alternative 3(a) would not significantly raise the prices for Gulf-caught tilefish. In this sense, most of the negative impacts of a quota for tilefish that is lower than historical landings would be borne by the vessels. This would become very important especially under the proposed 50-fathom longline ban.

7.7 Private and Public Costs

The preparation, implementation, enforcement and monitoring of this or any federal action involves the expenditure of public and private resources which can be expressed as costs associated with the regulations. Costs associated with this specific action include:

Council costs of document preparation, meetings, public hearings, and information dissemination	$475,000
NMFS administrative costs of document preparation, meetings and review	30,000
TOTAL	$505,000

The Council and Federal costs of document preparation are based on staff time, work outsourcing, travel, printing and any other relevant items where funds were expended directly for this specific action. Enforcement costs that may be required under the proposed actions in this amendment cannot be adequately estimated. Under a fixed budget, adoption of this amendment would mean a redirection of resources to enforce the new measures.

It should be noted that the cost estimates include the costs incurred in the preparation, development and review of Amendment 18 to the Reef Fish FMP, which serves as the main reference for this Secretarial Amendment. A major portion of the cost for that amendment was expended to complete the SEIS portion of the amendment.

7.8 Determination of a Significant Regulatory Action

Pursuant to E.O. 12866, a regulation is considered a "significant regulatory action" if it is likely to result in a rule that may: a) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments and communities; b) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; c) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or d) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

Proposed actions on red grouper sustainable fishing parameters, namely, MSY, F_{msy}, $B_{msy,}$ MSY, and OY, have no direct impacts on fishing participants in terms of changing harvest and fishing activities. However, these parameters set the stage for the proposed regulatory measures. For a rebuilding strategy, the proposed action is to adopt a 10-year rebuilding plan for red grouper, with the ABC for the first three years set at 6.55 MP. The ABC will be changed every three years or so based on average ABCs under a constant F scenario. A likely 10-year TAC under this scenario is shown in Table 7.2 as TAC 3 or in Table 7.5 as

Alternative 3. Relative to the 1999-2001 landings of red grouper, the required reduction in red grouper harvest is estimated to be about 9.4% for the first three years and practically none for the ensuing years. However, relative to the projected harvest under status quo, the required reduction in red grouper harvest is estimated to be 22 to 23% in the first three years, 11 to 14% in the next three years, and 4 to 7% in the subsequent three years. After the rebuilding years, the potential TAC based on the proposed MSY of 7.56 MP would be slightly above the projected harvest under status quo. To effect the required harvest reduction, the following actions are proposed for the commercial sector: (1) reduce the shallow-water grouper quota from 9.35 MP GW to 8.80 MP GW; and (2) to close the commercial shallow-water grouper fishery when the commercial quota of red grouper (5.31 MP) is reached, or the commercial shallow-water grouper aggregate quota (8.80 MP) is reached, whichever comes first. The corresponding proposed action for the recreational sector is to set a bag limit of two red grouper out of the five aggregate grouper bag limit per person, with double bag limit allowed for persons on qualified for-hire boats that are out over 24 hours. One other action proposed in this amendment affects the deepwater species. Specifically, the proposed action is to set a commercial quota of 0.44 MP landed (gutted) weight for tilefish and to reduce the deepwater grouper commercial quota from 1.35 MP landed weight (gutted) to 1.02 MP landed (gutted) weight.

In 2002, the entire Gulf commercial reef fish harvest sector had an ex-vessel value of approximately $32 million, with the grouper fishery accounting for about $16 million, and within the grouper fishery, the red grouper segment accounted for about $9 million while the gag segment accounted for about $4 million (Waters 2003). The deepwater groupers and tilefish quotas are equivalent to the historical catch of these species so that the most the quotas can do is to limit the fishery to harvest and generate revenue equivalent to their historical levels. In the shallow-water grouper fishery, the proposed quota closure would result in fishermen losing approximately $1.74 million per year, including $1.02 million for longline vessels, $0.62 million for vertical line vessels, and $0.11 million for other vessels.

In the recreational sector, the revenues of the for-hire vessels may be affected by this amendment. In the Gulf, there are about 1,377 for-hire vessels with reef fish permits and 1,437 for-hire vessels with coastal migratory pelagic permits. Holland et al. (1999) reported that in Florida, an average charter vessel grosses about $68 thousand annually while an average headboat grosses about $324 thousand annually. The proposed action for the recreational sector, namely a reduction in the red grouper component to two fish out of the five-fish aggregate grouper bag limit is expected to result in a 9.4% reduction in the recreational harvest of red grouper. This reduction in harvest may also translate into losses in angler consumer surplus. These reductions in harvest and consumer surplus would affect for-hire vessel revenues if anglers reduce their recreational trips through the for-hire fishing mode. The analysis in Section 7.6 has determined that if angler trip cancellations did occur due to the reduction in bag limit, the resulting revenue losses would be relatively minimal.

Considering the potential impacts on both the commercial and recreational sectors, it is concluded that a $100 million annual impact due to this amendment is not likely to happen.

Under the proposed quota closure, commercial harvest of shallow-water grouper, including red grouper is expected to fall, which would potentially increase the price to the consumers. But imports of grouper, which have remained at relatively high levels, would temper, if not totally negate, such increase in price. The quota closure, which is expected

to occur in mid-November, would effect a 12% reduction in vessel revenues from shallow-water grouper and an 8% reduction in the number of trips taken by vessels. Although these reductions are not inconsequential, particularly for longline vessels, they are not expected to be sufficiently large to force some vessels to cease operation. Vessels can potentially offset some of their losses in one year by taking more trips the next year. This, of course, would ultimately lead to ever shortening season if significant increases in harvest, particularly of red grouper, occur in the beginning of the year. But even under this latter scenario, the proposed quota closure would unlikely effect a significant change in employment and investment so long as vessels remain in the fishery. Over time, in fact, as the red grouper stock rebuilds and higher quotas are allowed, harvests and revenues would increase, resulting in turn into increases in employment and investment. A similar type of effects on employment and investment may be expected from support industries. A similar conclusion with respect to changes in employment and investment can be made for the for-hire sector, since this sector is unlikely to suffer reductions in the number of trips taken by recreational anglers. With minimal effects on the operations of fishing vessels and their support industries, communities where such operations are located are unlikely to face any major change in activities.

The proposed measures in this amendment do not interfere or create inconsistency with an action of another agency, including state fishing agencies. It should be noted, however, that Florida, which is the dominant state in the Gulf with respect to the grouper fishery, has issued certain policy actions favoring heavier restrictions on longline vessels, and this would be more consistent with some of the 50-fathom longline ban than with quota closure. At any rate, quota closures would still not be inconsistent with such policy direction. In fact, longlines, as a group, are expected to incur more losses than other gear types, since they account for most of red grouper catches and they tend to be in the high end of the distribution with respect to catches per trip.

At present, none of the entities involved in the grouper fishery affected by this amendment participate in any government sponsored entitlement, grants, user fees, or loan programs. Permit fees are the only ones that may approximate user fees. Commercial fishing vessel owners that may incur large harvest reductions due to the trip limit may lose their commercial reef fish permits if they fail to meet the more than 50% income requirement. At any rate, such possibility is inherent in any fishery regulatory actions that would severely limit participation in the fishery. In this manner, the measures in this amendment would not materially alter the permit fee system established for the commercial reef fish fishery. It is then concluded that measures in this amendment do not affect any entitlements, grants, user fees, or loan programs.

The measures in this amendment do not raise novel legal or policy issue. The proposed amendment is made applicable only to fishing operations on commercial, recreational, and recreational for-hire vessels in Federal waters, although the various states would be requested to make their rules applicable to fishing in state waters consistent with the provisions in this amendment. The concept of a rebuilding plan with accompanying management measures such as trip limits, and bag limits has been used in the Gulf and South Atlantic in previous actions of the Gulf and South Atlantic Councils, and thus is deemed not to raise novel legal and policy issues.

The foregoing discussions relative to the various issues enumerated in E.O. 12866 point to the conclusion that, if enacted as a regulation, the proposed set of actions in this amendment would not constitute a significant regulatory action.

8.0 FINAL REGULATORY FLEXIBILITY ANALYSIS

The purpose of the Regulatory Flexibility Act (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA does not contain any decision criteria; instead the purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of various alternatives contained in the FMP or amendment (including framework management measures and other regulatory actions) and to ensure that the agency considers alternatives that minimize the expected impacts while meeting the goals and objectives of the FMP and applicable statutes.

With certain exceptions, the RFA requires agencies to conduct a Final Regulatory Flexibility Analysis (FRFA) for each rule. The FRFA is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. A FRFA is conducted to primarily determine whether the action would have a "significant economic impact on a substantial number of small entities." In addition to analyses conducted for the Regulatory Impact Review (RIR), the FRFA provides: (1) a succinct statement of the need for, objectives of, and legal basis for, the proposed rule; (2) a summary of the significant issues raised by the public comments in response to the IRFA, a summary of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments; (3) a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; (4) a description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirements of the report or record; and, (5) a description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule and the reason that each one of the other significant alternatives to the rule considered by the agency which affect small entities was rejected.

The measures that have immediate relevance to the determination of significant impacts on a substantial number of small entities are those that affect harvest and/or operating activities of small entities. The following actions are proposed for the commercial sector: (1) reduce the shallow-water grouper quota from 9.35 MP to 8.80 MP GW; and (2) close the shallow-water grouper fishery when the commercial red grouper quota or the shallow-water grouper quota is reached, whichever comes first. The corresponding proposed action for the recreational sector is to set a bag limit of two red grouper out of the five aggregate grouper bag limit per person, with double bag limit allowed for persons on qualified for-hire boats that are out over 24 hours.

Description of the Reasons Why Action by the Agency Is Being Considered: The need and purpose of the actions are set forth in Section 3 of this document and is incorporated herein by reference.

Statement of the Objectives of, and Legal Basis for, the Rule: The primary objective

of this action is to optimize the net benefits to the Nation of the shallow-water grouper stocks by rebuilding the red grouper component to a stock level capable of supporting optimum yield. The following objectives are encompassed within the primary objective:

- Define the biological reference points and stock status determination criteria for the Gulf of Mexico stock of red grouper.
- Implement a plan to end overfishing of the Gulf of Mexico stock of red grouper and rebuild the stock within 10 years to a level capable of supporting maximum sustainable yield.
- Maintain to the extent practicable the historical allocation of red grouper harvest between commercial and recreational sectors through management measures to rebuild the red grouper stock.
- Minimize to the extent practicable socioeconomic disruptions to the largest amount of individuals within each sector while still achieving the necessary levels of harvest reduction to rebuild the stock.
- Minimize to the extent practicable bycatch within the shallow-water grouper complex and other species, and to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch through management measures to rebuild the red grouper stock.
- Minimize to the extent practicable the increase in fishing mortality on alternative target species for which the status of stock is unknown resulting from management measures to rebuild the red grouper stock.

The Magnuson-Stevens Act, as amended, provides the legal basis for the rule.

Summary of the Significant Issues Raised by the Public Comments in Response to the IRFA: No significant issues were raised by public comments in response to the IRFA. Therefore, no changes were made in the final rule as a result of such comments.

Description and Estimate of the Number of Small Entities to Which the Rule Will Apply: In June 2003, the NMFS published a final rule implementing a moratorium on the issuance of permits for the charter vessel/headboat (recreational-for-hire) sector of the reef fish and coastal migratory pelagics fishery. The objective of that rule was to cap the number of for-hire vessels permitted to fish for reef fish or coastal migratory pelagics in the EEZ of the Gulf of Mexico at the current level while the Council assesses the actions necessary to restore overfished reef fish and king mackerel stocks and determine whether a more comprehensive effort management system is appropriate for these fisheries. As of July 2003, a total of 1,437 coastal migratory and 1,377 reef fish permits had been issued to the recreational for-hire sector.

In 1992 when the moratorium on the issuance of new reef fish commercial permits first began, a total of 2,200 permits were issued to qualifying individuals and attached to vessels, and are deemed to comprise the reef fish fishery in the U.S. Gulf of Mexico. There are currently 1,204 active permits while others are in the process of being renewed. Waters (2002) reported that of the vessels with commercial reef fish permits, all of which are required to submit logbooks, 782 vessels in Florida and 207 in other Gulf states indicated they landed reef fish using vertical lines in 2000. Also, 155 vessels in Florida and 33 in other Gulf states indicated to have landed reef fish using longlines in 2000. Furthermore, 55 vessels reported to have landed reef fish using fish traps. All fish trap vessels are in Florida. A further examination of the number of vessels landing reef fish showed that a total of 546 vessels participate in the shallow-water grouper fishery on a more consistent basis. Of these vessels, 138 used longlines, 353 used vertical lines, and

55 used fish traps. Information from Table 6.5 shows that longlines accounted for 59% of commercial red grouper landings, handlines accounted for another 24% and fish traps accounted for another 16%. The corresponding percentages for gag are: 25% by longlines, 73% by handlines, and 2% by fish traps. Other gear types account for a minuscule portion of the commercial landings of these species. The measures in this amendment will directly or indirectly affect all these vessels.

The measures for the commercial sector will directly or indirectly affect many of the mentioned commercial vessels. However, the impacts are not proportionally distributed among the vessels. Since the bulk of the grouper fishery is in Florida, vessels in this state will be affected more than vessels in other states. Among the Florida vessels, the longline vessels will bear most of the cost of the proposed measures, particularly with respect to red grouper. Naturally, high-volume vertical line and fish trap vessels will also bear a disproportionate share of the burden. Longline vessels reported selling their red grouper catch to dealers located in various locations in Florida, notable of which are Key West (11 vessels), Fort Myers Beach (10 vessels), Cortez (11 vessels), Madeira Beach (54 vessels), St. Petersburg (34 vessels), Treasure Island (16 vessels), Apalachicola (11 vessels), Port St. Joe (11 vessels), and Panama City (15 vessels). Notable locations of dealers to whom fish trap vessels sell their catch are Naples (10 vessels), Crystal River (10 vessels), and Steinhatchee (9 vessels).

Fish dealers will also be affected by the measures in this amendment. About 431 dealers located in the five Gulf states received groupers from various fishing vessels. Of this number, about 87 dealers, all of which are located in Florida, would be directly affected by the measures in this amendment. About 54 of the 87 dealers generally receive less than 10,000 pounds of fish each year while 11 dealers generally receive more than 80,000 pounds of fish.

The measures for the recreational sector would also affect all for-hire vessels, but as is the case with the commercial sector, most of the effects will be borne by for-hire vessels in Florida. Although the recreational measures are specific only to red grouper, a fishing trip may also be undertaken to catch other grouper species and non-grouper species. For-hire vessels in Florida that depend on red grouper and grouper in general for their fishing trips are likely to be affected more than those that depend on other species, such as mackerel. Holland et al. (1999) considered the following as major activity centers for charter boats in Florida: Miami and Fort Lauderdale on the Atlantic; Naples and Fort Myers/Fort Myers Beach on the Peninsula Gulf; Destin, Panama City/Panama City Beach and Pensacola on the Panhandle Gulf; and, Key West, Marathon and Islamorada in the Florida Keys. The major activity centers for headboats are: Miami on the Atlantic; Clearwater and Fort Myers/Fort Myers Beach on the Peninsula Gulf; Destin and Panama City/Panama City Beach on the Panhandle Gulf; Islamorada, Key West and Marathon in the Florida Keys. Among these activity centers, those in the Gulf area of Florida are likely to be affected by the proposed rule more than those in other areas, because charter vessels and headboats in the Gulf tend to target grouper more than those in other areas. Charter vessels and headboats in the Florida Keys and Atlantic depend more on king mackerel, billfish and dolphin. Additional impacts will be borne by extended communities (i.e., support industries such as fish dealers, marinas, ship yards, maintenance facilities, gear supply firms). However, any negative impacts and the subsequent social disruption among fishery participants are not expected to be substantial or of long-term duration.

A further description of the affected vessels is provided below.

Description of the Projected Reporting, Record-keeping and Other Compliance Requirements: This amendment contains no changes on record-keeping and compliance requirements. The existing requirements are not significantly different from provisions for other fisheries in the Gulf.

Substantial Number of Small Entities Criterion: The Small Business Administration (SBA) defines a small business as a business that is independently owned and operated, is not dominant in its field of operation, and has annual receipts not in excess of $3.5 million in the case of commercial harvesting entities or $6.0 in the case of for-hire entities, or if it has fewer than 500 employees in the case of fish processors, or fewer than 100 employees in the case of fish dealers.

According to a survey of commercial reef fish fishermen in the Gulf (Waters 1996), fishing vessels in the reef fish fishery have the following annual gross receipts per vessel:

High-volume vessels using vertical lines:	
Northern Gulf:	$110,070
Eastern Gulf:	$ 67,979
Low-volume vessels using vertical lines:	
Northern Gulf:	$24,095
Eastern Gulf:	$24,588
High-volume vessels using bottom longlines:	
Both areas:	$116,989
Low-volume vessels using bottom longlines:	
Both areas:	$87,635
High-volume vessels using fish traps:	$93,426
Low-volume vessels using fish traps:	$86,039

In view of the fact that the grouper fishery is mostly in Florida, the rule would affect mostly the eastern Gulf vertical line vessels, bottom longline vessels, and fish trap vessels.

There are approximately 1,377 for-hire vessels with permits to fish for reef fish and 1,437 for-hire vessel with permits to fish for coastal pelagics in the Gulf. Holland et al. (1999) reported that in Florida the average annual receipts of charter vessels, as reported by respondents, total $56,000 and those of headboats, $140,000. However, based on fees, number of passengers and number of trips, average annual receipts total $68,000 for charter vessels and $324,000 for headboats. Charter vessels have an average length of 37 feet and headboats, 62 feet.

Average employment information per reef fish dealer is not known. Although dealers and processors are not synonymous entities, Keithly and Martin (1997) reported total employment for reef fish processors in the Southeast at approximately 700 individuals, both part and full time. It is assumed that all processors must be dealers, yet a dealer need not be a processor. Further, processing is a much more labor intensive exercise than dealing. Therefore, given the employment estimate for the processing sector, it is assumed that the average dealer employment would not surpass the SBA employment benchmark.

Based on the gross revenue and employment profiles presented above, all fishing vessels and reef fish dealers potentially affected by the proposed regulations are classified as small entities. Based on this determination and on the earlier discussion regarding the number of vessels affected by the rule, it is concluded that the rule would affect a substantial number of the small business entities comprising the reef fish commercial and

for-hire sectors.

Significant Economic Impact Criterion: The outcome of "significant economic impact" can be ascertained by examining two issues: disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All the business entities potentially affected by the rule are assumed to be small entities so that the issue of disproportionality does not arise in the present case. There are, however, some variations among fishing operations in terms of vessel revenues and size, as described above. As noted in the RIR, a quota closure would disproportionately affect the longline vessels, particularly the high-volume ones. To a lesser extent, vertical line and fish trap vessels, as a group, would also be affected by the measures. It should be noted that fish traps are currently under a phase-out plan and will be totally banned after February 2007.

Profitability: Do the regulations significantly reduce profit for a substantial number of small entities?

Holland et al. (1999) provided no estimates for net revenue or profit for the for-hire vessels in Florida. As discussed in the RIR, the two-fish red grouper out of an aggregate five grouper bag limit would likely not affect the revenues of for-hire vessels in a substantial manner. Charter vessel and headboat trip cancellations by recreational anglers may occur as a result of the bag limit change, but current information appears to indicate that the extent of trip cancellations is small. As reported by Holland et al. (1999), only 5% of charter vessels in Florida Gulf target one species while 36% target three or less and 90% target eight or less species. About 29% of charter vessels do not target specific species. None of the headboats in the Florida Gulf target only one species, 60% target four or less species, and 41% do not target specific species. Since the bag limit change is specific to red groupers and other species may still be targeted or caught, trip cancellations may be expected to be relatively few. Fishing trip costs of for-hire vessels are also not likely to increase, since these vessels may be expected to be fishing in the same areas after the implementation of the rule. Profits of for-hire vessels are, therefore, not expected to be significantly reduced by the rule.

Waters (1996) reported the following net income (defined as gross receipts less routine trip costs) information from commercial reef fish vessels, with numbers in parenthesis representing percent to gross receipts):

High-volume vessels using vertical lines:		
Northern Gulf:	$28,466	(26)
Eastern Gulf:	$23,822	(35)
Low-volume vessels using vertical lines:		
Northern Gulf:	$6,801	(28)
Eastern Gulf:	$4,479	(18)
High-volume vessels using bottom longlines:		
Both areas:	$25,452	(22)
Low-volume vessels using bottom longlines:		
Both areas:	$14,978	(17)
High-volume vessels using fish traps:	$19,409	(21)

Low-volume vessels using fish traps:	$21,025	(24)

The quotas for tilefish and deepwater groupers match the historical commercial harvests for the species so this particular measure is not expected to reduce the profits of commercial vessels. The quota closure for the commercial shallow-water grouper fishery is expected to take effect by mid-November of the first year of implementation. This quota closure is estimated to reduce annual net revenues by 11% for longlines vessels, 4% for vertical lines vessels, and 5% for fish trap vessels. If vessels can successfully increase their landings and revenues more than their costs by increasing their number of trips, net income losses due to the quota closure provision can be partially offset. However, this situation presents another risk and through the possibility that catches increase and the reduced quota is reached faster every year. In this scenario, a derby may develop that may result in decreases in ex-vessel prices and vessel profits.

Should prices and costs remain stable, the measures for the commercial sector, particularly the quota closure, are expected to significantly reduce the profits of longline vessels. Considering the fact that longline vessels account for most of the shallow-water grouper commercial landings, particularly red grouper, it is concluded that the significant reduction in vessel profits will affect a substantial number of commercial fishery participants in the harvesting sector.

The profit profile for dealers is not known. The projected reduction in ex-vessel sales ($2.248 million) as a result of the rule equals approximately 11.5% of total shallow-water grouper revenues. It is unlikely, however, that any dealer with substantial business operations would be wholly dependent upon harvests of shallow-water grouper. Thus, the potential reductions in harvests as a result of the rule should minimally affect dealers.

Description of Significant Alternatives to the Rule and Discussion of How the Alternatives Attempt to Minimize Economic Impacts on Small Entities: Three alternatives, including the no action alternative, were considered relative to the specification of red grouper maximum sustainable yield. The rule will establish red grouper maximum sustainable yield as a range whereas two alternatives specify the reference points alternately as the lower and upper bounds of the proposed range. Since specification of the maximum sustainable yield is a required component of a fishery management plan, the no-action alternative is not a viable alternative. Although no direct economic impacts are expected to accrue to either the rule or alternative specifications, since they merely serve as reference points for stock and fishery evaluation, the specification contained in the rule was selected as best accounting for the uncertainty associated with the spawner-recruit relationship for this species.

Three alternatives, including the no action alternative, were considered relative to the specification of red grouper minimum stock size threshold. Since specification of the minimum stock size threshold is a required component of a fishery management plan, the no-action alternative is not a viable alternative. One alternative would establish a more conservative specification of the minimum stock size threshold than the threshold contained in the rule, while another would establish a less conservative threshold. Although no direct economic impacts are expected to accrue to either the rule or alternative specifications, since they merely serve as reference points for stock and fishery evaluation, the specification contained in the rule was selected as best representing technical guidance for this required parameter.

Four alternatives, including the status quo alternative, were considered relative to the

specification of red grouper maximum fishing mortality rate. One alternative would establish a more conservative specification of the maximum fishing mortality rate, while the other three alternatives would establish a less conservative threshold. Although no direct economic impacts are expected to accrue to either the rule or alternative specifications, since they merely serve as reference points for stock and fishery evaluation, the specification contained in the rule was selected since it best represents technical guidance for this required parameter.

Three alternatives, including the no action alternative, were considered relative to the specification of red grouper optimum yield. Since specification of the optimum yield is a required component of a fishery management plan, the no-action alternative is not a viable alternative. One alternative would establish a more conservative specification of the threshold, while another would establish a less conservative threshold. Although no direct economic impacts are expected to accrue to either the rule or alternative specifications, since they merely serve as reference points for stock and fishery evaluation, the specification contained in the rule was selected as best following technical guidance for this required parameter.

Five alternatives, including the no action alternative, were considered relative to the red grouper rebuilding plan. Since specification of a rebuilding plan is a required component of a fishery management plan for a resource that has been identified as overfished, the no-action alternative is not a viable alternative. Three alternatives would establish the same recovery period, ten years, but specify different annual allowable biological catches. One of these alternatives would allow a higher initial catch than the rule, thereby inducing lower adverse impacts than the rule. This alternative would not, however, require mandatory evaluations of the allowable biological catch every three years, as the rule alternative would, and may not allow harvests to increase during the recovery period, as the rule would. Thus, this alternative may result in increased costs over the recovery period relative to the rule. The two alternatives that would establish lower catches than the rule would result in increased adverse impacts relative to the proposed alternative. An additional alternative would establish a shorter recovery period than the rule, requiring lower harvest levels, thereby accelerating the recovery schedule but at greater short term adverse economic impacts. The rebuilding plan contained in the rule, therefore, best accomplishes NOAA Fisheries' objectives while minimizing adverse economic impacts.

Three alternatives, including the no action alternative, were considered relative to the reduction in the shallow-water grouper quota by an amount equal to the reduction in the red grouper total allowable catch. Two alternatives would reduce the shallow-water grouper quota by amounts greater than the rule and would not, therefore, decrease the adverse impacts of the rule. The no action alternative could lead to greater mortality of red grouper as a result of catch and release mortality, therefore jeopardizing the recovery of the species.

Five alternatives, including the rule and the no-action alternative, were considered relative to commercial quota closure. The no-action alternative would close the commercial fishery for shallow-water grouper fishery when the aggregate quota is reached. This would result in less adverse economic impacts than the rule but would result in excessive red grouper mortality if the red grouper quota is reached before the shallow-water grouper quota is met. One alternative would close the commercial red grouper fishery when this quota is reached, but allow the fishery for other shallow-water grouper species to continue until the aggregate quota is reached. While this alternative would result in less short term adverse economic impacts than the rule, red grouper would continue to be caught as a

bycatch species, thereby resulting in total red grouper mortality exceeding the quota. In addition to closing the commercial red grouper fishery, another alternative would close fishing for all shallow-water grouper species in certain areas of the Gulf when the red grouper quota is met. Multiple area closure options were considered, up to and including closure of the entire Gulf, which would match the rule. For those options that are not Gulf-wide, the resultant short term adverse impacts would be less than those of the rule. These options would potentially allow, however, excessive mortality of red grouper since red grouper would continue to be caught as bycatch. The final alternative would allow continued red grouper harvest if the red grouper allocation has not been met when the shallow-water grouper aggregate quota has been achieved. This alternative, however, would result in the shallow-water grouper aggregate quota being exceeded. Since these other alternatives would result in either excessive red grouper or excessive total shallow-water grouper mortality, only the closure provisions specified by the rule are consistent with the NOAA Fisheries' objectives.

Four alternatives, including the rule, were considered relative to fixed shallow-water grouper closed seasons. The rule retains the status quo February 15 through March 15 closed season on red grouper, gag, and black grouper. One alternative would replace this closure with a March 1 through May 31 closure, and would apply the closure to either the same three species or all shallow-water grouper species. This alternative, regardless of the species options, would be more stringent than necessary to reduce red grouper harvests and protect gag spawning aggregations and would result in greater economic losses than the rule. A second alternative incorporates the same species options as the first rejected alternative, but does not identify a specific closure period. Depending upon the period chosen, the resultant impacts could be less than or greater than those of the rule. However, the fixed closed season provisions of the rule were selected since the period encompassed best meets the dual purpose of reducing red grouper harvest and protecting gag spawning aggregations. A final alternative would eliminate the fixed closure. While this alternative would also eliminate the short term adverse impacts of the rule, the desired reduction in red grouper harvests and protection of gag would not be accomplished.

Five alternatives, including the rule, were considered for commercial grouper trip limits. The rule contains the status quo condition of no commercial grouper trip limits. The remaining alternatives would either impose trip limits that applied throughout the year, or would be triggered upon shallow-water grouper harvests reaching 75 percent of the aggregate quota. Each of these alternatives would result in greater adverse economic impacts than the rule and are, therefore, not consistent with NOAA Fisheries' intent.

Approaches for constraining the recreational grouper harvest to its allocation included closures, bag limits and minimum size limits. In addition to the rule, which would maintain the status quo of no fixed closed season for the recreational grouper fishery, four alternatives were considered relative to recreational closures. In addition to options for applying the closure to selected species in the shallow-water grouper complex or the entire complex, each of these alternatives specified fixed closed seasons. One alternative additionally limited the closure to a specific region of the Gulf as opposed to the entire Gulf. Allowing the recreational fishery to remain open year-round, as would be accomplished by the rule in combination with appropriate bag and size limits, was determined to produce the least adverse economic impacts on the fishery. Thus, the rule was determined to best achieve NOAA Fisheries' objectives.

Four alternatives were considered for the recreational grouper bag limit. While the rule would establish a limit of two red grouper out of the aggregate five-fish shallow-water

grouper bag limit, one alternative would establish a similar limit on gag in addition to the red grouper limit. This alternative would, thus, be more restrictive than the rule and increase the expected adverse impacts. Additionally, this alternative would exceed the protection currently believed necessary for gag. Another alternative would not change the red grouper limit but would, instead reduce the total aggregate bag limit. Available options, however, would result in either or both reductions in red grouper harvests that are greater than necessary or reductions in the harvest of other grouper species that are not currently justified. Thus, this alternative would increase the negative impacts on the fishery. The final alternative, the status quo, would not achieve the required red grouper harvest reductions. The bag limit contained in the rule, therefore, best achieves the necessary harvest reductions at the least adverse impact.

Four alternatives were considered to the minimum size limit specifications of the rule which will retain the commercial and recreational red grouper minimum size limits at their current specification of 20 inches total length. The larger minimum size limits, however, would lead to harvest reductions that exceed the required reductions, generate increased discard mortality, and increase expected losses relative to the rule. Thus, the minimum size limits specified by the rule will best achieve NOAA Fisheries' objectives at the least adverse impact.

With regards to the specification of the fishing year, the status quo provides that the fishing year for all reef fish begins January 1 each year. Alternatives to the status quo provide for the fishing year to start after a fixed commercial season for any reef fish or for the grouper fishery only. These alternatives would not be expected to have any immediate impacts on fishing participants. Maintaining the status quo, however, will provide stability and help eliminate future uncertainty associated with changes in the start of the open season for various species within the grouper fishery in particular and reef fish fishery in general.

The rule specifies a quota for tilefish and reduces the deep-water grouper quota from its current level, which has never been met, to the average annual harvest from 1996-2000, with the intent to minimize the potential adverse impacts of participants in the shallow-water grouper fishery shifting effort to the deep-water species. In addition to options encompassing different quota levels and the status quo alternative, significant alternatives to the rule come in two forms. One form sets different quota levels for deepwater groupers and tilefish independently, while the other form combines deep-water groupers and tilefish and provides for different quota levels for the aggregate. The independent quotas for each group fall between the extremes of the alternative options and, thus, would be expected to result in less adverse impacts than the lower options, and more adverse impacts than the higher options. However, the quotas specified in the rule are equal to the average commercial harvest for these species, so actual adverse impacts on fishing participants are expected to be minimal.

9.0 AFFECTED ENVIRONMENT

The following description of the affected environment has been condensed from the Affected Environment section prepared by MRAG Americas for the DSEIS for Draft Reef Fish Amendment 18. Draft Reef Fish Amendment 18/DSEIS originally included the alternatives in this amendment as well as alternatives for other issues.

Draft Reef Fish Amendment 18/DSEIS is still under development at the time that this DSEIS is being prepared. Therefore, the relevant sections of the affected environment (i.e., those pertaining to the eastern Gulf of Mexico) are presented below. The full version of this section, which describes the environment for the entire Gulf of Mexico, is or will be contained in the November 28, 2001 draft of Reef Fish Amendment 18/DSEIS and its successor drafts.

9.1 Physical Environment

9.1.1 Geological Features

9.1.1.1 Bathymetry

The GOM basin was formed during the Jurassic Period as part of the initial breakup of Pangea as Africa/South America separated from North America. During the middle Jurassic, thick salt was deposited throughout the broad central basin area. The Gulf basin became locked in its current position with respect to North America by early Cretaceous time. Broad carbonate platforms with prominent rimmed margins became established along the edges of the basin. The margins were reefal, made up of algal, coral and rudistic banks. These carbonate shelf margins were exceptionally linear, following a line 129 to 161 km inward of the present Texas-Louisiana coastline, then turning southeast, ultimately determining the position of the Florida Escarpment. A later rise in sea level drowned the outer margins of the carbonate platforms, causing the margins to retreat to more landward positions. This sea level rise was followed by the later partial filling of the basin by large clastic sediments that prograded first from the west and northwest in late Cretaceous-early Cenozoic time and then from the north during the late Cenozoic.

Since the late Cenozoic the Mississippi River has had a profound effect on the north-central GOM. The Mississippi River supplies around 450 million metric tons of sediment annually to the Gulf basin, an order of magnitude greater than all other coastal rivers in the GOM combined. The Mississippi River is responsible for building the vast amounts of wetlands in coastal Louisiana and since the Cenozoic the continental shelf edge has prograded in the Gulf basin as much as 402 km (Woodbury et al., 1973). This accumulation of sediment has reached a thickness of 3,600 m in some areas (Woodbury et al., 1973). This large deposition of sediment on a base of several thousand feet of mobile salt and prodelta clay has caused the movement of the underlying material to form large salt domes and diapirs near the continental shelf edge in the north-central GOM.

The GOM is bounded by Cuba, Mexico, and the U.S., and has a total area of 564,000 km^2 (about 218,000 square miles) (Ogden no date). Over 24% of this is deep basin, over 3,000 meters deep (almost 2 miles), with a maximum depth of 3,850 meters (over 2 miles) in the Sigsbee Deep. Continental shelves occupy approximately 35% of the total Gulf area and the West Florida Shelf, at 150,000 km^2 (about 58,000 square miles), is the second largest continental shelf in the U.S. after Alaska.

The GOM continental shelf varies in width from about 280 km off southern Florida to about 200 km off east Texas and Louisiana. The shelf narrows to 110 km off southwest Texas. The shelf is widest in southern Florida (300 km) and narrowest off the modern Mississippi River Delta (10 km) (Rezak et al., 1985). The shelf is largely composed of muddy or sandy terrigeneous (formed by the erosive action of the rivers and of the ocean tides and currents) sediments from the Rio Grande River Delta to DeSoto Canyon off Pensacola, Florida. East of DeSoto Canyon, a thick accumulation of southeasterly trending carbonate rocks and evaporite sediments mainly dominate the shelf. This area has not been influenced by the massive terrigenous regime (i.e., formed by the erosive action of the rivers and the ocean tides and currents) that has occurred in other parts of the Gulf.

The continental shelf (0 - 200 m) occupies about 35.2% of the surface area of the Gulf, and provides habitats that vary widely from the deeper waters. The shelf and shelf edge of the GOM are characterized by a variety of topographic features. The value of these topographic features as habitat is important in several respects. Some of these features support hardbottom communities of high biomass and high diversity and an abundance of plant and animal species. These features are unique in that they are small, isolated, highly diverse areas within areas of much lower diversity. They support large numbers of commercially and recreationally important fish species by providing either refuge or food.

9.1.1.2 The West Florida Shelf

The west Florida shelf is composed mainly of carbonate sediments. These sediments are in the form of quartz-shell sand (> 50% quartz), shell-quartz sand (< 50% quartz), shell sand, and algal sand. The bottom consists of a flat limestone table with localized relief due to relict reef or erosional structures. The benthic habitat types include low relief hardbottom, thick sand bottom, coralline algal nodules, coralline algal pavement, and shell rubble. The west Florida slope forms the edge of a sequence of carbonates intercalated with evaporites more than 5 km thick (Doyle and Holmes, 1985).

The west Florida shelf provides a large area of scattered hard substrates, some emergent, but most covered by a thin veneer of sand, that allow the establishment of a tropical reef biota in a marginally suitable environment. The only high relief features are a series of shelf edge prominences that are themselves the remnants of extensive calcareous algal reef development prior to sea level rise and are now too deep to support active coral communities. In water depths of 70 to 90 m along the southwest Florida shelf, a series of carbonate structures forms a series of steps along the shelf (Holmes, 1981). This area corresponds to the partially buried, 10-km wide reef complex known as Pulley Ridge. The partially buried ridge runs from an area west of the Dry Tortugas, northward for approximately 250 km. The shelf edge is marked by a double reef trend in water depths of 130 and 300 m (Doyle and Holmes, 1985). This reef forms the feature named Howell Hook by Jordan and Stewart (1959). Howell Hook is an arcuate ridge running northward for approximately 105 km. The lower reef crests at about 210 m in the south and 235 m in the north and forms a 40-m high scarp (Holmes, 1981).

Moe (1963) described hundreds of offshore fishing areas along the west Florida coast. Moving northward along the west Florida shelf are areas with substantial relief. In an area south of the Florida Middle Grounds, in water depths of 46 to 63 m, is a ridge formed from limestone rock. Moe (1963) termed this area the Elbow, and it is about 5.4 km at its widest and has a vertical relief of 6.5 to 14 m. South of Panama City are two notable areas with high relief. The Whoopie Grounds are located in 66 to 112 m of water and

have rock ledges with 6 to 8 m of relief and are covered with coral and other invertebrate growth (Moe, 1963). The Mud Banks are formed by a ledge that has a steep drop of 5 to 7 m. The ledge extends for approximately 11 to 13 km in 57 to 63 m of water (Moe, 1963). The 3 to 5s are located southwest of Panama City in water depths of 31 to 42 m of water. The ledges are parallel to the 36.5-m isobath and have relief of 5.5 to 9 m (Moe, 1963).

The growth of coralline algae at mid-shelf depths (60 to 80 m), which results in the production of algal nodules and a crustose algal pavement, provides an extensive emergent substrate for the development of deepwater hermatypic corals. The coralline algal nodule and algal pavement/*Agaricia* assemblages represent the closest development of an active reef habitat on the shelf. Whether consisting of exposed or thinly covered hardbottom, the remaining hardbottom areas are scattered across the broad shelf . They are generally colonized by seasonal algae, sponges, and other filter feeders of mixed warm temperature and tropical affinities. The tropical biota consists primarily of the hardier, more tolerant forms, like the hard corals *Siderastrea* sp. and *Solenastrea* sp.

The west Florida shelf has been described by Woodward-Clyde Consultants, Inc. (1984), who grouped the benthic communities based on shared similarities and dissimilarities. The assemblages are:

- Inner Shelf Live Bottom Assemblage I - this live bottom biological assemblage consisted of patches of various algae (*Caulerpa* spp., *Halimeda* spp., and *Udotea* spp.), ascidians, hard corals (*Siderastrea* spp.), large gorgonians (*Eunicea* spp., *Muricea* spp., *Pseudoplexaura* spp., and *Pseudopterogorgia* spp.), hydrozoans, and sponges (*Geodia gibberosa, G. neptuni, Haliclona* spp., *Ircinia campanal* and *Spheciospongia vesparium*). Individual organisms were generally larger, and the fauna appeared to exhibit a higher biomass per unit area, than in the Inner and Middle Shelf Live Bottom Assemblage II. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in water depths of 20 to 27 m.

- Inner and Middle Shelf Live Bottom Assemblage II - this live bottom biological assemblage consisted of algae (*Cystodictyon pavonium, Halimeda* spp., and *Udotea* spp.), ascidians (*Clavelina gigantea*), bryozoans (*Celleporaria* spp. and *Stylopoma spongites*), hard corals (*Cladocora arbuscula, Scolymia lacera, Siderastrea* spp., and *Solenastrea hyades*), small gorgonians, hydrozoans, and several sponges (*Cinachyra alloclada, Geodia gibberosa, G. neptuni, Ircinia* spp., *Placospongia melobesioides,* and *Spheciospongia vesparium*). This assemblage has a higher number of sponges and a lower biomass per unit area than the Inner Shelf Live Bottom Assemblage I. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in water depths of 25 to 75 m.

- Middle Shelf Algal Nodule Assemblage - this assemblage consisted of coralline algal nodules formed by *Lithophyllum* spp. and *Lithothamnium* spp., combined with sand, silt, and clay particles. Algae (*Halimeda* spp., *Peyssonnelia* spp., and *Udotea* spp.), hard corals and small sponges (*Cinachyra alloclada* and *Ircinia* spp.) were also present. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in water depths of 62 to 108 m.

- Agaricia Coral Plate Assemblage - this biotal assemblage consisted of a dead, hard coral-coralline algae substrate covered with living algae (*Anadyomene menziesii* and *Peyssonnelia* spp.), live hard corals (*Agaricia* spp. and *Madracis* spp.), gorgonians, and sponges. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in

water depths of 64 to 81 m.

- Outer Shelf Crinoid Assemblage - this assemblage consisted of large numbers of crinoids (*Comactinia meridionalis, Neocomatella pulchella,* and *Leptonemaster venustus*) living on a coarse sand or rock rubble substrate. Small hexactinellid sponges may also be associated with this assemblage. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in water depths of 118 to 168 m.

- Outer Shelf Low Relief Live Bottom Assemblage - this live bottom assemblage consisted of various octocorals (including *Nicella guadalupensis*), the antipatharian corals *Antipathes* spp., *Aphanipathes abietina, A. humilis,* occasional hard corals (including *Madrepora carolina*), crinoids, the hydrozoan *Stylaster* sp., and small sponges in the Order Dictyonina. It was found in conjunction with low relief rock surfaces with a thin sand veneer. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in water depths of 108 to 198 m.

- Outer Shelf Prominences Live Bottom Assemblage - this biological assemblage consisted of the gorgonian *Nicella guadalupensis,* the antipatharian corals *Antipathes* spp., *Aphanipathes abietina, A. filix,* and *A. humilis,* the hard coral *Madrepora carolina,* crinoids, the hydrozoan *Stylaster* sp., and medium to large hexactinellid sponges in the Order Dictyonina. All of these organisms were found on rock prominences. These prominences generally emerged from a sand-covered bottom and had a vertical relief of up to 2 m. These prominences are most likely dead coral pinnacles. Woodward-Clyde Consultants, Inc. (1984) identified this assemblage in water depths of 136 to 169 m.

The hydrozoan coral *Millepora* sp. is believed to be the main frame builder in the Florida Middle Ground, although populations of hermatypic scleractinians (*Porites, Dichocoenia, Madracis*) are present at the upper depth ranges (26 to 30 m). Shallow-water alcyonaceans (*Muricea, Plexaura, Eunicea*) are also present, and the fauna bears a distinct dissimilarity to that of the Flower Garden Banks. Although the Florida Middle Ground provides a high-relief substratum for reef biota, its location is apparently too far northward to allow the establishment of massive hermatypic coral assemblages. Winter water temperatures can reach 15o to 16o C, and hermatypic corals require temperatures of 18o to 30o C for viable existence. Significantly productive areas in the Florida Middle Ground comprise about 12,100 ha (29,900 ac) (Woodward-Clyde Consultants, Inc., 1984).

The waters of Tampa Bay on the north and Sanibel Island on the south bound another west Florida shelf region with notable coral communities. The area consists of a variety of bottom types. Rocky bottom occurs at the 18 m contour where sponges, alcyonarians, and the scleractinians *Solenastrea hyades* and *Cladocora arbuscula* are especially prominent.

The west Florida shelf has long been recognized as an area that supports commercially important fish and shellfish populations, an importance attributed at least in part to the abundance of scattered rock outcrops and sponge bottoms that provide fish habitat (Darcy and Gutherz, 1984). One hundred seventy species of fish from 56 families have been observed or collected on the Florida Middle Ground. Of these, 97 species are considered primary reef fish and 45 species as secondary reef fish (Hopkins et al., 1977). Commercially important species include striped mullet, *Mugil cephalus,* spotted sea trout, *Cynoscion nebulosus,* Spanish mackerel, *Scomberomorus maculata,* king mackerel, *S. cavalla,* Florida pompano, *Trachinotus carolinus,* snappers, *Lutjanus* spp., and groupers, *Epinephelus* spp. and *Myctoperca* spp., several of which are primarily nearshore/estuarine

inhabitants. The most specious families of demersal fishes on the shelf are the left eye flounders (Bothidae), sea basses (Serranidae), drums (Sciaenidae), and searobins (Triglidae) (Darcy and Gutherz, 1984).

Hine et al. (1998) used acoustic surveys to update information about the west Florida Shelf. Acoustic surveys demonstrated that the west Florida inner continental shelf is dominated by a Cenozoic limestone bedrock unconformity supporting a thin, mixed siliciclastic/carbonate sedimentary veneer. The unconformity has various spatial scales of antecedent relief: (1) pits, depressions, ledges from cm's to several m's of relief and cm's to 100's m in width/length, to (2) broad rise, flat bedrock plain, and shelf valleys from m's of relief to km's in width/length. The sedimentary cover is commonly arranged in: (1) linear ridges ranging (.5 to 4 m's of relief, 10's m's in width, 100's m's of spacing, and km's in length), (2) broad, very thin sheets, or (3) active ebb-tidal deltas located just off tidal inlets.

Ongoing mapping allowed definition of distinct areas or shelf provinces that transition from one to another both alongshore and onshore/offshore. In addition, shelf provinces can be distinguished by either by their surface and subsurface characteristics or both. For example, subsurface shelf valley may support a relatively featureless sandy plain or a sediment ridge complex.

Hine at al. (1998) defined the following provinces:

Bedrock Rise/Linear Sand Ridges (Indian Rocks Headland)
Estuarine Retreat Path (Tampa Bay)
Shelf Valley (off Manatee County and Venice)
Sand Ridge Plain (off Sarasota County)
Sediment Barren Bedrock Terrace (off Venice)

Some of these provinces have significant onshore/offshore trends as well as the north to south trends seen above. For example, the shelf valley systems have smaller relief going offshore. In contrast, the shelf sand ridges off Indian Rocks and Sarasota increase in relief going seaward. However, close to the nearshore, the sand ridges seem to disappear all together suggesting that they do not provide sediment to the beach.

The link between coastal sectors and adjacent shelf provinces ranges from a strong direct link in the Indian Rocks Beach area and the Tampa Bay mouth area to no apparent link at all in the Sarasota/Venice area. For example, the bedrock rise supporting the linear ridges off Indian Rocks Beach is the direct seaward extent of the coastal headland. Antecedent rock topography controls both coastal headland and inner shelf geology. Similarly, the estuarine retreat path of Tampa Bay has left a featureless sediment plain that transitions into a swash-bar dominated, relatively new barrier island system covering open estuarine deposits. The coastal system south of Tampa Bay seems to have no large-scale morphologic relationship to the adjacent inner shelf provinces. However, most likely there are local direct links between barrier island/inlet morphology and underlying antecedent rock topography.

Little linkage between modern shelf processes and shelf provinces suggests that the shelf provinces are a product of the geologic past, having inherited large-scale properties such as regional bedrock topography, valley infill, and uneven sediment cover from long-term processes such as subterranean and surface dissolution, paleofluvial activity, climate change, and sea-level fluctuations.

9.1.1.3 Continental Slope

In its entirety, the continental slope of the Gulf basin is a region of gently sloping sea floor that extends from the shelf edge, or roughly the 200 m isobath, to the upper limit of the continental rise, at a depth of about 2,800 m (NMFS no date). The slope occupies more than 500,000 km^2 of prominent escarpments, knolls, basins, ridge and valley topography and submarine channels.

Sediment characteristics of the GOM continental slope exhibit regional differences (Gallaway et al. 1988). The most common sediment type on the slope was silty clay, occurring in all geographic regions. However, in the eastern Gulf this general sediment type had higher percentages of sand than in the western or central areas of the Gulf. Clay sediments were found in the western and central Gulf but not in the eastern Gulf samples. In contrast, sand-silt-clay sediments were represented at some eastern Gulf stations but absent from the western Gulf stations. Sandy clay was found at shallow and deep stations in the western Gulf and at deep stations in the eastern Gulf.

GOM slope sediments contain a mixture of terrigenous, petroleum, and planktonic hydrocarbons. Petroleum hydrocarbons were detected at all locations and have a dual source in natural seepage and river-associated transport. Hydrocarbons were preferentially associated with clayey, organic-rich sediments suggesting a linkage with river-derived material. Aromatic hydrocarbon concentrations were very low at all locations but their presence was confirmed by fluorescence analysis.

Megafaunal organisms collected from non-seep areas had variable levels of hydrocarbons in their tissues, mainly derived from the sediments either directly or from organisms that had ingested sediments. Hydrocarbons were more prevalent in fishes than in decapod crustaceans. Terrigeneous hydrocarbons were common but the majority of the hydrocarbons appeared of plankton origin. The central Gulf had the highest levels of total organic carbon and petroleum hydrocarbons and the lowest levels of sand in the sediments, the eastern Gulf had the lowest levels of organic carbon and hydrocarbons in slope sediments and the highest levels of sand, and the western Gulf slope transect were intermediate between these extremes.

The macrofauna (those organisms collected with box corers and retained on a 0.300 mm sieve) of the continental slope of the GOM are abundant (average transect densities ranged from 1,500 to 3,000 individuals/m^2) and highly diverse (Gallaway et al. 1988). Except in the region of the shelf break, there is little or no tendency towards dominance by any species. A total of 324 individual benthic samples taken in the program contained nearly 50,000 macrofaunal organisms. The concept that the slope macrofauna of the GOM is depauperate is clearly in error. The macrofauna, in fact, consists largely of "rare species." However, the GOM slope macrofauna are neither as abundant nor as diverse as the macrofauna of the U.S. Atlantic slope. Given that both diversity and density levels are reduced Galloway et al (1988) suggested that food limitation is a more likely explanation for the observed differences than a low standing stock due to higher turnover rates in the Gulf.

Most species exhibited highly restricted depth distributions, with variation across isobaths being much greater than variation along isobaths. Sampling depths ranged from approximately 350 to approximately 3,000 m. Gallaway et al. (1988) identified three macrofaunal zones on the continental slope of the GOM, one subdivided:

1) Shelf/Slope Transition Zone (300 to 700 m),
2) Upper Archibenthal Zone (700 to 1,300 m),
3) Lower Archibenthal Zone (1,300 to 1,650 m), and
4) Abyssal Zone (2,000 to 3,000 m).

The megafauna (caught with trawl) contained over 5,400 vertebrates (fish) and more than 40,600 invertebrates. Some 126 species of fish and 432 species of invertebrates were collected. A complete listing of all taxa by cruise and-station is provided in Gallaway et al. (1988).

Both fish and invertebrates showed strong species dominance patterns--i.e. the overall patterns usually reflected the distribution of one or two abundant species (Galloway et al. 1988). Only 22 of the 126 species of fish exhibited a total abundance of more than one percent of the catch (>54 specimens) and only 14 of the 432 species of megafaunal invertebrates were represented by as many as 400 specimens (one percent of the total). These data were not adequate to determine trends among regions, seasons, years and depths. For the most part, a few large trawl catches comprise most of the data for each of the abundant species.

9.1.2 Oceanographic Features

9.1.2.1 Water

The GOM 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. Although its surface area is more than 160 million ha (395 million ac), it is a small basin by oceanic standards. Most of the oceanic water entering the Gulf flows through the Yucatan Channel, a narrow (160 km wide) and deep (1,650-1,900 m) channel. Water leaves the Gulf through the Straits of Florida, which is about as wide as the Yucatan Channel, but not nearly as deep (about 800 m). This pattern of water movement produces the most pronounced circulation feature in the GOM basin, known as the Loop Current with its associated meanders and intrusions. After passing through the Straits of Florida, the Loop Current merges with other water masses and the Gulf Stream.

Runoff from precipitation on almost two-thirds of the land area of the U.S. eventually drains into the GOM via the Mississippi River. The combined discharge of the Mississippi and Atchafalaya Rivers alone accounts for more than half the freshwater flow into the Gulf and is a major influence on salinity levels in coastal waters on the Louisiana/Texas continental shelf. The annual freshwater discharge of the Mississippi/Atchafalaya River system represents approximately 10% of the water volume of the entire Louisiana/Texas shelf to a depth of 90 m. The Loop Current and Mississippi/Atchafalaya River system, as well as the semi permanent, anticyclonic gyre in the western Gulf, significantly affect oceanographic conditions throughout the GOM.

9.1.2.2 Temperature

The physical characteristics of the GOM have been extensively mapped. Darnell et al. (1983) mapped physical parameters for the northwestern GOM (the Rio Grande River to the Mississippi River). Bottom temperature was mapped for the coldest and warmest months (January and August). During January, the shallowest waters of the central shelf ranged between 12°C (54°F) and 14°C (57°F). The temperature increased with depth, with a broad band of warmer water, between 17°C (63°F) and 19°C (66°F), across the middle to

deeper shelf. However, on the outer shelf off central Louisiana and south Texas, temperatures dropped below 17°C (63°F), presumably due to the intrusion of cold deeper waters in both areas.

During August, the shallowest waters of the central shelf reached 29°C (84°F), and bottom water temperatures decreased almost regularly with depth, attaining lows of around 17°C (63°F) to 18°C (64°F) toward the outer shelf. Thus, bottom temperatures showed a seasonal range of 15°C (27°F) or more, but on the outer shelf the seasonal range was only 2°C (3.6°F) or less. Clearly, the middle to outer shelf waters could provide a haven for nearshore warm water species during the winter months, and for offshore species it is inhabitable the year round.

Darnell and Kleypas (1987) mapped the eastern GOM (Mississippi River to the Florida Keys), following the same protocol as Darnell et al. (1983) in gathering bottom temperature data during January and August. During the months of January, the coldest shelf water (14°C (57°F)) appeared just off the Mississippi barrier islands. Water colder than 16°C (61°F) occupied the nearshore shelf out to the 25-m isobath from the Chandeleur Islands to Cape San Blas, Florida, and below that point it extended to the 20-m isobath to northern Tampa Bay. West of DeSoto Canyon all bottom shelf waters were below 18°C (64°F). However, east of DeSoto Canyon all outer shelf waters exceeded 18°C (64°F), and the 18°C (64°F) and 20°C (68°F) isotherms passed diagonally shoreward across the isobaths so that all shelf waters from just above Charlotte Harbor to the Florida Keys were 18°C (64°F) or above. The maximum January temperature (22°C (72°F)) was encountered near the southern tip of the Florida shelf at a depth of 60 m to 70 m.

During August, the temperature of the nearshore bottom water ranged from 26°C (79°F) near Panama City, Florida, to 30°C (86°F) around Cedar Keys, Florida. Throughout the eastern Gulf shelf, bottom water temperatures decreased with depth. Near the Mississippi River Delta the outer shelf water was 22°C (72°F), but temperatures down to 16°C (61°F) were observed along both the eastern and western rims of DeSoto Canyon and at several localized areas along the outer shelf of Florida. For most of the shelf of the Florida peninsula, bottom isotherms paralleled the isobaths.

Seasonal comparisons reveal that nearshore waters for the entire eastern Gulf shelf were 10°C (50°F) to 15°C (59°F) warmer in the summer than in the winter. Near the Mississippi River Delta, the bottom waters of the outer shelf were only about 5°C (9°F) warmer in the summer than during the winter. However around the rim of DeSoto Canyon and along the shelf of Florida, summer temperatures ranged 1°C (1.8°F) to 4°C (39°F) colder in the summer than in the winter. This summer temperature depression is due to the intrusion of colder slope water onto the outer shelf during the summer months.

Surface temperatures for the entire GOM were reported by NOAA (1985). Surface temperatures were measured in January and July. During January, temperatures ranged from 14°C (57°F) to 24°C (75°F). MMS (1997) found surface temperatures in the GOM in January to range from 25°C (77°F) in the Loop current core to 14°C (57°F) to 15°C (59°F) along the shallow northern coastal estuaries. NOAA (1985) found the coldest water along the Louisiana/Texas border on the upper shelf. The warmest was found off the southwestern tip of Florida. Temperatures gradually increased with distance from shore in the entire Gulf. Temperatures also increased southward on the Florida peninsula with temperatures ranging from 16°C (61°F) to 24°C (75°F) north to south.

Surface temperatures in July ranged from 28°C (82°F) to 30°C (86°F). The coolest water

was found off the south Texas coast. The warmest water was found off the Mississippi/Alabama coast, the Big Bend area of Florida, and the southern tip of Florida. Temperatures gradually decreased with distance from shore. Surface temperature reported from SEAMAP cruises during July (Donaldson et al., 1997) ranged from 28°C (82°F) to 31°C (88°F). The warmest water was found around the Florida Keys. The coolest water was found off the Big Bend area of Florida, while most of the Gulf had surface temperatures of 29°C (84°F). These temperatures agree closely with MMS (1997) data showing 29°C (84°F) to 30°C (86°F) water throughout the Gulf during August.

9.1.2.3 Salinity

Surface salinities in the GOM vary seasonally. During months of low freshwater input, surface salinities near the coastline range between 29 and 32 ppt (MMS, 1997). High freshwater input conditions during the spring and summer months results in strong horizontal salinity gradients with salinities less than 20 ppt on the inner shelf. The waters in the open Gulf are characterized by salinities between 36.0 and 36.5 ppt (MMS, 1997).

In the eastern Gulf, Darnell and Kleypas (1987) found that during May the bottom salinity of the nearshore water varied locally. From Tampa Bay to the Mississippi River Delta the salinity of the nearshore water was 35 ppt or less with a low value of 33 ppt above Cedar Keys and off the coasts of Alabama and Mississippi. The lowest reading (31.5 ppt) occurred just off the Mississippi barrier islands. Below Tampa Bay all nearshore water was 36 ppt except locally off Charlotte Harbor and the Everglades. Bottom water of about 33 ppt characterized the entire shelf off Mississippi and Alabama, and tongues of fresher water extended from the Mississippi River Delta along the outer shelf. Water of full marine salinity covered the margins and head of DeSoto Canyon, and on the Florida shelf it ran diagonally shoreward to Tampa Bay. The highest salinity (36.5 ppt) appeared at mid-shelf above the outer Keys of south Florida.

The same pattern prevailed in August. From Tampa Bay to the Mississippi River Delta the shore water was 35 ppt or less. A pocket of 32 ppt water appeared near Cedar Key, and off most of Alabama and Mississippi the water was 34 ppt or less. Below Tampa Bay all nearshore water was 36 ppt or greater except for a small extension of slightly fresher water from Charlotte Harbor. The entire shelf off Mississippi and Alabama had bottom water of less than 36 ppt, and tongues of fresher water protruded eastward from the Mississippi River Delta along the middle and outer shelf. Salinities of 36 ppt and above characterized the area around the rim of DeSoto Canyon and, with undulations, ran diagonally shoreward to Tampa Bay. Salinities in excess of 36 ppt appeared at several areas along the outer half of the Florida shelf, and higher salinity water extended across much of the shelf off the Everglades and above the Keys.

The salinity patterns reflect heavier river outflows in the Louisiana, Mississippi, Alabama area especially during the spring, and lower freshwater outflow from the streams of Florida. The patterns also reflect the movement of open Gulf water over the lower half of the Florida shelf and intrusion of slope water around DeSoto Canyon and along the outer shelf of Florida. Freshwater springs occur at several locations on the Florida shelf.

9.1.2.4 Dissolved Oxygen and Hypoxia

Dissolved oxygen values in the GOM average about 6.5 ppm, with values averaging about 5 ppm during the summer months (Barnard and Froelich, 1981). Areas of anoxic bottom water have not been reported from the eastern Gulf continental shelf. However, summer

hypoxia of bottom water has been noted for Mobile Bay and Tampa Bay.

Oxygen depletion results from the combination of several physical and biological processes. As a general rule, the nutrients delivered to estuarine and coastal systems support biological productivity. Excessive levels of nutrients, however, can cause intense biological productivity that depletes oxygen. The remains of algal blooms and zooplankton fecal pellets sink to the lower water column and seabed. The rate of depletion of oxygen during processes that decompose the fluxed organic matter exceeds the rate of production and resupply from the surface waters, especially when waters are stratified. Stratification is accentuated in the summer due to solar warming of surface waters and calming winds. Following a fairly predictable annual cycle beginning in the spring, oxygen depletion becomes most widespread, persistent and severe during the summer months.

Hypoxia is most widespread, persistent, and severe in June, July, and August (Rabalais, ND). Hypoxic waters can include 20 to 80% of the lower water profile between 5 and 30 m water depth, and can extend as far as 130 km offshore. Throughout its distribution, the impact of hypoxic bottom waters is exacerbated by the release of toxic hydrogen sulfide from sediments.

The biotic community responds to hypoxia-anoxia in a fairly predictable way (Rabalais et al. 1997). Motile organisms leave an area when oxygen level fall below 1.5-2.0 mg l-1, less motile invertebrates die at oxygen levels below 1.5 mg l-1, infauna display stress below 1.0 mg l-1, and a fairly linear decrease in benthic abundance occurs below 0.5 mg l-1. Direct mortality, altered migration, reduction in suitable habitat, increased susceptibility to predation, changes in food resources and susceptibility of early life stages occur for fish during hypoxia.

9.1.2.5 Turbidity

Surface turbidity in the marine environment in the GOM is limited to the areas affected by the major river systems. The Mississippi/Atchafalaya river system deposits the most sediment and has the greatest effect on surface turbidity in the Gulf (Scruton and Moore 1953). Close inshore the high turbidity from the Mississippi River commonly extends through the entire water column with turbidity maximum occurring at the surface and toward the bottom. Farther offshore where color and intensity of turbidity indicate the amount and average grain size of material in the surface layer have decreased, the subsurface waters are also somewhat turbid, but the difference between the waters above and below may be more visible than inshore. Still farther offshore, the interface below the surface stratum becomes more diffuse as vertical mixing progresses, until a distinction ceases to exist.

Wind and currents are the agents responsible for the observed direction of turbidity distribution. In the inshore areas, river velocity carries the freshwater over the more saline water beneath. Tidal currents modify these original surface currents and, aided by the wind, deliver the turbid water to offshore areas. Turbidity introduced into the GOM by the Mississippi River can be moved by the wind and tides in plumes that may extend 105 km seaward from the delta (Scruton and Moore, 1953). While Scruton and Moore (1953) only dealt with the Mississippi River Delta, the same type of river, tidal, and wind dispersal of turbidity is thought to occur at the other major rivers whose waters are laden with sediment entering the Gulf.

Another type of turbidity is the layer of turbid water commonly found near the bottom. Called nepheloid layers, these turbid waters occur in the north-central and northwestern GOM when the turbulence of the water is high enough to offset the settling of the sedimentary particles under the influence of gravity. The larger the particles, the more intense the turbulence must be to maintain a suspension. Nepheloid layers are therefore usually composed of silt and clay particles, because only the most energetic flows can maintain a sand suspension.

9.1.2.6 Currents

Current speeds may exceed 2 m/s and transports are of the order of 0.03 km^3 /s (NMFS no date). Large unstable rings of water are shed off of the Loop Current, bringing massive amounts of heat, salt and water across the Gulf. It is suggested that about 10% of inflowing Loop Current waters are exchanged with the open Gulf (Maul, 1978), and the shelf-break region of the Mississippi-Alabama Shelf is influenced by the Loop Current 40% of the time (Kelly, 1991). Thus, the Loop Current plays an important role in shelf nutrient balance, at least in the eastern Gulf.

The Loop Current sheds eddies in the Northeast GOM as current meanders break off the main current (TAMU 1998). Clockwise-spinning - or anticyclonic - eddies cause warm water to flow towards the center of the eddy and sink to greater depth. The low nutrient water makes cyclonic eddies a marine desert. The anticyclonic eddies also spin off counterclockwise - cyclonic - eddies. Cyclonic eddies flow up from the depths and brings nutrient rich water that supports marine life.

Part of the Loop Current bends to the east after entering the Gulf through the Yucatan Channel and becomes the Florida Current, after leaving the Gulf through the Straits of Florida (TAMU, 1998). Some water flows farther north into the Gulf and then veers to the east to form a clockwise gyre bounded by two or more smaller counterclockwise gyres off West Florida. Some water also turns to the west and contributes to a series of anticyclonic warm eddies which travel west across the Gulf in a process of decay that typically last 4 to 10 months. The Loop Current has an annual cycle of growth and decay, but the variability in patterns from year to year is significant.

When the Loop Current is north of 27^{o}N latitude, a large anticyclonic eddy about 300 km in diameter usually separates. These warm core eddies originate as pinched off northward penetrations of Loop Current meanders. In the following months the eddy migrates westward at about 4 km/day until it reaches the western Gulf shelf where it slowly disintegrates over a span of months. The boundary of the Loop Current and its associated eddies is a dynamic zone with meanders, strong convergences and divergences, that can concentrate planktonic organisms including fish eggs and larvae.

Richards et al. (1993) collected larvae of 100 different fish families and found that two groups were present in Loop Current boundaries. These were oceanic and continental shelf groups. Within the oceanic group were two subgroups formed by typically mesopelagic families such as the marine hatchetfishes, (sternoptychids), and by ocean but epipelagic families such as the man-of-war fishes (nomeids) and lanternbellies (acropomatids). The shelf group was also divided into two subgroups roughly characterized as the demersals (flounders (bothids), lizardfishes (synodontids), and sea basses (serranids)) plus likely epipelagics (leatherjackets (balistids) and herrings (clupeids)), and the epipelagics (jacks (carangids) and mackerels (scombrids)) along with widely dispersing reef species (wrasses (labrids), parrotfishes (scarids), and scorpionfishes

(scorpaenids)). Current boundaries and fronts can concentrate zooplankton and larval fish and are an important habitat for a highly diverse assemblage of fish species (Richards et al., 1993).

An area of increased primary production occurs on the west Florida shelf each spring (Gilbes et al., 1996). The chlorophyll plume occurs mainly during spring with high pigment concentrations persisting for one to six weeks. The plume extends along 250 km of the west Florida shelf from Cape San Blas toward the Florida Keys along the shelf break (Gilbes et al., 1996). The cause of the chlorophyll plume is undetermined, but Gilbes et al. (1996) suggest that formation may be associated with one or a combination of the following processes. The first is from the discharge of nutrients from small local rivers along the northwest Florida coast. The next possible cause is the circulation of water from deeper Gulf waters to the surface and then southward along the west Florida shelf. This upwelling of nutrients is associated with Loop Current intrusions. The final possible cause is the discharge of the Mississippi and Mobile Rivers. The significance of the yearly spring plankton bloom is that it coincides with reef fish spawning on the west Florida shelf.

9.2 Biological Environment

Many aspects of the biological environment are unknown or unavailable. Lack of data limits ability of management agencies to specifically develop management programs for managed species or the essential habitat needed by those species. The number of managed species and the complex components of the environment exceed the capability of state and federal management and scientific organizations to provide information. In general, data collections and analyses have been limited to selected species or components of the environment. Several federal agencies and all state fishery/natural resource agencies have programs underway to expand necessary information.

- NMFS has the lead responsibility for fishery management and protection in the federal waters of the GOM (beyond 9-miles off Texas and the west coast of Florida, and 3-miles off the other states).
- The US Army Corp of Engineers requires permits for many activities in state and federal navigable waters, and has biological assessment capabilities.
- The Mineral Management Service has a responsibility to assess biological effects of federally authorized mineral extraction (especially oil and gas in the GOM).
- The US Geological Service has biological research division that emphasizes shallow-water processes and is also engaged in mapping the benthic habitat of the Gulf.
- The US Fish and Wildlife Service has responsibility for marine birds, anadromas fish and some marine mammals (e.g., manatees).

9.2.1 Fishery Resources

9.2.1.1 Status of Stocks

The Reef Fish Fishery Management Plan applies to 40 species (Table 8.0). Of these, six have had stock assessments performed by NMFS (red grouper, red snapper, vermilion snapper, gag, greater amberjack, and gray triggerfish). A review of the stock assessment results for each of these species is presented below. (A stock assessment for yellowedge grouper and a new stock assessment for red grouper were recently completed by NMFS and are currently undergoing review by the Reef Fish Stock Assessment Panel. Those

assessments are not included in this discussion.)

Of the six reef fish species for which stock assessments have been completed and reviewed, three are classified by NMFS as overfished(red grouper, red snapper and greater amberjack). Vermilion snapper is classified as undergoing overfishing but the overfished status is unknown. Gag were recently reclassified from not overfished but approaching an overfished condition to neither overfished not undergoing overfishing. Gray triggerfish are classified as unknown for both overfished and overfishing status. Goliath grouper and Nassua grouper are also classified as overfished but not undergoing overfishing (harvest of both species is prohibited). Neither species has had stock assessments performed. The remaining reef fish species are classified as unknown status for both overfishing and overfished.

Most of the stock assessments previously used spawning potential ratios (SPR) to determine overfishing and if stock is in an overfished condition. However, MRAG Americas (in press) demonstrates that while SPR effectively indexes overfishing (fishing mortality (F) is too high), it does not index the overfished condition (biomass too low). SPR does not track recruitment trends, so biomass can increase or decrease independently of SPR. Thus, the practice of using SPR as a proxy for Maximum Sustainable Yield (MSY) is not appropriate. The extent of stock depletion and appropriate harvest levels should be indexed by absolute or relative estimates of biomass. The Council recognized this problem and through its Generic SFA amendment modified the framework procedure for specifying TAC for all the finfish stocks to provide for adopting biomass-based overfished thresholds as NMFS and the stock assessment panels develop these parameters.

9.2.1.1.1 Red Snapper

The management of red snapper (*Lutjanus campechanus*) has been surrounded by much controversy over the last decade, in particular because a large number of juvenile fish are caught as bycatch in shrimp trawls. Since the late 1980s, the stock has been considered to be in a severely depleted condition in need of rebuilding. This is one of the few species for which transitional SPR has been used as a measure of stock status, relative to target and limit (threshold) measures of static%SPR (e.g. Goodyear 1995, Schirripa 1998a, 1999).

In recent years, fishers have reported seeing and catching many more and larger fish, and the species appears to be returning to the waters of the eastern Gulf. Yet, the estimate of transitional SPR has remained well below the overfishing limit (threshold) (Schirripa 1999). With several years of strong recruitment, one would expect the catches to improve. However, since newly recruited year classes take some time to contribute significantly to the reproductive potential of the stock, it also takes time before these year classes generate a corresponding increase in transitional SPR. This is particularly true when the spawning stock is composed of a large number of year classes.

Since 1990, the Council has set targets for recovery of Gulf red snapper based on SPR measures and specified rebuilding times. Monitoring over the period 1993 to 1995 indicated improvements in the stock status, which appeared to indicate that management actions were having a positive effect on the stock. However, simulations conducted by NMFS scientists in 1997 indicated that at the constant TAC of 9.12 MP, the goal of 20% SPR would not be reached by 2019, even with a reduction of bycatch mortality rate in shrimp fishery by 44%. The NMFS assessment concluded that to reach the goal, either the TAC had to be lowered to 6 MP or bycatch needed to be reduced by 55%. Scientists also noted that future levels of SPR were much more sensitive to differences in bycatch

mortality than differences in levels of TAC. Unfortunately, the former is much more difficult to achieve. NMFS agreed in early 1998 to adopt the Council's recommendations regarding the use of bycatch reduction devices (BRDs) and agreed to retain the 9.12 MP TAC. However, this was subject to scientific verification of a BRD efficiency rate of at least 60%.

In 1999, a new red snapper stock assessment was prepared by the NMFS SEFSC (Schirripa and Legault 1999). In view of new requirements of the Magnuson-Stevens Act, associated Technical Guidelines, and the concern stated in the 1997 Peer Review that uncertainty in the stock assessment had not been fully characterized, a new modeling methodology was used for the Red Snapper Stock Assessment. This methodology, called Age-Structured Assessment Program (ASAP), provides greater flexibility in population model structure and provides internally consistent estimates of management parameters of interest (e.g., the instantaneous fishing mortality rate and stock biomass level capable of producing MSY [F_{MSY} and B_{MSY}]). ASAP includes a statistical fitting procedure that provides an improved basis for characterizing uncertainty in the evaluation of a stock's status.

Results of the ASAP model showed that the condition of the stock was, in general, the same as was reported in the 1995 assessment (Goodyear 1995). The 1995 assessment was the basis for the initial setting of the current 9.12 million pound TAC. Fishing mortality has increased in the recreational sector over time, has remained flat in the commercial handline (west) and shrimp bycatch sectors, and has decreased in the commercial handline (east) and commercial longlines. The estimated abundance of exploitable-sized red snapper has increased rapidly in recent years, although the total population has not increased and may have even slowly decreased.

The management alternative that is currently under review comprises a 31-year rebuilding plan for red snapper with 5-year interim management goals as follows:

- set TAC for years 2001-2005 at 9.12 MP;
- assume bycatch reduction at 40% (existing BRD requirements); and
- develop technological and management mechanisms to allow for a 60% reduction in bycatch after 5 years and up to an 80% reduction in bycatch after 10 years.

The rebuilding targets and thresholds associated with this alternative are:

Maximum Sustainable Yield (MSY)	41-66 MP	
Optimum Yield (OY)	a.	2001-2005: OY=9.12 MP
	b.	2006-until recovery ($B_{current}/B_{MSY}<1$), OY is the yield defined by a constant fishing mortality rate strategy consistent with rebuilding to B_{MSY} within the allowable rebuilding period.
	c.	After achieving the rebuilding target, OY is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ (The magnitude of this yield depends on the ultimate biomass at MSY and cannot be reliably estimated at this time.)
Maximum Fishing	F_{MSY} [the range of F_{MSY} is 0.116 - 0.092	

Mortality Rate (MFMT)	(33% - 36% static SPR)]
Minimum Stock Size Threshold (MSST)	Existing estimates of B_{MSY} and MSST are not considered reliable; however, all available scientific information indicates that Bcurrent is << (1-M)*B_{MSY}. Based upon maximum recruitment equal to the low recruitment scenarios with steepness of 0.90 or 0.95, the B_{MSY} = 2.6-2.7 billion pounds and MSST [(1-M)*B_{MSY} = 0.9*B_{MSY}] = 2.3-2.4 billion pounds.

A 40-% reduction in juvenile red snapper bycatch mortality in the Gulf shrimp fishery has been achieved, as substantiated by data that NMFS submitted to the Council (Nichols, 1990; Nichols & Pellegrin, 1992), and that the RFSAP reviewed. Further NMFS biologist Dr. Scott Nichols, at the September 20-24, 1999 RFSAP meeting, and at the October 27, 1999 meeting of the Council's Scientific and Statistical Committee, stated that, excluding the now illegal configuration of a fisheye BRD covered by the trawl net's elephant ear, fisheye BRDs are currently attaining a 40-% reduction in fishing mortality of juvenile red snappers and a 50-% reduction appears feasible. Additionally, NMFS biologist Dr. John Watson, in statements to the Council at its November 8-12, 1999 and November 13-16, 2000 meetings, indicated that a 50-% bycatch reduction could be achieved from fisheye BRDs. NMFS believes that further reductions are possible with improved BRD technology. Tests conducted by NMFS have already demonstrated that prototype BRDs can reduce bycatch mortality of red snapper in shrimp trawls by as much as 70%. [66 RF 53590]

9.2.1.1.2 Vermilion Snapper

Vermilion snapper are caught throughout the GOM, and most landings occur in Florida (Schirripa 1998b). Fishermen who catch vermilion snapper also catch a variety of other species. Florida leads in landings for both commercial and recreational fisheries, while Louisiana has the second most commercial landings, and Alabama has the second most recreational landings. Handline fishermen dominate commercial landings, and a small fraction of the fleet (2-3%) catches most of the harvest (50%). About 10 headboats account for 50% of harvest from that mode. Vermilion snapper landings increased regularly from 1981 to 1993, and declined through 1995. Schirripa (1998b) concluded that vermilion snapper were not over harvested, but recruitment and catch trends point to possible declining future abundance. SPR from 1986-1995 ranged from 0.26-0.28.

Schirripa and Legault (2000) updated the previous stock assessment with data through 1998, with some catch data from 1999. The commercial fishery accounts for 70-80% of fish landed weight. Commercial landings increased from around 1 MP in the early 1980s to a peak near 2.7 MP in 1993. Catch declined for three years, and remained in the 2.3-2.6 million pound range from 1996-1998,comparable to landings in the early 1980s. Longline fisheries took a small fraction, mostly in the 1980s. Recreational harvest jumped from 0.1-0.6 million fish in the early 1980s to 1.0-1.5 million fish from 1986 to 1995. Harvest for 1996-1998 dropped to 0.4-0.6 million fish, slightly above harvest of the early 1980s. The headboat fishery accounts for 1/3 - ½ of the recreational catch, and charter boats account for most of the rest. The recreational fisheries discard about 15-25% of its catch. Schirripa and Legault (2000) suggested that vermilion snapper is a bycatch of the red snapper fishery, and Schirripa (1998b) noted that vermilion snapper catch varied inversely with red snapper catch. Declining catch may, therefore, be associated with increasing abundance of red snapper. While CPUE of the commercial vessels has varied with out

trend since 1990, the recreational headboat CPUE has declined more than 50% since 1993.

Schirripa and Legault (2000) assessed stock condition using two VPA models that added abundance indices to the model used in 1998. Both models used a recruitment index from the NMFS Fall Groundfish Survey. One model incorporated CPUE from both the handline and the headboat fisheries, while the other did not use the handline CPUE. The handline-headboat CPUE represents data from virtually the entire fishery, while the headboat-only CPUE incorporates data from about 10% of the landings. The handline-headboat model indicated a high probability of overfishing and the overfished condition, while the headboat-only model indicated a low probability of overfishing and the overfished condition.

The most recent assessment of the vermilion snapper fishery was undertaken in 2001 using data through 1999, with some commercial catch data for 2000 (Porch and Cass-Calay 2001). Two models were used: VPA and a non-equilibrium production model. The majority of the six VPA runs and the production model runs that used the full time series of data indicate that the stock is overfished and is undergoing overfishing based on the default thresholds. These results were considered to be consistent with the results of Schirripa and Legault (2000). Two of the VPA runs and one of the production model runs (one that did not use the last three years of data) indicated that the stock is not overfished and that no reduction in the current rate of fishing is required. Of the model runs that indicated the stock was overfished, the VPAs indicated the need for a reduction in the rate of fishing by one to two thirds. The production models indicated that the fishing mortality needs to be reduced to about half its current level. One of the main problems cited in the assessment was conflicting trends in time series of catch per unit effort. The commercial CPUE series suggests there has been little change in the relative abundance of vermilion snapper, but the eastern headboat index suggests that they have declined dramatically.

In summary, the authors of the most recent assessment conclude that, based on the default thresholds, the vermilion snapper stock may now be overfished and that overfishing will continue at the current rates of fishing. Some reduction is therefore necessary. The authors prefer the production model approach to assessing this species because it avoids the need to use uncertain and poorly determined catch at age (arising from aging difficulties).

9.2.1.1.3 Red Grouper

(Note: For more detailed discussion of the status of the red grouper stock, see Section 5.0, Status of Red Grouper Stock.)

Red grouper are caught mostly in the GOM from Panama City, Florida to the Florida Keys, and primarily south of Tampa. Red grouper catch statistics were no longer lumped with other grouper species in 1986 (Goodyear and Schirripa 1993). Cuban fishermen caught a significant amount of red grouper from US waters prior to extended jurisdiction in 1976. Handline/power reel fishermen caught most of the red grouper until the early 1980s when longlines increased operations and dominated the catch. Florida implemented an 18-in minimum size limit in 1985 for state waters and the Council implemented a 20-in minimum size limit in 1990 for the EEZ, which Florida matched in state waters. Goodyear and Schirripa (1993) concluded that red grouper were not overfished through the early 1990s. They estimated SPR at around 30%.

Schirripa et al. (1999) updated the previous assessment with data through 1997. By

applying the ratio of red grouper to all grouper from 1986-1997 to the total US grouper catch and incorporating the Cuban red grouper catch, Schirripa et al. (1999) estimated the historical catch. Total catch, including Cuban, US commercial and recreational, peaked during the late 1940s to 1950s at 14 to 18 MP. A substantial drop in Cuban catch led to a total catch around the 8-10 million pound range from the 1960 until the exclusion of the Cuban fleet in 1977. Subsequently, the US catch fluctuated from 6-11 MP. Since 1986, the commercial handline catch of red grouper declined by about half, while the longline catch showed no trend. Trap fisheries represented a minor component. The recreational fishery peaked in the mid- to late-1980s at about 0.6-1.0 million fish retained per year . Catch dropped to 0.2 million fish in 1990 following the minimum size limit, increased somewhat in 1992-1993, and declined to 0.2-0.1 in 1996-1997. Since 1983, recreational fishermen released most red grouper, up to 80-90% in the 1990s.

Commercial CPUE values, estimated from logbook data, for the longline, handline, and trap fisheries remained fairly constant from 1990 when logbook coverage began (Schirripa et al. 1999). Recreational CPUE (retained plus discarded) showed different patterns from the Harvest Per Unit Effort (HPUE) (retained only) . HPUE for private/charter boats and for headboats declined from the mid- to late-1980s to reach minimum historical values in 1996 and 1997. Private/charter HPUE dropped following the minimum size limit of 1985 (no data available for headboats) and dropped minimally in 1990. Headboats HPUE dropped about 50% in 1990. Private/charter CPUE increased in 1990 indicating increased catch of discarded fish. Later declines in CPUE paralleled HPUE. Schirripa et al. (1999) suggested that the CPUE could index undersized red grouper, and the recent decline could portend declining recruitment. However, the parallel CPUE-HPUE pattern could also suggest a declining legal component, but not necessarily declining sublegal component.

Use of a stock production model (ASPIC) and a virtual population analysis (ASAP) both demonstrated an overfished condition and overfishing occurring, based on the default thresholds (Schirripa et al. 1999). Using ASPIC, the estimated biomass relative to biomass at MSY (B_{MSY}) declined rapidly from the 1940s to 1960, then declined gradually to current levels less than half B_{MSY}. Over the same time period, estimated fishing mortality increased to over twice the fishing mortality at MSY (F_{MSY}). $B/B_{MSY} < 0.8$ and $F/F_{MSY} > 1.0$ indicate an overfished condition and overfishing occurring for red grouper. Estimates from a series of ASAP models with different assumptions showed B_{MSY} ranging from 0.19 to 0.60 and F/F_{MSY} ranging from 1.4 to 3.2.

The Reef Fish Stock Assessment Panel (RFSAP 1999), reviewing Schirripa et al. (1999), chose the ASAP model with the full time series as most representative of the stock status, but noted that the similarities of the ASAP and ASPIC model results increase confidence in the ASAP model. The RFSAP (1999) recommended a recovery time of F = 0 plus one generation (2018 target date). Subsequently, the RFSAP (2000) reevaluated the red grouper stock assessment, especially suitability of the Cuban data, and requested additional runs of the ASAP model to explore other assumptions. The Panel selected the data since 1986 (no Cuban data) as most representative and that overfishing and the overfished condition were not as great as with the longer data set. Since the results now indicated that the stock could be recovered to B_{MSY} in less than 10 years in the absence of fishing mortality, the Panel recommended a maximum 10-year rebuilding period.

In 2002, a new red grouper stock assessment was prepared by NMFS and reviewed by the Reef Fish Stock Assessment Panel. The new assessment updated the landings data to 2001, and developed a new relative fecundity-at-age relationship that assigned slightly higher fecundities to the younger age groups. The 2002 assessment also incorporated the

effect of a strong 1996 year-class which began entering the fishery in 1999, too late to have been included in the previous assessment. The RFSAP settled on a recommendation that the steepness value of the spawner-recruit relationship in the ASAP model be set at 0.7 rather than the range of 0.7 to 0.8 used in the previous recommendations. The new assessment confirmed the previous assessment's finding that the red grouper stock was below the overfished threshold of 80%*B_{MSY} in 1997, but the stock was found to be less severely overfished due to the effect of incorporating the new fecundity-at-age relationship. At a steepness of 0.7, the previous assessment had found the red grouper spawning stock biomass to be at 56% of B_{MSY} in 1997. The revised estimate from the 2002 assessment was that the stock was at 62% of B_{MSY} in 1997, and at 84% of B_{MSY} in 2001. Although the most recent status estimate now put the stock above the overfished threshold, the confirmation that it was below the threshold in 1997 left intact the overfished designation and the requirement to rebuild the stock to B_{MSY} in no more than 10 years.

9.2.1.1.4 Gag

Gag are caught on the west coast of Florida from northern Pinellas County to the northern extent of the state (Schirripa and Goodyear 1994). Misidentification of gag and black grouper caused problems in all data sets except for scientific research data. Schirripa and Goodyear (1994) used species composition obtained by trained staff in MRFSS and headboat observations from 1990-1992 to correct recreational and commercial catch and landing data. They did not use information from commercial logbooks because some fishermen non-quantifiably changed reporting from black grouper to gag and because of large discrepancies between MRFSS-headboat and commercial logbook data. After re-apportioning gag-black grouper catches based on scientific data collections and observed recreational catch, Schirripa and Goodyear (1994) concluded that gag were not overfished, although the male to female ratio had decreased from the late 1970s to the early 1990s. They estimated SPR at approximately 30%.

Schirripa and Legault (1997) most recently updated the previous assessment with data through 1996, used preliminary estimates of discard mortality rates of sublegal-sized gag, and evaluated the implications of protogynous hermaphroditism in the stock assessment. For 1986-1996, years with gag harvest separated from other groupers, the commercial catch remained fairly constant in the range of 1.5 MP. The commercial harvest does not show an effect of a 20-inch minimum size limit set in 1990. Applying the average ratio of gag to other groupers (1986-1996) to catches from 1965 suggested lower commercial gag harvest of around 1.0 MP through the 1980s. The recreational fishery showed the effects of a minimum size limit with lower catch since 1990. The recreational fishery showed an order of magnitude increase in discarded gag since 1990.

CPUE for commercial (handline, bottom longline, and trap) and recreational (headboat and private) fisheries, though variable, also remained fairly stable during the 1986-1996 period Schirripa and Legault (1997). Recreational fisheries harvest smaller fish than do the commercial fisheries. The average size of gag in the commercial and recreational fisheries showed no trend during the 1986-1996 period, although the average size increased following implementation of a minimum size in 1990. Harvest, CPUE, and mean size indices suggest that the fishery for gag has not changed much since 1986.

Fishing mortality estimated with catch curve analysis and with several VPA models indicated recent $F > F_{0.1}$ or F_{max}, generally by a factor of 2 or more. F values estimated with VPA that incorporated variable recruitment were higher than estimates with constant

recruitment, but the estimates from variable-recruitment were judged unreasonable. About 25% of the estimated F came from estimated mortality of discarded gag.

SPR values ranged widely depending on estimation of F in the VPA models and on assumptions about fecundity. The fecundity function had the most effect on SPR. The RFSAP (1998) judged that the transitional SPR from the most reasonable assumptions were slightly above the Council's current threshold of 20%. Schirripa and Legault (1997) noted that protogynous hermaphrodites such as gag do not fit the assumptions for SPR, and that SPR may not apply well to gag. They recommended maintaining SPR well above the 20% threshold as a cautionary measure. However, the shift from female to male is equivalent of a higher natural mortality for females, which would underestimate actual SPR, and provide more conservative management (MRAG Americas in press). Even so, SPR does not adequately reflect the condition of stock biomass.

Schirripa and Legault (1997) and the RFSAP (1998) expressed concern that spawning aggregations of gag may be more vulnerable to harvest than suggested by the standard models and reference points. This concern is reflected in the spawning ground closures implemented by the Council.

In the 2000 gag assessment (Turner et al. 2000), the method for determining age from length was reevaluated. The 1997 assessment (Schirripa and Legault 1997) had used the recruitment-and-mortality modulated catch-at-age (RMM) procedure to estimate ages from length information, due to the sparse nature of available length-at-age data at that time (RFSAP 1998). For 2000, new length-at-age information was available (Fitzhugh et al. 2001), and a method for aging that combines a semi-annual age-length key with a stochastic growth estimation procedure for periods when the aged fish were not available, called the ALK (age-length key) method (Cummings and Parrack in prep.) was deemed more suitable by the RFSAP (2000). This method used semiannual age-length keys applied to 1992-1994, the latter 6-months of 1995 and 1996, and 1998-1999. Gag catch at length densities for which age length keys did not exist were aged using the stochastic ageing approach.

The RFSAP (2001) reconsidered the previous use of a fishing mortality rate of $F_{30\% SPR}$ as a proxy for F_{MSY}. This usually works well with fish that do not change sex, since egg production remains fairly proportional to biomass throughout a fish's life. However, gag is a protogynous hermaphrodite, and the relationship between egg production and biomass does not hold. The $F_{30\% SPR}$ proxy is based on the potential number of eggs produced by each age class, which decreases rapidly after a peak at age 8 because older fish turn into males. The F_{max} proxy, on the other hand, is based on the average weight of each age class, which increases a great deal after age 8. Thus, it seems clear that, for gag, an F_{max} policy is more compatible with the concept of MSY than is an $F_{30\% SPR}$ policy. The RFSAP (2000) recommended that efforts be undertaken to maintain a harvest strategy that maintains F at F_{MAX}, or moves toward F_{OY}. This strategy allows higher yields than fishing at $F_{30\% SPR}$, allows male biomass to be about 10% of its unfished biomass, and reduces harvest costs to the fishery.

Using the default thresholds of F_{MAX} for overfishing and 85% (1-M) of B_{MSY} for overfished status, the VPA was bootstrapped 500 times for use in estimating uncertainty about the current status and benchmark statistics. The results indicated that there was an 85% probability the stock biomas was above the MSY level, and only a 41% probability that overfishing was occurring. Although the model recommended a maximum ABC of 6.23 MP GW, this high end of the ABC range reflected assumptions about the future

status of the stock that are not inherent in the current status and have not yet been demonstrated to be true. Therefore, the RFSAP (2000) recommended a precautionary approach of not allowing landings to exceed the recent levels of about 5 MP.

9.2.1.1.5 Greater Amberjack

Amberjacks in the GOM are caught primarily along the west coast of Florida westward to about the Mississippi River. Amendment 1 of the Reef Fish Fishery Management Plan concluded that amberjacks were overfished, and that the fishery harvests had increased in the recent years prior to the Amendment. The RFSAP concluded in 1993 that available data were too poor in quality and quantity to use for stock assessment, but that data existed to monitor the trends in the fishery. McClelland and Cummings (1996) cited severe under-sampling of the amberjack fisheries for length and weight data. They updated landing, catch per effort, and biological data, and presented results of a VPA analysis for greater amberjack. Declining biological sampling after 1993 diminished reliability of results after 1994. McClellan and Cummings (1996) concluded that fishing mortality for adult fish (ages 4-7+) during 1987-1995 ranged from 0.10-0.45, with values below 0.15 in 1994 and 1995; that fishing mortality on young fish (ages 1-3) dropped in 1990 after a minimum size limit went into effect. Abundance estimates were variable, with increases in 1993-1995. They found an SPR of 0.43 in 1994.

Turner et al. (2000) reassessed the greater amberjack stock using data through 1998. They used a calibrated VPA and data on catch-at-age, selectivity, and indices of abundance from private and charter boats, headboats, and handline fisheries. Turner et al. made runs with a variety of assumptions and a combination of the abundance indices that showed variability in the results. The RFSAP selected four of the runs as most likely to represent stock conditions, all of which showed an overfished condition for greater amberjack in 1998. Two of the runs indicated that overfishing also occurred, including the run considered most likely by the RFSAP. The Panel also concluded that management actions (closed seasons, bag limits, and size limits) taken in 1998 might reduce fishing mortality sufficiently to eliminate overfishing. NMFS notified the Council in January of 2001 that the stock was overfished and the Council should specify a rebuilding plan.

9.2.1.1.6 Gray triggerfish

The gray triggerfish is widely distributed in tropical and temperate waters throughout the Atlantic; in the Western Atlantic it ranges from Nova Scotia through Bermuda and the GOM to Argentina (Harper and McClellan 1997). This species is an important component of the GOM reef fishery, particularly for the recreational fishing sector (Goodyear and Thompson, 1993). Prior to the 1980s, gray triggerfish were not considered a desirable catch by most fishers, but there has been an increase in targeting of this and other "under-utilized" species, probably caused by the decline in other reef fish stocks (e.g., red snapper and groupers).

There was an initial increase in average annual landings from 1.46 MP in 1986 to 2.88 MP in 1990. This was followed by a steady decline to 0.85 MP in 1998. The cause of this decline has not been determined, but it could be attributed to a consistent increase in fishing effort and a possible consequent decrease in stock size. In response to this problem, the first assessment for the gray triggerfish was published in March 2001 (Valle et al. 2001).

Standardized indices of abundance were estimated from five recreational and commercial

fisheries data sets: the Marine Recreational Fishery Statistics Survey (MRFSS), the SEFSC, GW (SEFSC-NMFS) Headboat Survey, the Alabama Charterboat Survey, the Panama City Charterboat Survey, and the commercial Florida Logbook System Program. A sixth data set from the Texas Park and Wildlife Department (TPWD) Recreational Creel Survey was examined but the indices developed were not considered for subsequent analyses. The standardized indices were estimated using Generalized Linear Mixed Models under a delta lognormal model approach.

Catch-effort statistics from the recreational and commercial sectors for years 1986 to 1998 were used for stock assessment. The standardized catch rates were used to tune a non-equilibrium production model (ASPIC).

Problems were encountered in the assessment. The model frequently failed to converge on a satisfactory solution, due to the limited time series of catch and effort data. Nevertheless, the authors considered there was reasonable evidence that the current rate of removal is not sustainable: a steady decline in landings since the peak in 1990 to a level (in 1998) that is below the MSY range. Estimated biomass levels are low and exploitation rates are high. The assessment concludes that the evidence suggests the stock is overfished, that overfishing is still occurring, and catches should be at least held constant, or preferably reduced to allow stock rebuilding (Valle et al. 2001).

9.2.1.1.7 Other Managed Species

Quantitative stock assessments do not currently exist for other managed reef fish species in the GOM. However, observations of declining abundance of jewfish and Nassau grouper led the Council to set TAC for both species at zero; no commercial or recreational retention is allowed for either species. Low observed abundance led the Council to restrict harvest of speckled hind and warsaw grouper to one fish per recreational vessel.

9.2.2 Protected Species

There are 28 cetacean, one sirenian, and one non-native pinneped (California sea lion) species that have confirmed occurrences in the GOM (Davis and Fargion, 1996). Of these, six marine mammal species are listed as endangered species. Additionally, all five of the sea turtles found in the GOM (Kemp's ridley, loggerhead, green, leatherback, and hawksbill) are protected under the Endangered Species Act. Gulf sturgeon is the one fish species that is listed as threatened, and smalltooth sawfish has recently been proposed to be listed as endangered. Thirteen species of fish are currently on the candidate list. The most recent biological opinion pertaining to the Gulf of Mexico was conducted on the Minerals Management Service's Gulf of Mexico Outer Continental Shelf Oil and Gas Lease Sales 189 and 197. This biological opinion, along with additional information on protected species, is available at www.nmfs.noaa.gov/prot_res/overview/publicat.html. These reports contain the most updated information on GOM protected species.

9.2.2.1 Marine Mammals

9.2.2.1.1 Sperm Whale

Sperm whales were listed as endangered under the ESA in 1973 (NMFS 2001f). They are also protected by the Convention on International Trade in Endangered Species of wild flora and fauna and the Marine Mammal Protection Act of 1972. Critical habitat has not been designated for sperm whales. The primary factor for the species' decline, that

precipitated ESA listing, was commercial whaling (Blaylock et al. 1995). Sperm whales were hunted in America from the 17th century through the early 1900s, but the exact number of whales harvested in the commercial fishery is not known. A commercial fishery for sperm whales operated in the GOM during the late 1700s to early 1900s. Since the ban on nearly all hunting of sperm whales, there has been little evidence that human-induced mortality or injury is significantly affecting the recovery of sperm whale stocks. NMFS believes there are insufficient data to determine population trends for this species.

There has been speculation, based on a year-round occurrence of strandings, opportunistic sightings and whaling catches, that sperm whales in the GOM may constitute a distinct stock, and indeed, they are treated as such in NMFS' Marine Mammal Stock Assessment Report (Waring et al., 2000). Sperm whale sightings recorded from the National Oceanic and Atmospheric Administration (NOAA) vessel Oregon II from 1991 - 1997 are concentrated just beyond the 100 m depth contour in the northern GOM, east of the Mississippi River Delta. These waters are the only known breeding and calving area in the GOM.

The GOM sperm whale stock is estimated at 530 sperm whales, calculated from an average of estimates from 1991-1994 surveys (Waring et al. 2000). The minimum population estimate (Nmin) is 411 sperm whales (Waring et al. 2000). The estimate of Nmin is calculated as the lower limit of the two-tailed 60% confidence interval of the lognormal distributed abundance estimate (or the equivalent of the 20th percentile of the lognormal distributed abundance estimate as specified by NMFS. Nmin is a required component of the Potential Biological Removal level (PBR) calculation as required under the MMPA. The estimated PBR for the Gulf sperm whale stock is 0.8 sperm whales. PBR is an estimate of the number of animals, which can be removed (in addition to natural mortality) annually from a marine mammal population or stock while maintaining that stock at OSP (optimum sustainable population level) or without causing the population or stock to slow its recovery to OSP by more than 10%. Stock size is considered to be low relative to OSP; there is no trend in population size discernable from estimates of abundance over time (Waring et al. 2000 and references within).

9.2.2.1.2 Other Whales

During spring through late fall, right whales are found off Canada and the northeast United States in feeding areas (MMS 2000). Winter distribution for the majority of the population is unknown, but coastal waters between Georgia and Florida are the only known calving areas for these whales. Existing records of this species in the GOM represent strays from the wintering grounds, outside of the normal distribution range.

There are only two reliable records (strandings on the Texas coast) of blue whales in the GOM, and they are not thought to be regular inhabitants of the Gulf (MMS 2000).

The sei whale probably has only an accidental occurrence in the Gulf (though it is interesting to note that three of the four reliable records were from strandings on the eastern Louisiana coast) (MMS 2000).

Humpback whales spend winter in warm waters to calve, and then move to colder waters to feed during the summer (MMS 2000a). The few reports of humpback whales in the Gulf are considered to be whales that may have lost their way on return northerly migrations (from the Caribbean) in the western North Atlantic.

The fin whale is found in all major oceans in the world. Like other large baleen whales, it migrates seasonally from temperate waters where it mates and calves in the winter to polar feeding grounds in the summer (USM no date). The wintering grounds of the north Atlantic stock are the Caribbean Sea and GOM. Stocks of the North Atlantic were heavily fished and soon depleted. There are now only a few thousand fin whales in the North Atlantic. Pre-exploitation populations have been estimated at over 464,000, with about 18,000 in the North Atlantic, 45,000 in the North Pacific, and 400,000 in the Southern Ocean (NMFS, 1991). Current stocks were estimated to include about 119,000 individuals, with about 17,221 in the North Atlantic, 16,625 in the North Pacific, and 85,200 in the Southern Ocean. Sightings and strandings indicate that fin whales continue to use the GOM as part of their wintering habitat, although in limited number (Davis et al., 1995). If the protected populations in the Atlantic increase, the Gulf will likely be used more frequently as a wintering ground for these mammals.

9.2.2.1.3 Dolphins

Nine species of dolphins occur in the GOM (Waring et al. 2000). All are members of the family Delphinidae, and none are considered threatened or endangered. Most inhabit deeper waters in the Gulf, with the exception of the bottlenose and Atlantic spotted dolphins.

The bottlenose (*Tursiops truncatus*) is the most common dolphin in nearshore waters and outer edge of the continental shelf in the Gulf. The Atlantic spotted dolphin *(Stenella frontalis*) is the only other species that commonly occurs over the continental shelf, typically inhabiting shallow waters within the 250-m isobath.

The Risso's (*Grampus griseus*), Clymene (*Stenella clymene*), and spinner *(Stenella longirostris*), striped (*Stenella coeruleoalba*), and rough-toothed (*Steno bredanensis*) dolphins are deepwater species endemic to tropical and subtropical waters. Other Gulf species include the pantropical spotted dolphin (*Stenellas attenuata*) and Fraser's dolphin (*Lagenodelphis hosei*).

9.2.2.1.4 Manatees

The West Indian manatee (*Trichechus manatus latirostris*) is found throughout the coastal waters of Florida (Waring et al. 2000). These large mammals are normally found in near-shore shallow coastal and estuarine waters where they feed on sea-grasses and aquatic vegetation. Manatees also are found far up freshwater rivers and streams. On Florida's Gulf coast, they commonly range from the Everglades northward to the Suwanee River, are somewhat less abundant northward in the Big Bend area, and occur even less frequently westward. However, manatees have been occasionally found as far west as Louisiana and Texas (Powell and Rathbun, 1984; Rathbun et al., 1990; Schiro et al., 1998).

Their winter range is more restricted than their summer range due to their migration toward warmer areas. Manatees have a very low metabolic rate and high thermal conductance that can lead to energetic stresses during cold periods (O'Shea et al., 1995). Thus, in winter, they are generally found at the southern tip of Florida or congregated at warm-water sources, most commonly power plants. On the Gulf Coast, there are nine aggregation sites, the major ones being the natural springs on the Crystal and Homosassa Rivers; Tampa Electric Company's Big Bend Power Plant on the east side of Tampa Bay (Apollo Beach); Florida Power Corporation's Bartow Power Plant at Weedon Island, west

side of Tampa Bay; Florida Power & Light Company's Fort Myers Power Plant in Lee County; and Port of the Islands Marina in Collier County.

In January 2001, a record number of manatees were counted in three synoptic aerial surveys. Favorable weather conditions were considered to have contributed in part to the record count, which produced a total number of 3,276 manatees, including 1,765 counted by observers on Florida's Gulf Coast (Florida Marine Research Institute, 2001). For the five years from 1995 to 2000, the annual count averaged 2,293 manatees.

As herbivores, manatees feed opportunistically on a wide variety of submerged, floating, and emergent vegetation. They often use secluded canals, creeks, embayments, and lagoons near mouths of coastal rivers and sloughs for feeding, resting, mating, and calving (USDOI, FWS, 1995).

The primary threats to manatees are loss of essential manatee habitats and human-related mortality, injury, (both generally due to collision with vessels) and disturbance. In 2000, there were 273 total manatee deaths statewide, with 78 of these due to collision with water craft, eight due to floodgates or canal locks, eight due to other human causes and 62 undetermined. All other deaths were perinatal (58), due to natural causes and cold stress (14), or unrecovered (8). In Gulf Coast counties alone, there were 35 deaths due to collision with water craft, 35 that were undetermined, and four due to other human causes (Florida Marine Research Institute, 2001).

9.2.2.2 Sea Turtles

9.2.2.2.1 Green (*Chelonia mydas*)

The green sea turtle was listed under the ESA on July 28, 1978. Green turtles are distributed circumglobally, mainly in waters between the northern and southern 20^{o} C isotherms (Hirth 1971). Green turtles were traditionally highly prized for their flesh, fat, eggs, and shell. Fisheries in the United States and the Caribbean are largely to blame for the decline of the species.

In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida. Occasional nesting has been documented along the Gulf coast of Florida, at Southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). The vast majority of green turtle nesting within the Southeast Region occurs in Florida where green turtle nesting has been extensively and consistently surveyed during the period 1989-1999 (NMFS 2001f). In Florida during the 11-year period, green turtle abundance from nest counts ranges 109-1389 nesting females per year. High biennial variation and a predominant two-year re-migration interval (Witherington and Ehrhart 1989a, Johnson and Ehrhart 1994) warrant combining even and odd years into two-year cohorts. This gives an estimate of total nesting females that ranges 705-1509 during the period 1990-1999. In Florida during the period 1989-1999, numbers of green turtle nests by year show no trend ($n = 11$, $r^2 = 0.055$, $p = 0.49$). However, odd-even year cohorts of nests (as described and as justified above) did show a significant increase ($n = 5$, $r^2 = 0.72$, $p = 0.033$) during the period 1990-1999 (Florida Marine Research Institute, Index Nesting Beach Survey Database). Total nest counts and trends at index beach sites during the past decade suggest that green turtles that nest within the Southeast Region are recovering and have only recently reached a level of approximately 1000 nesting females.

While nesting activity is obviously important in identifying population trends and

distribution, the majority portion of a green turtle's life is spent on the foraging grounds. Green turtles are herbivores and appear to prefer marine grasses and algae in shallow bays, lagoons, and reefs (Rebel 1974). Some of the principal feeding pastures in the GOM include inshore south Texas waters, the upper west coast of Florida and the northwestern coast of the Yucatan Peninsula. The Proposed food sources in these areas are Cymodocea, Thalassia, Zostera, Sagittaria, and Vallisneria (Babcock 1937; Underwood 1951; Carr 1952; 1954).

Green turtles were once abundant enough in the shallow bays and lagoons of the GOM to support a commercial fishery, which landed over one MP of green turtles in 1890 (Doughty 1984). Doughty reported the decline in the turtle fishery throughout the GOM by 1902. Currently, green turtles are uncommon in offshore waters of the northern Gulf, but abundant in some inshore embayments. Shaver (1994) live-captured a number of green turtles in channels entering into Laguna Madre in south Texas. She noted the abundance of green turtle strandings in Laguna Madre inshore waters and opined that the turtles may establish residency in the inshore foraging habitats as juveniles.

9.2.2.2.2 Hawksbill (*Eretmochelys imbricata*)

Hawksbill turtles feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands. In the Western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Peninsula of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (NMFS 2001f). In the northern GOM, a number of small hawksbills are encountered in Florida and Texas. Most of the Texas records are probably in the 1-2 year class range. Many of the individuals captured or stranded are unhealthy or injured (Hildebrand 1983). Pinellas County, Florida, including Tampa Bay, has the largest share of west coast hawksbill strandings. It is likely that immature hawksbills utilize the various hard-bottom habitats off the west coast as developmental habitat (NMFS 2001f). The lack of sponge-covered reefs and the cold winters in the northern GOM probably prevent hawksbills from establishing a strong presence in that area.

9.2.2.2.3 Kemp's Ridley (*Lepidochelys kempii*)

Of the seven extant species of sea turtles of the world, the Kemp's ridley has declined to the lowest population level (NMFS 2001f). The Recovery Plan for the Kemp's Ridley Sea Turtle (USFWS and NMFS 1992) contains a description of the natural history, taxonomy, and distribution of the Kemp's ridley turtle. Kemp's ridleys nest in daytime aggregations known as arribadas, primarily at Rancho Nuevo, a stretch of beach in Mexico. Most of the population of adult females nest in this single locality (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1982). Recent observations of increased nesting suggest that the decline in the ridley population has stopped, and there is cautious optimism that the population is now increasing.

The near shore waters of the GOM are believed to provide important developmental habitat for juvenile Kemp's ridley and loggerhead sea turtles. Ogren (1988) suggests that the Gulf coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern GOM. Stomach contents of Kemp's ridleys along the lower Texas coast had a predominance of near shore crabs and mollusks, as well as fish, shrimp and other foods considered to be shrimp fishery discards (Shaver

1991). Analyses of stomach contents from sea turtles stranded on upper Texas beaches apparently suggest similar near shore foraging behavior (Plotkin, Personal Communication).

Research being conducted by Texas A&M University suggests that subadult Kemp's ridleys stay in shallow, warm, near shore waters in the northern GOM until cooling waters force them offshore or south along the Florida coast (Renaud, Personal Communication).

In recent years, unprecedented numbers of Kemp's ridley carcasses have been reported from Texas and Louisiana beaches during periods of high levels of shrimping effort (NMFS, 2000). NMFS established a team of population biologists, sea turtle scientists, and managers, known as the Turtle Expert Working Group (TEWG), to conduct a status assessment of sea turtle populations. Analyses conducted by the group have indicated that the Kemp's ridley population is in the early stages of recovery (NMFS 1998).

Nesting data indicated that the number of adults declined from a population that produced 6,000 nests in 1966 to a population that produced 924 nests in 1978 and a low of 702 nests in 1985 (NMFS, 2000). This trajectory of adult abundance tracks trends in nest abundance from an estimate of 9,600 in 1966 10 1,050 in 1985. The TEWG estimated that in 1995 there were 3,000 adult ridleys. The TEWG (1998) indicated that the Kemp's ridley population appears to be in the early stage of exponential expansion. Over the period 1987 to 1995, the rate of increase in the annual number of nests accelerated in a trend that would continue with enhanced hatchling production and the use of TEDs. It determined that the data reviewed suggested that adult Kemp's ridley turtles were restricted somewhat to the GOM in shallow near shore waters, and benthic immature turtles of 20-60 cm straight line carapace length are found in near shore coastal waters including estuaries of the GOM and the Atlantic. In 2000 these were 6,277 nests counted (G&SAFF Newsletter July 2001).

9.2.2.2.4 Leatherback Turtle (*Dermochelys coriacea*)

The Recovery Plan for Leatherback Turtles (*Dermochelys coriacea*) contains a description of the natural history and taxonomy of this species (NMFS and USFWS 1992). Leatherbacks are widely distributed throughout the oceans of the world, and are found throughout waters of the Atlantic, Pacific, Caribbean, and the GOM (Ernst and Barbour 1972). Leatherbacks are predominantly pelagic, feeding primarily on jellyfish such as *Stomolophus*, *Chryaora*, and *Aurelia* (Rebel 1974). They may come into shallow waters if there is an abundance of jellyfish near shore.

The status of the leatherback population is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States (NMFS, 2000). The primary leatherback nesting beaches occur in French Guiana and Suriname in the western Atlantic and in Mexico in the eastern Pacific. Although increased observer effort on nesting beaches has resulted in increased reports of leatherback nesting, declines in nest abundance have been reported from the beaches of greatest nesting densities. Some nesting occurs on Florida's east coast.

9.2.2.2.5 Loggerhead Turtle (*Caretta caretta*)

Loggerhead sea turtles occur throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans and are the most abundant species of sea turtle occurring in U.S. waters (NMFS 2001f). The loggerhead is a highly migratory species and is found in

waters around the globe. The threatened loggerhead is the most abundant species of sea turtle occurring in U.S. waters. The near shore waters of the GOM are believed to provide important developmental habitat for juvenile loggerheads. Studies conducted on loggerheads stranded on the lower Texas coast (south of Matagorda Island) have indicated that stranded individuals were feeding in near shore waters shortly before their death (Plotkin et al. 1993).

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. The TEWG report (NMFS 1998) identified four nesting subpopulations of loggerheads in the western North Atlantic based on mitochondrial DNA evidence. These include: (1) the northern subpopulation producing approximately 6,200 nests/year from North Carolina to northeast Florida; (2) the south Florida subpopulation occurring from just north of Cape Canaveral on the east coast of Florida and extending up to Naples on the west coast and producing approximately 64,000 nests/year; (3) the Florida Panhandle subpopulation, producing approximately 450 nests/year; and (4) the Yucatán subpopulation occurring on the northern and eastern Yucatán Peninsula in Mexico, producing approximately 1,500-2,000 nests/year.

The TEWG (NMFS 1998) considered nesting data collected from index nesting beaches to index the population size of loggerheads and to consider trends in the size of the population. The TEWG constructed total estimates by considering a ratio between nesting data (and associated estimated number of adult females and therefore adults in near shore waters), proportion of adults represented in the strandings, and in one method, aerial survey estimates. These two methods indicated that for the 1989-1995 period, there were averages of 224,321 or 234,355 benthic loggerheads, respectively. The TEWG listed the methods and assumptions in their report, and suggested that these numbers are likely underestimates. Aerial survey results suggest that loggerheads in U.S. waters are distributed in the following proportions: 54% in the southeast U.S. Atlantic, 29% in the northeast U.S. Atlantic, 12% in the eastern GOM, and 5% in the western GOM (NMFS 1998).

The TEWG report (NMFS 1998) considered long-term index nesting beach data sets when available to identify trends in the loggerhead population. Overall, the TEWG determined that trends could be identified for two loggerhead subpopulations. The northern subpopulation appears to be stabilizing after a period of decline; the south Florida subpopulation appears to have shown significant increases over the last 25 years suggesting the population is recovering, although the trend could not be detected over the most recent 7 years of nesting. An increase in the numbers of adult loggerheads has been reported in recent years in Florida waters without a concomitant increase in benthic immature animals. These data may forecast limited recruitment to south Florida nesting beaches in the future. Since loggerheads take approximately 20-30 years to mature, the effects of decline in immature loggerheads might not be apparent on nesting beaches for decades. Therefore, the TEWG report (1998) cautions against considering trends in nesting too optimistically.

Briefly, the TEWG report (NMFS 1998) made a number of conclusions regarding the loggerhead population. The recovery goal of "measurable increases" for the south Florida subpopulation (south of Canaveral and including southwest Florida) appears to have been met, and this population appears to be stable or increasing. However, index nesting surveys have been done for too short a time; therefore, it is difficult to evaluate trends throughout the region. Recovery rates for the entire subpopulation cannot be determined with certainty at this time

9.2.2.3 Fish

9.2.2.3.1 Gulf Sturgeon

NMFS and US Fish and Wildlife Service (FWS) listed the Gulf sturgeon as a threatened species on September 30, 1991. NMFS and FWS share jurisdiction for this species under the Endangered Species Act (NMFS 2001c, 2001f).

The Gulf sturgeon, also known as the Gulf of Mexico sturgeon, is a subspecies of the Atlantic sturgeon (USFWS 1994). The Gulf sturgeon is restricted to the GOM and its drainages, primarily from the Mississippi River to the Suwannee River, in Louisiana, Mississippi, Alabama, and Florida. The subspecies may also occur sporadically as far west as Texas, and in marine waters in Florida south to Florida Bay. While little is known about the abundance of Gulf sturgeon through most of its range, estimates exist for the Suwannee and Apalachicola rivers (NMFS 2001f). The USFWS reported an average of 115 individuals larger than 45 cm total length over-summering in the Apalachicola River below Jim Woodruff Lock and Dam. For the Suwannee River, population size estimates ranging from 2,250 to 3,300 individuals have been made.

Subadult and adult fish begin migration into rivers from the GOM in early spring and continuing until early May (Carr 1983, Wooley and Crateau 1985, Odenkirk 1989, Clugston et al. 1995). In late September or October, subadult or adult sturgeon begin downstream migrations. Sturgeon apparently only feed during their stay in marine waters; food items are rarely found in the stomachs of specimens sampled from rivers. Gulf sturgeon are long-lived, reaching an age of at least 28 years. Age at sexual maturity for females ranges from 8 to 17 years, and for males from 7 to 21 years (Huff 1975). Spawning of Gulf sturgeon is not well documented. However, a few larval sturgeon have been collected in early April and early May in the Apalachicola River (Wooley et al. 1982).

Habitat destruction and degradation, exacerbated by potential over-exploitation of the species, are primarily responsible for the sturgeon's decline. Dams have prevented access to historic sturgeon migration routes and spawning areas (Wooley and Crateau 1985). Dredging and other navigation maintenance, possibly including lowering of river elevations and elimination of deep holes and altered rock substrates, may have adversely affected Gulf sturgeon habitats (Wooley and Crateau 1985). A decrease in groundwater flows has reduced cool water habitats, which are thought to be warm water refugia for sturgeon (S. Carr, personal communication); recent droughts in the Apalachicola River system have aggravated the loss of cool water refugia. Increased groundwater withdrawal for irrigation in southwest Georgia may result in a 30% reduction of discharge to streams (Hayes et al. 1983).

Breeding populations take years to establish because of their advanced age at sexual maturity. In addition, Gulf sturgeon appear to be home stream spawners with little, if any, natural repopulation from migrants from other rivers (USFWS and GSMFC, 1995).

9.2.2.3.2 Smalltooth Sawfish

The National Oceanic and Atmospheric Administration's National Marine Fisheries Service on April 1, 2003 listed as endangered the U.S. population of smalltooth sawfish that once ranged in shallow waters off the GOM and Eastern Seaboard. An extensive status review concluded that the U.S. population of smalltooth sawfish, currently found

only off South Florida, is in danger of extinction (NMFS 2001a).

Sawfish, like sharks, skates and rays, belong to a class of fish called elasmobranchs, whose skeletons are made of cartilage (NMFS 2001b). Sawfish are actually modified rays with a shark-like body, and gill slits on their ventral side. Early sawfish arose around 100 million years ago, but these first sawfish are actually distant cousins to the modern day sawfishes, which first appeared around 56 million years ago. Sawfish get their name from their "saws" - long and flat snouts edged with pairs of teeth that are used to locate, stun and kill prey. Their diet includes mostly fish but also some crustaceans.

Smalltooth sawfish is one of two species of sawfish that inhabit U.S. waters (NMFS, 2001a). Smalltooth sawfish commonly reach 18 ft (5.5 m) in length, and may grow to 25 ft (7 m). Little is known about the life history of these animals, but they may live up to 25-30 years and mature after about 10 years. Like many elasmobranchs, smalltooth sawfish are ovoviviparous, meaning the mother holds the eggs inside of her until the young are ready to be born, usually in litters of 15 to 20 pups.

Sawfish species inhabit shallow coastal waters of tropical seas and estuaries throughout the world (NMFS, 2001a). They are usually found in shallow waters very close to shore over muddy and sandy bottoms. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths. Certain species of sawfish are known to ascend inland in large river systems, and they are among the few elasmobranchs that are known from freshwater systems in many parts of the world.

Smalltooth sawfish has been reported in both the Pacific and Atlantic Oceans, but the U.S. population is found only in the Atlantic (NMFS, 2001a). Historically, the U.S. population was common throughout the GOM from Texas to Florida, and along the east coast from Florida to Cape Hatteras. The current range of this species has contracted to peninsular Florida, and smalltooth sawfish are relatively common only in the Everglades region at the southern tip of the state. No accurate estimates of abundance trends over time are available for this species. However, available records, including museum records and anecdotal fisher observations, indicate that this species was once common throughout its historic range and that smalltooth sawfish have declined dramatically in U.S. waters over the last century.

Sawfish are extremely vulnerable to overexploitation because of their propensity for entanglement in nets, their restricted habitat, and low rate of population growth (NMFS, 2001a). The decline in smalltooth sawfish abundance has been caused primarily by bycatch in various fisheries, likely compounded by habitat degradation. In order to protect this species, the states of Florida and Louisiana have prohibited the take of sawfish. Three National Wildlife Refuges in Florida also protect their habitat.

9.2.2.3.3 Candidate List for Protection

Candidate species are defined as “any species being considered by the Secretary for listing as an endangered or threatened species, but not yet subject of a proposed rule” (49FR 38900). The candidate species list serves to notify the public that NMFS has concerns regarding these species/vertebrate populations that may warrant listing in the future, and to facilitate voluntary conservation efforts. Candidate species do nor receive any substantive or procedural protection under the ESA.

9.2.2.3.3.1 Goliath Grouper (also known as Jewfish)

The goliath grouper was added to the candidate species list in 1991 for the region of North Carolina Southward to the GOM, which encompasses the entire range of this species in US waters (NMFS 2001e). The American Fisheries Society changed the official name from jewfish to goliath grouper in 2001. Historically, goliath grouper were found in tropical and subtropical waters of the Atlantic Ocean, both coasts of Florida, and from the GOM down to the coasts of Brazil and the Caribbean. Most adults are found in shallow waters, the deepest being about 150 feet. Spawning occurs at aggregation sites in July through September over full moon phases. Fish may move up to 100 km from inshore reefs to the offshore spawning aggregations in numbers of up to 100 or more on ship wrecks, rock ledges, and isolated patch reefs along the southwest coast of Florida. Aggregations declined in the 1980's from 50-100 fish to less than 10 per site. Since the harvest prohibition, aggregations have rebounded somewhat to 20-40 fish per site. When goliath grouper are not on their spawning aggregations, they are dispersed along shallow reefs. Historically, they were abundant in very shallow water, often associated with piers and jetties along the Florida Keys and southwest coast of Florida. They are no longer abundant in these shallow areas.

Juvenile goliath grouper have been found along shallow mangrove shorelines, underneath mangrove prop roots (NMFS, 2001e). Their historical center of abundance is in the Ten Thousand Islands area of southwest Florida. Although goliath grouper are very vulnerable to cold waters and red tide, they are one of the only groupers that can live in brackish waters. Fish taken from an exploited population were aged from 0-37 years, but it is likely that goliath grouper live much longer than 40 years if left unexploited.

The most likely cause of drastic declines was the heavy fishing pressure on aggregations (NMFS, 2001e). When large numbers of normally dispersed fish are concentrated at predictable areas and times, they are highly vulnerable to overexploitation. Fishing on spawning aggregations also removes many reproductive individuals before they have had the opportunity to spawn. Many goliath grouper were caught between the ages of 9-15 years, meaning that individuals only lived through only a few reproductive years before being captured. Their slow growth rate, long lives, and large size at sexual maturation has made them especially susceptible to overfishing. Finally, their genetic diversity could be impacted when the fishing mortality rate is greater than the natural mortality rate.

Quantitative data on fishing mortality rates and biomass levels are lacking. Goliath grouper are especially vulnerable to fishing due to their availability in aggregations and due to their low productivity. The fishery has been closed since 1990; consequently, fishing mortality rates are currently near zero.

9.2.2.3.3.2 Speckled Hind

The speckled hind was added to the candidate species list in 1997 (NMFS 2001d). Speckled hind inhabit warm, moderately deep waters from North Carolina to Cuba, including Bermuda, the Bahamas and the GOM. The Proposed habitat is hard bottom reefs in depths ranging from 180 to 360 feet, where temperatures are from 60 to 85 degrees F.

Like other epinepheline groupers, speckled hind are protogynous hermaphrodites, which means they begin life as females and as they mature they become males (NMFS, 2001d). Most of the larger, older fish are males. Females reach sexual maturity around four to five year-olds. Spawning takes place offshore from July through September. The fertilized

eggs are pelagic, and the newly hatched young are commonly found on the surface before migrating to the bottom. Speckled hind generally engulf their prey whole. The fish opens its mouth and extends the gill covers rapidly to draw in a current of water, thus inhaling the food. Groupers are also known to pursue their prey and strike it. Prey items for the speckled hind include: fishes, crabs, shrimps and mollusks that inhabit the hard bottom.

The major threat to the speckled hind is mortality as a result of fishing.

9.2.2.3.3.3 Nassau grouper

The Nassau grouper was an addition to the 1991 candidate species list. It is a tropical western Atlantic serranid that is an extremely popular food fish, resulting in its declining status (NMFS 2001g). The Nassau grouper grows to about 100 cm (3 ft) and 25 kg (55 lbs). It is a top-level predator found from inshore to about 100 m. Adults are generally found near shallow high-relief coral reefs and rocky bottoms to a depth of at least 90m. This species is found in the Florida Keys, but is absent in the GOM where it is apparently replaced by red grouper (Sadovy and Eklund 1999).

Quantitative data on fishing mortality rates and biomass levels are lacking. Nassau grouper are especially vulnerable to fishing due to their availability in aggregations and due to their low productivity. The fishery has been closed in the GOM since 1997; consequently, fishing mortality rates are currently near zero. GOM Nassau Grouper are considered severely depleted due to lack of occurrence in sampling and catches prior to moratorium.

9.2.2.3.3.4 Warsaw grouper

Warsaw groupers are classified as deep-water groupers; they inhabit reefs on the continental shelf break in waters 76-219 m deep. They are characterized by an elongated second spine in the dorsal fin, the rear margin of the caudal fin convex or truncate with rounded corners, and pelvic fins longer than pectoral fins. They are dark reddish brown or brownish grey to almost black in color dorsally, dull reddish grey below. Juveniles had a yellow caudal fin and a few randomly scattered whitish spots on body. Adults are usually found on rough, rocky bottoms in depths of 55 to 525 m; juveniles are occasionally seen on jetties and shallow-water reefs. Very little information is available about the reproduction of the Warsaw grouper; eggs and larvae are presumed to be pelagic. Warsaw is long-lived (up to 41 years) and has a slow growth rate. Maximum size is about 235 cm TL and about 200 kg. The Warsaw grouper's large mouth enables it to engulf prey whole after capturing it in ambush or after a short chase. Diet items include crabs, shrimps and fishes.

Historically, Warsaw grouper were rarely landed; currently less than a few hundred, often less than 50, are landed annually in the Atlantic. Fishing is primarily by hook and line and bottom longlines; the species is caught incidentally in the deepwater snapper/grouper fishery. The major threat to the Warsaw grouper is mortality as a result of fishing or by-catch release mortality (due to barotrauma). Both recreational and commercial fisheries for Warsaw grouper are currently regulated in the south Atlantic; the South Atlantic Fisheries Management Council considers the species as overfished and undergoing overfishing. In the Gulf of Mexico commercial fishery, there are no possession limits for the species for federally permitted reef fish vessels, and the species is managed under the Deep-water grouper commercial quota. The Council classifies the status of Warsaw grouper as “unknown.”

The major threat to the Warsaw grouper is mortality as a result of fishing or by-catch release mortality (due to barotrauma). Both recreational and commercial fisheries for Warsaw grouper are currently regulated in the south Atlantic; the South Atlantic Fisheries Management Council considers the species as overfished and undergoing overfishing. In the Gulf of Mexico commercial fishery, there are no possession limits for the species for federally permitted reef fish vessels, and the species is managed under the deep-water grouper commercial quota.

9.2.2.4 Seabirds

Seabirds are a diverse group of birds that spend much of their lives on or over saltwater. Some can live far from land for long extended periods of time, coming back to coastal areas to breed and nest. Seabirds fish for prey from the sea through dipping, plunging, surface seizing, as well as the behaviors of piracy and scavenging.

Three of the four primary orders of seabirds are represented in the GOM, Procellariiformes (petrels, albatrosses, and shearwaters), Pelecaniformes (pelicans, gannets and boobies, cormorants, tropic birds, and frigate birds), and Charadriiformes (phalaropes, gulls, terns, noddies, and skimmers) (Clapp et al., 1982; Harrison, 1983). Additionally, the orders Gaviiformes (loons) and Podicipediformes (grebes) are also found in the Gulf.

Species of seabirds and other coastal species that inhabit or frequent the northern GOM that are recognized by the U.S. Fish and Wildlife Service as either endangered or threatened include: piping plover, least tern, roseate tern, bald eagle, and brown pelican (the brown pelican is endangered in Mississippi and Louisiana and de-listed in Florida and Alabama). The southeastern snowy plover is a species of concern to the state of Florida.

The incidental catch of seabirds in various fisheries around the world has generated much concern over the long-term ecological effects, during past two decades. In particular, longline fishing is susceptible to seabird bycatch. The U.S. voluntarily developed a National Plan of Action for reducing the Incidental Catch of Seabirds in Longline Fisheries (NPOA-S) as requested in the International Plan of Action for Reducing the Incidental Catch of seabirds in Longline Fisheries (IPOA-S) (see Section 7.2.2.4).

The brown pelican, Pelecanus occidentalis (Family: Pelicanidae), one of two pelican species in North America, has been listed as endangered since 1970 in its entire range, except that it is a delisted taxon, recovered (and were being monitored for the first five years) in Alabama and Florida since 1985. Although not listed as endangered in Florida, it is listed as a species of special concern by the State.

Pelicans feed entirely upon fishes that they capture by plunge diving into coastal waters. They seldom venture to more than 20 miles out to sea except to take advantage of especially good fishing conditions, and even then it is rare to find one more than 40 miles out. Sand spits and offshore sandbars are used extensively as daily loafing and nocturnal roost areas. The Proposed nesting sites are small coastal islands, which provide protection from mammal predators, especially raccoons, and sufficient elevation to prevent wide scale flooding of nests.

Primary factors affecting the eastern subspecies include human disturbance of nesting colonies and mortalities that result from the birds being caught on fishhooks and subsequently entangled in monofilament line. Oil or chemical spills, erosion, plant

succession, hurricanes, storms, heavy tick infestations, and unpredictable food availability are other threats.

9.2.3 Estuarine and Nearshore

Estuaries and nearshore areas provide essential habitat for many species managed by the Council, serving primarily as nursery areas for the juveniles and also as habitat for adults in certain seasons of the year.

9.2.3.1 Oyster Beds

The southernmost oyster reef in the U.S. occurs in Oyster Bay, near Cape Sable, Florida Bay; north of that point, oysters grow almost everywhere in the GOM (McNulty et al. 1972). Oysters grow on pilings, red mangrove roots, sea walls, and as reefs ranging in shape and size from small mounds to long ridges extending several miles. Extensive oyster reefs often divide bays into segments and alter circulation patterns (Diener 1975). Oyster beds consist of consolidated oyster shell and live oysters, and other organisms, in intertidal and shallow subtidal areas of estuaries, tidal creeks, and some near shore areas (GMFMC 1998). In the turbid estuaries of the northern GOM, oyster reefs seem to serve as a congregation area for spotted sea trout, drums etc., i.e., a function that submerged vegetation serve in estuaries with clear water.

In Florida, nearly 5,666 ha (14,000 acres) of live oyster beds (2,074 ha (5,125 acres) occur in private leases and public beds comprise 3,529 ha (8,719 acres), most of which are in the panhandle estuaries of Apalachicola Bay and St. George Sound. Apalachicola Bay has 83% of the natural public beds on the Gulf coast (McNulty et al. 1972) More than 71,066 ha (170,000 acres) of estuarine bottom are closed to shell fishing because of unacceptable levels of coliform bacteria.

Optimal temperature and salinity for oysters range from 10 to 26 ‖C and 12 to 25 ppt (SAFMC 1998). Oyster spat settlement and survival are best on clean, firm surfaces such as oyster shell exposed to good water circulation. Oyster reefs depend on water currents to provide food and oxygen, remove waste and sediments, and disperse larvae. Oysters along many parts of the eastern seaboard declined significantly during the 20th Century (Coen et al. 1999), leading to collapse of some formerly productive fisheries and to reduction in ecological functions.

The ecological role of the oyster reef as critical fish habitat derives from providing structure, food, and protection (SAFMC 1998). The three-dimensional reef provides niches on what is often otherwise flat or soft bottom habitat. Oyster eggs, embryos, and larvae provide food for a variety of invertebrates and fish. Oysters filter large quantities of water (Coen et al. 1999) and can affect the distribution and abundance of phytoplankton, potentially reducing eutrophication.

Coen et al. (1999) described three categories of relationships for finfish and oysters: 1) reef residents; 2) facultative residents; and 3) transients. Several reef fish species inhabit oyster reefs as transients during part of their life history: gag, mahogany snapper, and gray snapper. Pinfish and pigfish, species of finfish used by reef fish as forage, also inhabit oyster reefs as transients.

9.2.3.2 Hard bottom

In addition to hard bottom communities in offshore waters in the Gulf, hard bottom communities occur in coastal and estuarine regions of central and southern Florida. On Florida's west coast, they range from the Keys region up to Hernando Beach on the west central coast. Coral reefs dominate hard bottom in the Florida Keys region, and limestone outcroppings dominate in the west central region. Sessile species attached directly to the bottom dominate the biota, and consist of sponges, hard and soft coral, hydroids, anemones, bryozoans, decapod crustaceans, and gastropods.

Dawson (1953) and Derrenbacker and Lewis (1985) reported and documented the flora and fauna associated with two hard bottom communities in Tampa Bay. Further mapping and documentation was conducted on 13 sites in 1993 (Savercool and Lewis, 1994), to assist in developing a bay wide environmental management plan to protect the environmentally sensitive organisms typically associated with hard bottom communities. Dominant species found included starlet coral (*Siderastrea radians*), loggerhead sponge (*Spheciospongia vesperia*), boring sponge (*Cliona celata*), sea whip *(Leptogorgia virgulata*) and the alga *Sargassum filipendulum*.

The Tampa Bay National Estuary Program (1994) reported three hard bottom communities in Tampa Bay detected by aerial photography with ground truthing. Native limestone outcrops occur in all three areas, and may be supplemented by oyster reefs and concrete construction rubble. Additional areas may occur, and dredging in shipping channels has exposed limestone bedrock.

The quantity of light reaching the bottom has an important influence on nearshore and estuarine hard bottom communities (Continental Shelf Associates, Inc. 1990). Some coral and sponge species contain symbiotic algae that depend on photosynthesis for at least a portion of nutritional needs. Species associated with nearshore hard bottom probably tolerate the periodic turbidity and sedimentation that they typically experience as part of their environment. Some nearshore coral species (e.g. Solenestrea hyades) are capable of expelling their symbiotic algae during times of stress, and later reacquiring or regenerating them (Continental Shelf Associates, Inc. 1990). The epibiotic community on nearshore hard bottom areas can probably withstand periodic turbidity and sedimentation, but not prolonged burial.

9.2.3.3 Seagrass Meadows and Emergent Vegetation

Emergent vegetation is not evenly distributed along the Gulf coast. Some 63% of the marsh is found in Louisiana as the result of an abundant sediment supply transported by the Mississippi River. Some 160,000 ha (395,000 acres) of mangrove are found almost exclusively along the southern Florida coast. While substrate and currents (to carry germinated seeds) are generally favorable along the entire Gulf coast, mangrove distribution is limited to areas where hard freezes do not occur.

Emergent vegetation provides essential habitat for many of the Gulf's managed fish species. Marsh and mangroves are an integral part of the estuarine system, serving as nursery grounds for larvae, postlarvae, juveniles and adults of several species. The brown shrimp is a notable example of a species that is intimately linked to the nursery aspects of emergent vegetation. The role of nursery, however, is but one important function of marshes and mangroves. They also 1) export nutrients that are vital to adjacent waters; 2) provide an important water quality function in the form of secondary and tertiary waste

treatment through removal and recycling of inorganic nutrients; 3) serve as an in important buffer against storms by absorbing energy of storm waves and acting as a water reservoir thus reducing damage farther inland; and 4) serve an important role in global cycles of nitrogen and sulfur (Gosselink et al., 1974; Turner, 1977; Zimmerman et al., 1984).

Submerged vegetation is found along most of the Gulf coast but is particularly abundant and diverse along the shores of central and southern Florida. The relative abundance and type of submerged vegetation depends mainly on bottom type, turbidity, salinity, water temperature, bottom slope, and tidal range (McNulty et al., 1972). Along the Gulf coast of southern Florida nearly 50% of the estuarine bottoms are covered by submerged vegetation. Cover density generally decreases northward, with bays along the panhandle having only 5% vegetated bottoms. Reports for isolated study sites indicate that the 5% figure would hold for the remainder of the Gulf coast, except for portions of Louisiana where the percentage would be less, and the lower Texas coast where abundance is greater. In their summary of the GMEI, Lindall and Saloman (1977) report 322,593 ha (796,805 acres) of submerged vegetation in estuaries along the Gulf, of which 63% are found in Florida and 31% are found in the Laguna Madre and Copano-Aransas Bays in Texas.

As with emergent vegetation, submerged vegetation is extremely important to fisheries production. Seagrass meadows are often populated by diverse and abundant fish faunas (Zieman and Zieman, 1989). The seagrasses and their attendant epiphytic and benthic fauna and flora provide shelter and food to the fishes in several ways and are used by many species as nursery grounds for juveniles. The grass canopy provides shelter for juvenile fish and for small permanent residents. These also can feed on the abundant invertebrate fauna of the seagrass meadows, on the microalgae, on the living seagrasses themselves, or on seagrass detritus. In addition, because of the abundance of smaller fish and large invertebrate predators, such as blue crabs and penaeid shrimp, larger fish in pursuit of prey organisms use the meadows as feeding grounds.

9.2.4 Marine/Offshore

9.2.4.1 Seagrass/Marine Vegetation

Offshore seagrass beds in the eastern GOM consist of the rare genus *Halophila* spp., and were discovered in the 1980s during baseline studies in preparation for oil and gas exploration (Fonseca et al. 2000). Estimates of the extent of the beds exceeded 1 million acres. *Halophila* grows to depths of 35 m, has one of the highest growth rates and turnover rate (days instead of months or years as for most seagrasses) of its tissues of any seagrass known, and has high reproductive rates (often reestablishing from seed every year). The rapid turnover and decomposition provides nutrients that can be rapidly used in the aquatic food chain. The *Halophila* beds occur in close proximity to live sea bottom.

Recent studies of the *Halophila* beds in the Big Bend area off the west coast of Florida have used remotely operated vehicles, towed video arrays, advanced sonar systems, and SCUBA to study the *Halophila* seagrasses (Fonseca et al. 2000). Preliminary assessment suggests *Halophila* coverage of 2 million acres. Grunts, snappers, and other fish appear to move from adjacent live bottom habitat during the day to the *Halophila* beds at night, similar to the movements between coral reefs and adjacent seagrass meadows.

9.2.4.2 Pelagic Vegetation

The pelagic brown algae *Sargassum* spp. provides a dynamic structural habitat in the surface waters of the GOM. The pelagic species propagate by vegetative fragmentation (SAFMC 1998). The plants exhibit a complex branching that forms lush foliage. While most *Sargassum* occurs in the Atlantic Ocean, it also occurs in the GOM. Pelagic *Sargassum* supports a diverse assemblage of marine organisms. Juvenile and adult fish often associated with *Sargassum* also frequent other drifting objects. Possible reasons for the association with *Sargassum* include protection, feeding, cleaning, shade, structural affinity, visual reference, tactile stimulation, historical accident, passive drift, and use a spawning habitat (SAFMC 1998).

Shrimp and crabs comprise the bulk of the invertebrates and a major source of food for *Sargassum* associated fish. *Sargassum* acts as a vehicle for dispersal of some its inhabitants and maybe important in the life histories of many species of pelagic, littoral, and benthic fish, providing them with a substratum, protection against predation, and concentration of food in the open Gulf (Dooley, 1972). Dooley (1972) found 54 species of fish associated with the *Sargassum* complex and as many as 100 different animal species can be found in the floating *Sargassum* in the GOM (MMS, 1997). These species include mostly hydroids and copepods, but also contain fish, crabs, gastropods, polychaetes, bryozoans, anemones and sea-spiders. The jacks (carangids) were one of the most numerous and diverse groups associated with *Sargassum*. Very young jacks (< 20 mm) were found within the protection of the weed, while the larger jacks were found progressively further below and away from the weed (Dooley, 1972). Large amberjacks, *Seriola dumerili*, dolphin, *Coryphaena hippurus*, and almaco jacks, *S. rivoliana*, are major predators of the Sargassum complex. The gray triggerfish, *Balistes capriscus*, is also associated with *Sargassum* (Dooley, 1972).

9.2.4.3 Vents

Chemosynthetic communities have been known to exist in the deep waters of the GOM since the 1980s (e.g. Brooks et al. 1986). The densest aggregations occur around 500m and deeper. They comprise communities of Vestimentiferan tubeworms, vesicomyid and infaunal lucinid or thyasirid clams and mytilid mussels. There are also substantial colonies of the deep water coral Lophelia attached to carbonate outcroppings. Many of the species found at cold seep communities in the Gulf are new to science and remain undescribed. There is no information regarding reef fish association with chemosynthetic communities.

9.2.4.4 Live/Hard bottom

Hard bottoms constitute a group of biological communities characterized by a thin veneer of live corals and other biota overlying assorted sediment types. They are generally dominated by epifaunal organisms such as sponges, hard and soft corals, hydroids, anemones, barnacles, bryozoans, decapod crustaceans and gastropods. Many species of reef fish in the Reef Fish FMP assemblages aggregate or associate with various hardbottom communities at some stage of their adult life. Hardbottoms on banks are topographic highs or salt domes created by geologic uplifting. They have vertical relief measured in tens of meters. On the continental shelf, hardbottoms are usually of low relief and many are associated with relict reefs where the coral veneer is supported by dead corals.

The Florida Middle Ground is the best-known and most important area on the west coast

of Florida, in terms of coral communities. At present, live corals contribute little to the configuration of the area (Smith, 1976), so that the area has been described as a hardbottom rather than a coral reef. This region is a 153,600 ha (379,392 ac) hardbottom area 160 km west-northwest of Tampa, Florida. The Florida Middle Ground is characterized by steep profile limestone escarpments and knolls rising 10 to 13 m above the surrounding sand and sand-shell substrate, with overall depths varying from 26 to 48 m (Smith, 1976).

The hydrozoan coral Millepora alcicornis forms massive colonies along the rocky margins at about 27 m depth (Hopkins et al., 1977). Millepora alcicornis is the major contributor to frame building on the Florida Middle Ground. The dominant scleractinians in the Florida Middle Ground include Madracis decactis, Porites divaricata, Dichocoenia stellaris, D. stokesii, and Scolymia lacera. Octocorals, a relatively minor component of other Gulf reefs, are prominent on the Florida Middle Ground. Dominant forms of octocorals include Muricea elongata, Muricea laxa, Eunicea calyculata, and Plexaura flexuosa.

A species zonation pattern exists on the Florida Middle Ground with overlap between adjacent zones. Grimm and Hopkins (1977) describe a Muricea-Dichocoenia-Porites zone at 26 to 28 m. From 28 to 30 m the dominant forms are Dichocoenia and Madracis. Millepora dominates from 30 to 31 m but becomes co-dominant with Madracis from 31 to 36 m.

9.2.4.5 Soft Bottom

The GOM can be divided into two major sediment provinces, carbonate to the east of DeSoto Canyon and southward along the Florida coast, and terrigenous to the west of DeSoto Canyon past Louisiana to the Mexican border. The soft bottom sediments of the northwestern Gulf shelf represent a complex array of particle size distribution patterns with much local variation. Darnell et al. (1983) tried to establish the more general sediment patterns as one basis for interpreting the shrimp and fish distributions. They mapped surface sediments in terms of the predominant classes of particle size. Sand and mixed sand were considered coarse sediments. Silt and clay were classified as fine sediments.

The continental shelf of the eastern GOM presents a diverse array of surface substrates (Darnell and Kleypas, 1987). The benthic environments vary greatly on a local scale. West of Mobile Bay, fine-grained organic-rich silts and clays of terrestrial origin are brought to the shelf by distributaries of the Mississippi, Pearl and other rivers. These fine sediments spread eastward from the Louisiana marshes to Mobile Bay, but off the Mississippi barrier islands they are interrupted by a band of coarser quartz sand that extends to a depth of about 40 m. Another tongue of fine sediments runs southwestward from the Everglades, extending the full length of the Florida Keys. Here the surface material is fine carbonate ooze that in the nearshore sector is mixed with some organic material. A third area of fine sediments lies along the eastern flank of DeSoto Canyon. This outer shelf carbonate deposit is a shallow extension of the fine-grained slope sediments.

Coarser surface deposits include quartz sand, carbonate sand, and mixtures of the two, and the carbonate material itself is rich in the fragmented remains of mollusks, sponges, corals, algae, and foraminifera in various proportions, depending upon the locality. Quartz sand predominates in the nearshore environment to a depth of 10 m to 20 m from the Everglades northward along the coast of Florida. However, from below Apalachicola Bay

to Mobile Bay it covers the entire shelf out to at least a depth of 120 m, except the immediate eastern flank of DeSoto Canyon. The outer half to two-thirds of the Florida shelf is covered with a veneer of carbonate sand of detrital origin. Between the offshore carbonate and nearshore quartz there lies a band of mixed quartz/carbonate sand.

Sediment type is a major factor in determining the associated fish community (Hildebrand, 1954; Hildebrand, 1955; Chittenden and McEachran, 1976; Darnell et al., 1983). Shrimp distribution closely matches sediment distribution. White shrimp, Penaeus setiferus, and brown shrimp, P. aztecus, occupy the terrigenous muds, while pink shrimp, P. duorarum, occur on calcareous sediments (Pattillo et al., 1997). Shrimp have been shown to actively select substrate type (Williams, 1958). Similar sediment associated distribution also has been observed for many demersal fish (Caldwell, 1955; Hildebrand, 1955; Dawson, 1964; Topp and Hoff, 1972).

The carbonate sediments present east of DeSoto Canyon and southward along the west Florida shelf support a distinct fish community (Chittenden and McEachran, 1976). The pink shrimp predominates on calcareous sediments (Hildebrand, 1955; Darcy and Gutherz, 1984; Pattillo et al., 1997). The dominant fish species of the pink shrimp grounds include Atlantic bumper, *Chloroscombrus chrysurus*, silver jenny, *Eucinostomus gula*, sand perch, *Diplectrum formosum*, leopard searobin, Prionotus scitulus, fringed flounder, *Etropus crossotus*, pigfish, *Orthopristis chrysoptera*, and dusky flounder, *Syacium papillosum* (Hildebrand, 1955). The bathymetric distribution of pink shrimp in the GOM extends to about 45 m (Hildebrand, 1955; Pattillo et al., 1997).

The terrigenous sediments are divided into two communities. The brown shrimp grounds and the white shrimp grounds support distinct ichthyofauna (Chittenden and McEachran, 1976). The two communities are separated by different bathymetric ranges (3.5-22 m and 22-91 m) based on the shrimp distributions of Hildebrand (1954). The white shrimp ground (3.5-22 m) fishes have a strong affinity for estuaries, while the brown shrimp ground (22-91 m) fishes are independent of estuaries. Chittenden and McEachran (1976) found Atlantic croaker, Micropogonias undulatus, to be the dominant species of the white shrimp grounds. The most dominant family was the drums (Sciaenidae) along with representatives from the snake mackerels (Trichiuridae), threadfins (Polynemidae), sea catfishes (Ariidae), herrings (Clupeidae), jacks (Carangidae), butterfishes (Stromateidae), bluefishes (Pomatomidae), and lefteye flounders (Bothidae). The dominant family of the brown shrimp grounds is the porgies (Sparidae), and the longspine porgy, Stenotomus caprinus, is the dominant species. Important supporting fauna includes a variety of species from the drums (Sciaenidae), searobins (Triglidae), sea basses (Serranidae), lefteye flounders (Bothidae), lizardfishes (Synodontidae), snappers (Lutjanidae), jacks (Carangidae), butterfishes (Stromateidae), cusk-eels (Ophidiidae), toadfishes (Batrachoididae), batfishes (Ogcocephalidae), scorpionfishes (Scorpaenidae), goatfishes (Mullidae), and puffers (Tetraodontidae) (Hildebrand, 1954; Chittenden and McEachran, 1976).

9.2.4.6 Coral Reefs

Coral reef communities and solitary specimens exist throughout the GOM. This wide distribution places corals in oceanic habitats of corresponding variability, from nearshore environments to continental slopes and canyons, including the intermediate shelf zones. Corals may dominate a habitat (coral reefs), be a significant component (hardbottom), or be individuals within a community characterized by other fauna (solitary corals).

Geologically and ecologically, the range of coral assemblages and habitat types is equally diverse. The coral reefs of shallow, warm waters are typically built upon coralline rock and support a wide array of hermatypic and ahermatypic corals, finfish, invertebrates, plants and microorganisms. Hardbottoms and hard banks, found on a wider bathymetric and geographic scale, often possess high species diversity but may lack hermatypic corals, the supporting coralline structure, or some of the associated biota (see 4.2.4.3 Live/Hard Bottom). In deeper waters, large elongate mounds called deepwater banks, hundreds of meters in length, often support a rich fauna compared with adjacent areas. Lastly are communities including solitary corals. This category often lacks a topographic relief as its substrate, but may use a sandy bottom instead. Solitary corals are a minor component of the bottom communities and comprise a minor percentage of the total coral stocks in the GOM.

Ecologically and geologically, hardbottoms and hard banks are two diverse categories. Both habitats include corals but typically not the carbonate structure of a patch or outer bank coral reef nor the lithified rock of lithoherms, a type of deepwater bank. Diverse biotic zonation patterns have evolved in many of these communities because of their geologic structure and geographic location.

Coral reefs exist in areas surrounding the Dry Tortugas, an island group about 117 km west of Key West, Florida. The Dry Tortugas reefs form an elliptical atoll-like structure about 27 km long by 12 km wide. Living coral reefs occupied less than 4% (4,831 ha (11,933 ac) of the bottom above the 18-m line at the Dry Tortugas in 1976 (Davis, 1982). Jaap et al. (1989) studied Bird Key Reef in the Dry Tortugas, recording 45 species of stony corals. The most extensive reef type coral was staghorn coral, *Acropora cervicornis*. It covered a total of 478 ha (1,181 ac), and accounted for 55% of the scleractinian coral cover. Nearly half the staghorn reef type was concentrated in a single 220 ha (543 ac) reef. This reef was at depths of 6 to 14 m in an area of strong tidal currents. Coral head buttresses occupied a total 251 ha (620 ac). While they occupied only 1.1% of the bottom, they provided shelter for large concentrations of fishes, spiny lobster, *Panulirus argus*, and echinoderms near seagrass and octocoral foraging areas, making them critical elements of the Dry Tortugas system (Davis, 1982). The bank reef area accounted for 137 ha (338 ac) of the coral reef hardbottom.

On the shallow flats between the outer reefs and the lagoonal grass beds, a hardbottom community of exposed limestone dominated by octocorals occupied 3,965 ha (9,794 ac) (Davis, 1982). On the shallowest portions of the southeastern sides of the major banks, small algal communities occupied a total of 114 ha (282 ac). From 100 to 250 m seaward, the sea floor is a mosaic of low relief, limestone outcroppings interspersed with carbonate sediments. The limestone outcroppings support a diverse assemblage of sessile reef organisms.

9.2.5 Man-made structures

9.2.5.1 Artificial Reefs

Artificial reefs have proliferated in US waters since the 1980s (Seaman 1997), especially in the southeastern US and in the GOM. Yet the role of artificial reefs in the ecology ecosystem has not been resolved. Fish density, and density of lower trophic level organisms, increases on artificial reefs compared to surrounding waters. But do artificial reefs increase production of fish, or merely aggregate them from surrounding areas (Bohnsack 1989; Lindberg 1997)? The answer probably falls within a continuum of

variable proportions of aggregation and production (Bohnsack 1989). The argument for production assumes that habitat limits production of reef fish, and that production will increase as habitat increases. The argument for aggregation points out that recruitment limitation is an alternative explanation, and that habitat cannot be limiting for a fish stock in an heavily fished condition (available habitat remains constant as the resource abundance declines).

In most cases, habitat added by artificial reefs accounts for a small part of the total habitat, and would add an insignificant amount to production (Bohnsack et al. 1997). However, in the central and western GOM, approximately 4,000 oil-drilling platforms (oil rigs) add considerable structure to a region of typically soft bottom with low relief (Dauterive 2000).

If artificial reefs do increase production, the effect on fish abundance depends on the relative rates of production and the rates of fishing mortality associated with the artificial reefs (Grossman et al. 1997). Grossman et al. (1997) found little evidence of regional increased fish production or of habitat limitation. They cautioned that deleterious effects on reef fish could occur by 1) increasing fishing effort and catch rates; 2) increasing potential for overexploitation by increasing access to otherwise unexploited stock components; and 3) increasing potential for overexploitation by aggregating previously harvested stock components.

9.2.5.2 Oil Rigs

Stanley and Wilson (2000) evaluated the abundance and species composition of fish at GOM oil platforms. Use of hydroacoustics in addition to more traditional dive surveys improved the assessment. They found variability in abundance, size composition, and species composition of fish associated with the platforms. Depending on depth, fish density declined to that of ambient areas within 10-50 m of the structure. Six species, with a different mix at each platform studies, made up over 90% of the fish observed. Reef fish in a top-six list included almaco jack, amberjack, red snapper, gray snapper (mangrove snapper), and gray triggerfish. Densities ranged from 0.029 fish m-3 to 0.496 m-3. Total abundance ranged from about 13,000 to 29,000 fish per platform. Depth and presence or absence of the Mississippi River water influenced densities and abundance.

Species composition data from the various platforms indicate a north-south shift from estuarine to tropical and pelagic dominated communities (Heath et al. 2000). Species richness and species diversity were highest off western Louisiana and adjacent to the Mississippi River, and was lowest off central Louisiana. The Flower Garden area off Texas likely serves as a source of recruits for the platform communities of the western side of Louisiana, and live bottom communities off Alabama and Mississippi serve as recruitment sources for eastern Louisiana (Heath et al. 2000).

At the end of 1999, 5,862 oil platform installations and 1,879 platform removals left a net of 3,983 platforms in the GOM (Dauterive 2000). The MMS requires removal of platforms following termination of a lease, but its policy - the Rig to Reef (RTR) program - encourages reuse of obsolete platforms as artificial reefs. The RTR program converted 151 platforms to reefs. Oil companies donate half the savings in disposal costs to state artificial reef programs, nearly $20 million dollars. Three methods of converting platforms to reefs consist of tow and place, topple in place, and partial removal. The first two methods require severing the platform supports at -5 m below mud line. Approximately 64% of the removals used explosives, requiring several hundred pounds per platform

(Gitschlag et al. in press).

As a consequence of explosive removals of oil and gas platforms, many fish in the vicinity of the platform are killed. Five species accounted or 90% of the mortality due to explosives (Gitschlag et al. in press): Atlantic spadefish (estimated mean mortality per platform at 1,431), blue runner (541), red snapper (515), sheepshead (455), and gray snapper (122). One of the dominant species associated with platforms, red snapper, is considered overfished and requiring rebuilding (Schirripa 1998a). Gitschlag et al. (in press) concluded that even doubling mortality per platform would have a small impact on the red snapper population, well within the variation of the current assessment, and would not affect management strategy. They recommended no quantitative mitigation measures for platform removals, but suggested minimizing mortality on smaller fish (the most prevalent mortalities).

9.2.6 Environmental Sites of Special Interest

9.2.6.1 GOM marine protected areas established by the Council

Tortugas Shrimp Sanctuary - A shrimp nursery ground in the Florida Keys permanently closed to use of trawls and harvest or possession of shrimp. Result in shrimp growing to about 47 count/pound before harvest (3,652 square nautical miles).

Cooperative Texas Shrimp Closure - A shrimp nursery ground off Texas cooperatively closed by the council and state of Texas for 45 to 60 days out to either 15 or 200 miles. This closure results in shrimp growing to about 39 count/pound (5,475 square nautical miles).

Southwest Florida Seasonal Closure (Shrimp/Stone Crab) - Closure of federal and state waters to shrimping from November 1 through May 20 inshore of the line to protect juvenile stone crab and prevent loss of stone crab traps in trawls (4,051 square nautical miles).

Central Florida Shrimp/Stone Crab Separation Zones - Closure of state and federal waters to either shrimping or crabbing from October 5 to May 20. Crab or shrimp fishing alternate in zones IV and V. (174 square nautical miles).

Longline/Buoy Gear Area Closure - Permanent closure to use of these gears for reef fish harvest inshore of 20 fathoms off the Florida shelf and inshore of 50 fathoms for the remainder of the Gulf (72,300 square nautical miles).

Florida Middle Grounds HAPC - Pristine coral area protected by preventing use of any fishing gear interfacing with bottom (348 square nautical miles).

Madison/Swanson and Steamboat Lumps Marine Reserves - No-take marine reserves sited on gag spawning aggregation areas where all fishing is prohibited (219 square nautical miles).

Stressed Area - Permanent closure Gulf-wide of the nearshore waters to use of fish traps, power heads, and roller trawls (i.e., "rock hopper trawls") (48,400 square nautical miles).

Flower Garden Banks HAPC - Pristine coral area protected by preventing use of gear interfacing with the bottom. Subsequently made a marine sanctuary by NOS (41 square

nautical miles).

Tortugas North and South Marine Reserves - No-take marine reserves cooperatively implemented by the state of Florida, NOS, the Council, and National Park Service (see jurisdiction on chart) (185 square nautical miles).

9.2.6.2 Existing GOM Fishery Management Plan Area Closures

Closure Area	Area (square nautical miles)
Gulf Wide Closures	
Stressed Area Closure*	48,400
Longline/Buoy Gear Area Closure	
Eastern Gulf	24,400
Central/Western Gulf*	47,900
Total	72,300
Florida Closures	
Tortugas Shrimp Sanctuary*	3,652
Southwest Florida Seasonal Closure (Shrimp/Stone Crab)**	
State Waters (1 October - 31 May)	2,562
Federal Waters (1 January - 20 May)	1,489
Total	4,051
Central Florida Shrimp/Stone Crab Separation Zones	174
Florida Middle Grounds HAPC*	348
Tortugas South Marine Reserve	60
Madison/Swanson Marine Reserve	115
Steamboat Lumps Marine Reserve	104
Florida Total	8,594
Texas Closures	
Cooperative Shrimp Closure (15 May - 15 July)	
Initial 15 nautical miles offshore*	5,475
200 miles**	NA
Flower Garden Banks HAPC*	41
Texas Total	5,516
Overall Total	**134,720**

* EFH Closures
** Gear Closures

9.2.6.3 Reef Fish Habitat Sites Off of Gulf Coast of Florida

The following are descriptions of habitat sites identified by Dr. Chris Koenig and Chris Gledhill. Most of these sites are far offshore. Site locations are identified both by latitude/longitude boundaries and by USGS lease blocks. Discussion text is that of Chris Gledhill and Chris Koenig. Kathy Scanlon, U.S. Geological Survey, calculated the size of

each area in square nautical miles.

1. 29 Edge/27 Edge, North and West rim of the DeSoto Canyon (several sites within the same area - total area = 367 sq. naut. mi.)

Area A (62 sq. naut. mi), USGS lease blocks 853-857, 897-901; boundaries:
N= 30 º09'N, S= 30º 04'N, E=86º 43'W, W=86º 58'W.
Area B (75 sq. naut. mi), USGS lease blocks 939-942; 983-986, 15-18; boundaries: N=30º 04'N, S=29º 57'N, E=86º 53'W, W=87º 05'W.
Area C (86 sq. naut. mi), USGS lease blocks 57, 58, 101, 102, 145, 146; boundaries: N=29º 57'N, S=29º 48'N, E=87º 05,W, W=87º 16'W.
Area D (144 sq. naut. mi), USGS lease blocks 185-188, 229-232, 273-276, 317-320, 361-364; boundaries: N=29º 48'N, S=29º 33'N, E=87º 11'W, W=87º 22'W.

Discussion: This area includes a site that has been slated for oil and gas development (proposed Chevron Development unit 56). It is a high relief area, which has been significant in reef fish fishery production but due to proximity from shore has historically received high fishing pressure (Moe 1963). The area is large, but the most significant habitat occurs between 50 and 150 meters. A ridge extends about 8 km (5 miles) thru the Chevron site in lease blocks 99, 56, and 57. We broke the area into four discrete blocks, each covered by smaller (5x5 kin) lease blocks.

The following sites (on charts) are arranged from north to south along the West Florida Shelf:

2. "Woodward-Clyde" Pinnacles (42 sq. naut. mi)

Destin Dome USGS lease blocks 473, 474, 516, 517, 518, 562.

Boundaries: NW= 29º 33'N, 86º 11'W NE= 29º 33'N, 86º 05' W
SW= 29º 25'N, 86º 11'W SE= 29º 25'N, 86º 05'W

Discussion: These are high relief (up to 11 m) pinnacles on the 90 m contour reported by Woodward-Clyde consultants.

3. "3-to-Ss" area (76 sq. naut. mi)

Destin Dome USGS lease blocks 434, 478, 522, 566, Apalachicola USGS lease blocks 397, 398, 441, 442, 485, 486, 529, 530.

Boundaries: NW= 29º 35'N, 85º 56'W NE= 29º 35'N, 85º 47'W
SW= 29º 25'N, 85º 56'W SE= 29º 25'N, 85º 47'W

Discussion: This is a rugged area along the 20-fathom contour just off Panama City. This was listed in Martin Moe's 1963 survey of offshore fishing in Florida and has similar features to the Middle Grounds. The bottom is mostly sand with irregular reef relief of 3 to 4 fathoms.

4. Area North of Johnny Walker site (denoted as Mud Banks by Moe 1963) (28 sq. naut. mi)

Apalachicola USGS lease blocks 654, 617, 618, 619.
Boundaries: NW= 29º 22'N, 85º 56'W NE = 29º 22'N, 85º 45'W
SW = 29º 19'N, 85º 45'W SE = 29º 19'N, 85º 5'W

Discussion: This area is a 7-8 mile rock ledge with a steep seaward slope just north of the Johnny Walker, Madison and Swanson sites. The depth is about 30 fathoms.

5. Madison and Swanson sites (denoted as Whoopie Grounds by Moe 1963) (115 sq. naut. mi).

Apalachicola USGS lease blocks 706, 707, 708, 709, 750, 751, 752, 753, 794, 795, 796, 797, 838, 839, 840, 841.

Boundaries: NW= 29º 17'N, 85º 50'W NE= 29º 17'N, 85º 38' W
SW= 29º 06'N, 85º 50'W SE= 29º 06'N, 85º 38'W

Discussion: This area is denoted in Moe's (1963) fishing survey as having rock ledges with relief up to 5 fathoms (9 m). There is also plenty of recent anecdotal fishing information from port samplers (Debbie Fable, Personal Communication). This site also shows confirmed outcrops of limestone and reef fish habitat from the reef fish survey (Chris Gledhill, Pascagoula NMFS lab, Personal Communication). Also, (2) transects through this area by Ludwick and Walton (1957) showed pinnacle trends. Some of these formations have names- Madison and Swanson's Rocks.

6. Twin Ridges site (5 sq. naut. mi).

USGS lease block 979 bordering Apalachicola and Florida Middle Ground bathymetric maps.

Boundaries: NW= 29º 00'N, 85º 24'W NE= 29º 00'N, 85º 21'W
SW= 28º 58'N, 85º 24'W SE= 28º 58'N, 85º 21'W

Discussion: This is the rugged double ridgeline that was mapped with side-scan sonar during the spring 1997 cruise (NMFS Panama City, Pascagoula/USGS Woods Hole) showing notable reef fish habitat features at 70-80 meters (233-262 feet) depths. This site covers about one lease block and is embedded in a larger area marked by Moe (1963). This area was originally picked for survey by NMFS because it enclosed a concentrated area of gag/copperbelly catches recorded from recent at-sea reports.

7. Florida Middle Grounds. (340 sq. naut. mi).

Large area (irregular polygon) on the 20-fathom isobath that covers about 40 USGS lease blocks.
Boundaries: (A). 28º 42.S'N, 84º 24.8'W;
(B). 28º 42.S'N, 84º 16.3'W;
(C). 28º 11'N, 84º 0'W;
(D). 28º 11'N, 84º 07'W;
(E). 28º 26.6N, 84º 24.8'W.

Discussion: This area was designated in the Coral Reef Fishery Management Plan (1982) as a HAPC (habitat areas of particular concern). Its coordinates are therefore already fixed. Current restrictions apply to gear - no bottom longlines, traps, pots or bottom

trawls. It is thought that many species of grouper and snapper spawn in this area.

8. 40 Fathom Contour West of the Middle Grounds (denoted as The Edges by Moe 1963) (several sites within the same area - total area = 436 sq. naut. mi.).

Area A (61 sq. naut. mi), Florida Middle Grounds USGS lease blocks 147, 148, 149, 150,151, 191, 192, 193, 194, 195;

Boundaries: NW= 28º 51'N, 85º 12'W NE= 28º 51'N, 84º 57'W,
SE= 28º 46'N, 84º 57'W SW= 28º 46'W, 85º 12'W;

Area B (67 sq. naut. mi), Florida Middle Grounds USGS lease blocks 237, 238, 239, 240, 281, 282, 283, 284;

Boundaries: NW= 28º 46'N, 85º 06'W NE= 28º 46'N, 84º 54'W,
SE= 28º 40'N, 84º 54'W SW= 28º 40'W, 85º 06'W;

Area C (57 sq. naut. mi), Florida Middle Grounds USGS lease blocks 326, 327, 328, 329, 370, 371, 372, 373;

Boundaries: NW= 28º 40'N, 85º 03'W NE= 28º 40'N, 84º 51'W,
SE= 28º 34'N, 84º 51'W SW= 28º 34'W, 85º 03'W;

Area D (143 sq. naut. mi), Florida Middle Grounds USGS lease blocks 415, 416, 417, 418, 419, 459, 460, 461, 462, 463, 503, 504, 505, 506, 507, 547, 548, 549, 550, 551;

Boundaries: NW= 28º 34'N, 85º 01'W NE= 28º 34'N, 84º 45'W,
SE= 28º 24'N, 84º 45'W SW= 28º 24'W, 85º 01'W;

Area E (108 sq. naut. mi), Florida Middle Grounds USGS lease blocks 593, 594, 595, 596, 637, 638, 639, 640, 681, 682, 683, 684, 725, 726, 727, 728;

Boundaries: NW= 28º 24'N, 84º 54'W NE= 28º 24'N, 84º 42'W,
SE= 28º 14'N, 84º 42'W SW= 28º 14'W, 84º 54'W;

Discussion: Although this site is of low relief, we directly observed a gag and scamp spawning aggregations with an ROV on a R/V Chapman survey in 1994. NMFS Panama City and Pascagoula conducted a Fishery Acoustic System (FAS) survey in 1996. This site is also listed in Moe's 1963 survey as an extensive linear area along the 40-fathom isobath scattered high relief rocky outcrops of limestone rock extending parallel to the coastline. At-sea fishing surveys also revealed this is currently an active region of commercial grouper fishing.

8. "Steamboat lumps". (104 sq. naut. mi.)

Florida Middle Grounds USGS lease blocks 771, 772, 816, 860, 861, 862, 906

Boundaries: NW= 28º 14'N, 84º 48'W NE= 28º 14'N, 84º 37'W
SW= 28º 03'N, 84º 48'W SE= 28º 03'N, 84º 37'W

Discussion: This area is due W. of Clearwater, Fla. and SW of the Middle Grounds at a depth of 40-50 fathoms. These are prominent features reported to be low relief areas with

limestone rock.

9. "The Elbow". (107 sq. naut. mi).

Elbow USGS lease blocks 36, 37, 80, 81, 124, 125, 168, 169, 212, 213, 256, 257, 300, 301;

Boundaries: NW= 27º 57'N, 84º 11'W NE= 27º 57'N, 84º 05'W
SW= 27º 38'N, 84º 11'W SE= 27º 38'N, 84º 05'W

Discussion: This is a large ridge as wide as 3 nautical miles composed of limestone rock (Moe 1963). It rises 4-8 fathoms above the bottom and can be seen on the bathymetric map by the 30fathom isobath due west of Tampa Bay.

10. "Christmas Ridge". (191 sq. naut. mi).

Charlotte Harbor USGS lease blocks 444, 445, 446, 488, 489, 490, 532, 533, 534, 576, 577, 578, 620, 621, 622, 664, 665, 666, 708, 709, 710, 752, 753, 754, 796, 797, 798;

Boundaries: NW= 26º 31'N, 83º 51'W NE= 26º 31'N, 83º 41'W
SW= 26º 06'N, 83º 49'W SE= 26º 06'N, 83º 42'W

Discussion: The main features of this area are rock ridges of several fathoms in relief at about 45 fathom depths. These ridges follow the depth contours.

11. "Hambone Ridge/the Finger". (153 sq. naut. mi).

Pulley Ridge USGS lease blocks 445, 446, 447, 489, 490, 491, 533, 534, 535, 577, 578, 579, 621, 622, 623, 665, 666, 667, 709, 710, 711;

Boundaries: NW= 25º 31'N, 83º 46'W NE= 25º 31'N, 83º 37'W
SW= 25º 12'N, 83º 46'W SE= 25º 12'N, 83º 37'W

Discussion: Moe (1963) describes these as well defined rock ridges rising 4-5 F above a flat sand bottom along the 40-fathom contour.

13. " Northwest Peaks". (182 sq. naut. mi).

Pulley Ridge USGS lease blocks 617, 618, 619, 620, 661, 662, 663, 664, 705, 706, 707, 708, 749, 750, 751, 752, 793, 794, 795, 796, 837, 838, 839, 840, 881, 882, 883, 884.

Boundaries: NW= 25º 20'N, 830 57'W NE= 25º 20'N, 83º 46'W
SW= 25º 02'N, 830 57'W SE= 25º 02'N, 83º 46'W

Discussion: This is a relatively deep site with depths below 50 fathoms. This area is northwest of the Tortugas and has high rock pinnacles with one peak rising to 25 fathoms, but it is not depicted on the bathymetric chart.

14. "Riley's Hump". (11 sq. naut. mi).

Boundaries: NW= 24º 32.2'N, 83º 08.7'W NE= 24º 32.2'N, 83º 05.2'W
SW= 24º 28.7'N, 83º 05.2' W SE= 24º 28.7'N, 83º 08.7'W

Discussion: This area is a rise between the 20 and 30 fathom isobaths southwest of the Dry Tortugas and it covers about one lease block of area. This area is designated as a mutton snapper spawning grounds in Amendment 5 (supplement) of the Reef Fish FMP. No fishing is allowed in this area in May and June but other times of the year fishing is not restricted.

9.2.7 Habitat Use by Managed Species

9.2.7.1 Reef fish habitat

9.2.7.1.1 Distribution

The National Ocean Service (NOS) of NOAA collaborated with NMFS and the Council to develop distributions of reef fish (and other species) in the GOM (SEA 1998). The NOS obtained fishery independent data sets for the GOM, including SEAMAP, state trawl surveys, and GUS trawl surveys. Data from the Estuarine Living Marine Resources (ELMR) Program contain information on relative abundance (highly abundant, abundant, common, rare, not found, and no data) for a series of estuaries, by five life stages (adult, spawning, egg, larva, and juvenile) and month for five seasonal salinity zones (0-0.5, 0.5-5, 5-15, 15-25, and >25). NOS staff analyzed the data to determine relative abundance of the mapped species by estuary, salinity zone, and month. For some species not in the ELMR database, distribution consisted of only observed-not observed for adult, juvenile, and spawning stages.

In general, reef fish are widely distributed in the GOM, 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. Juvenile and adult reef fish are typically demersal and usually associated with bottom topographies on the continental shelf (<100m) which have high relief, i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. However, several species are found over sand and soft-bottom substrates. For example, juvenile red snapper are common on mud bottoms in the northern Gulf, particularly off Texas through Alabama. Also, some juvenile snapper (e.g. mutton, gray, red, dog, lane, and yellowtail snappers) and grouper (e.g. jewfish, red, gag, and yellowfin groupers) have been documented in inshore seagrass beds, mangrove estuaries, lagoons, and larger bay systems (GMFMC, 1981b). More detail on hardbottom substrate and coral can be found in the Fishery Management Plan (FMP) for Corals and Coral Reefs (GMFMC and SAFMC, 1982).

9.2.7.1.2 Prey Habitat

With 40 species of reef fish in the management unit, the prey of this species complex is rich and varied (GMFMC, 1981b). Habitat important to the prey of reef fish species ranges from the estuaries to the offshore reefs and adjacent sand and mud bottom areas. Prey dependence is one factor that determines the importance of these habitats for reef fish.

Many species of snapper and grouper occupy inshore areas during their juvenile stages (e.g., mutton, dog, lane, gray and yellowtail snapper; and jewfish, red, gag, and yellowfin groupers) where they feed on estuarine dependent prey (e.g., shrimp, small fish and crabs). As they mature and move offshore, their diets in many cases focus more on fish, but estuarine-dependent species can still constitute an important dietary component.

Many reef fish species are considered to be unspecialized, opportunistic feeders: feeding on a variety of fishes and crustaceans (Parrish, 1987). In general, these species prey primarily on crustaceans early in life but target fish as they grow larger. The gray snapper is a good example of a species with widely diverse habitat and feeding regimens. This species is classified as an opportunistic carnivore at all life stages (Pattillo et al. 1997). During the juvenile stage in the estuarine environment, the gray snapper feeds on small shrimp, copepods, amphipods and larval fish. Offshore reefs, adults feed primarily on fish and secondarily on crustaceans. Likewise, the red snapper is basically carnivorous, feeding mainly on fish and squid. Juvenile red snapper often feed on shrimp but become more piscivorous after age one. Of the vertebrates consumed, most are not obligate reef dwellers, indicating that red snapper feed away from reefs (GMFMC, 1981b). For more information on specific feeding habits of other reef fish species see GMFMC (1981b).

The following sections briefly summarize the available information on habitat use and dependencies of all of the 42 species covered by the reef fish FMP. Table 6.1 provides a summary of this information to demonstrate the important habitat dependencies of the reef fish complex.

9.2.7.2 Balistidae-Triggerfishes

FMP species list: Gray triggerfish *Balistes capriscus*

Information is sparse, particularly for the early life stages (i.e., eggs, larvae and postlarvae). Eggs occur in late spring and summer in nests prepared in sand near natural and artificial reefs. Eggs are guarded by the female and/or male. Larvae and postlarvae are pelagic, occurring in the upper water column, usually associated with Sargassum and other flotsam. Early and late juveniles also are associated with Sargassum and other flotsam and may be found in mangrove estuaries. Triggerfish leave the surface sargassum habitat in the fall when juvenile fish (5 to 7 inches) move to reef habitat on the bottom. Adults are found offshore in waters greater than 10 m where they are associated with natural and artificial reefs. However, triggerfish may move away from the reef structure in order to feed. They have been observed working soft bottoms by aiming a jet of water at the sand with enough force to reveal sand dollars and sea urchins hidden just under the surface. Spawning adults occur in late spring and summer, also around natural and artificial reefs in water depth greater than 10 m.

9.2.7.3 Carangidae-Jacks

FMP species list	Greater amberjack	*Seriola dumerili*
	Lesser amberjack	*Seriola fasciata*
	Almaco jack	*Seriola rivoliana*
	Banded rudderfish	*Seriola zonata*

General habitat use:

Most carangids are believed to spawn offshore. Juveniles associate with floating objects such as clumps of sargassum, bits of wood and debris, and jellyfish. As the fish grow they drift inshore and assume an inshore schooling existence. However, some of the larger amberjacks follow a solitary existence.

Species-specific habitat use:

Greater Amberjack

The greater amberjack occurs throughout the Gulf coast to depths of 400 m. Information is sparse on habitat associations for all life stages of amberjack. Adults are pelagic and epibenthic, occurring over reefs and wrecks and around buoys. Very little information exists on spawning adults, but in the northern Gulf spawning occurs from May to July and may be as early as April based on histology. Spawning occurs offshore year- round. Juveniles also are pelagic and often attracted to floating plants and debris in the nursery areas that also are offshore (NOAA, 1985).

Lesser Amberjack

Information is sparse, particularly for the early life stages (i.e., eggs, larvae and postlarvae). Juveniles occur offshore in the late summer and fall in the northern Gulf. Small juveniles are associated with floating Sargassum. Adults are found offshore year round in the northern Gulf where they are associated with oil and gas rigs and irregular bottom. Spawning occurs offshore September-December and February-March, probably in association with oil and gas structures and irregular bottom.

Almaco jack

Very little information is available on the habitat associations of the almaco jack. Juveniles use Sargassum as a refuge in open waters and off barrier islands. Adults are found far offshore, often associated with rigs in the northern GOM. Spawning is thought to occur from spring through fall.

Banded rudderfish

Adult Banded rudderfish are pelagic or epibenthic and confined to coastal waters over the continental shelf where they feed on fish and shrimps. They are not common in the central part of the northern GOM. They spawn in offshore waters of the eastern GOM, the Yucatan Channel and Straits of Florida. Juveniles occur in offshore waters and associate with jellyfish and drifting weeds, such as Sargassum and Physalia.

9.2.7.4 Labridae-Wrasses

FMP species list Hogfish *Lachnolaimus maximus*

General habitat use

Hogfish are large wrasses that inhabit areas of moderate-high relief in shelf waters. They range from North Carolina south, through the Caribbean Sea and GOM to the northern coast of South America. Juveniles can be found in shallow seagrass beds in Florida Bay where they feed on benthic crustaceans, mollusks, and echinoderms. Adults are widely distributed on coral reefs and rocky flats, where they consume bivalves, gastropods, sea urchin, crabs, and other mollusks (Sierra et al 1994; Randall 1967). Adult hogfish feed mostly by winnowing hard shelled animals from the bottom substrate and crushing their prey with their pharyngeal jaws (Clifton and Motta 1998).

9.2.7.5 Lutjanidae-Snappers

FMP species list Queen snapper *Etelis oculatus*

Mutton snapper	*Lutjanus analis*
Schoolmaster	*Lutjanus apodus*
Blackfin snapper	*Lutjanus buccanella*
Red snapper	*Lutjanus campechanus*
Cubera snapper	*Lutjanus cyanopterus*
Gray (mangrove) snapper	*Lutjanus griseus*
Dog snapper	*Lutjanus jocu*
Mahogany snapper	*Lutjanus mahogoni*
Lane snapper	*Lutjanus synagris*
Silk snapper	*Lutjanus vivanus*
Yellowtail snapper	*Ocyurus chrysurus*
Wenchman	*Pristipomoides aquilonaris*
Vermilion snapper	*Rhomboplites aurorubens*

General habitat use:

Snappers are common in all warm marine waters of the world. Most are inshore dwellers, although some occur in open-water. Some species enter estuaries and mangroves, with the latter functioning as nursery grounds.

Species-specific habitat use:

Queen snapper

Very little information is available on the habitat associations of the queen snapper. Queen snapper are a deep-water species with adults distributed in the southern portion of the GOM where they commonly associate with rocky bottoms and ledges between 135 and 450 meters, feeding on small fish, squid and crustaceans.

Mutton snapper

Mutton snapper spawn on steep drop offs near reef areas, and larvae and post larvae are found in shallow continental shelf waters. Juveniles and adults inhabit shallow seagrass beds in tidal creeks and bights surrounded by mangroves, and in shallow protected bays. Adults are also found on patch reefs and deep barrier reefs and are most abundant off south Florida and in the Caribbean.

Schoolmaster

Juvenile schoolmaster occupy shallow and offshore habitats, moving to deeper offshore waters with growth. As juveniles they are associated with shallow seagrass beds and mangrove habitats, and congregate around jetties. Late juveniles are found over grass flats Inshore and offshore rocky and coral reefs and may enter estuaries and mangrove habitats. Adult schoolmaster occur throughout coastal waters, from shallow water to about 90 m. They are found over various substrates including rock, vegetated sand, inshore and offshore reefs, esp. elkhorn coral, and mud. Late juveniles may enter mangrove swamps and tidal creeks due to their capability to tolerate low salinities.

Blackfin snapper

This species of snapper occupies shelf edge habitats, where it feeds on fish and

crustaceans. It is most commonly found at depths of 40 to 300 meters. Juveniles occur in shallower hard bottom areas at 12-40 meters.

Red Snapper

Red snapper occur throughout the GOM shelf. They are particularly abundant on the Campeche Banks and in the northern Gulf. The relatively high abundance once known on the shelf areas of west Florida was significantly reduced in the 1980s and 1990s (e.g. GMFMC, 1981b), but recent evidence points to increasing abundance in this area (Mike Murphy, Personal Communication). The species is demersal and is found over sandy and rocky bottoms, around reefs, and underwater objects from shallow water to 200 m, and possibly even beyond 1200 m. Adults favor deeper water in the northern Gulf. Spawning occurs in offshore waters from May to October at depths of 18 to 37 m over fine sand bottom away from reefs. Eggs are found offshore in summer and fall. Larvae, postlarvae and early juveniles are found July through November in shelf waters ranging in depth of 17 to 183 m. Early and late juveniles are often associated with structures, objects or small burrows, but also are abundant over barren sand and mud bottom. Late juveniles are taken year round at depths of 20 to 46 m. Adults are concentrated off Yucatán, Texas, and Louisiana at depths of 7 to 146 m and are most abundant at depths of 40 to 110 m. They commonly occur in submarine gullies and depressions, and over coral reefs, rock outcroppings, gravel bottoms, and under oil and gas rigs (see 9.2.5.2).

Cubera snapper

This species occurs infrequently in the GOM. It is the largest of the snapper species occurring in the Western Atlantic. Adult cubera snapper are found on both shallow and deep reefs and wrecks (to at least 85 meters deep) and in mangroves. Unusual among snappers, they have a high range of salinity tolerance and can enter water that is nearly fresh (e.g. the intra-coastal waterway on the east coast of Costa-Rica. Adults feed on fishes, shrimps, and crabs, and notably spiny lobster. Juveniles are found in streams, canals, seagrass beds, mangrove areas, and lagoons. Spawning aggregations have been observed in June and July. Two spawning sites have been recorded in the eastern Gulf: both wrecks located in 67-85 m of water, off Key West and the Dry Tortugas. Similar aggregations have been recorded in Belize, Buttonwood Cay and Cay Bokel.

Gray Snapper

Gray snapper occur on the shelf waters of the Gulf and are particularly abundant off south and southwest Florida. Gray snapper occur in almost all of the Gulf's estuaries but are most common in Florida. Considered to be one of the more abundant snappers inshore, the gray snapper inhabits waters to depths of about 180 m. Adults are demersal and mid-water dwellers, occurring in marine, estuarine, and riverine habitats. They occur up to 32 km offshore and inshore as far as coastal plain freshwater creeks and rivers. They are found among mangroves, sandy grassbeds, and coral reefs and over sandy, muddy and rocky bottoms. Spawning occurs offshore around reefs and shoals from June to August. Eggs are pelagic and are present June through September after the summer spawn, occurring in offshore shelf waters and near coral reefs. Larvae are planktonic, occurring in peak abundance June through August in offshore shelf waters and near coral reefs from Florida through Texas. Postlarvae move into estuarine habitat and are found especially over dense grass beds of Halodule and Syringodium. Juveniles also are marine, estuarine, and riverine dwellers, often found in estuaries, channels, bayous, ponds, grassbeds, marshes, mangrove swamps, and freshwater creeks. They appear to prefer Thalassia grass flats, marl bottoms,

seagrass meadows, and mangrove roots. They are also associated with oil and gas rigs (see 9.2.5.2). More detailed information on habitat associations of gray snapper is provided in Nelson (1992) and Pattillo et al. (1997).

Dog snapper

Adult dog snapper are found throughout coastal waters from shallow waters down to over 150 m depth. They occupy a diverse variety of habitats ranging from shallow vegetated areas to deep reefs. They are most commonly found on coral reefs and display territoriality, tending to occupy a home range. The diet comprises mainly fish, but can also include crustaceans and other invertebrates. Early juveniles are found on shallow water seagrass beds of coastal waters and estuaries, and may enter rivers. Late juveniles also occur around mangrove roots and jetties and pilings. Dog snapper tend to move to deeper water as they grow larger.

Mahogany snapper

Adult mahogany snappers occur throughout the Gulf, especially around islands and in reef areas. They occupy a shallower range than other snappers, being found from shallow waters down to 30 meters. Specific habitat associations include rocky bottoms and reefs, where, like other snappers they feed on fish, crustaceans and invertebrates. They are less frequently found on sandy and vegetated bottoms.

Lane Snapper

Lane snapper occur throughout the shelf area of the Gulf in depths ranging from zero to 130 m. The species is demersal, occurring over all bottom types, but is most common in coral reef areas and sandy bottoms. Spawning occurs in offshore waters from March through September (peak July-August). Information on habitat preferences of larvae and postlarvae is non-existent and is in need of research. Nursery areas include the mangrove and grassy estuarine areas in the southern Texas and Florida and shallow areas with sandy and muddy bottoms off all Gulf states. Early and late juveniles appear to favor grass flats, reefs, and soft bottom areas to offshore depths of 20 m (NOAA, 1985). Adults occur offshore at depths of 4 to 132 m on sand bottom, natural channels, banks, and man-made reefs and structures.

Silk snapper

Silk snapper is a deeper water species found near the edge of continental and island shelves, usually ascending to shallower waters at night. It is common between 90 and 140m, but is also found in deeper waters over 200m. Its diet consists of fish and crustaceans such as shrimps and crabs. Juveniles are found in shallower water than adults.

Yellowtail Snapper

Yellowtail snapper are distributed throughout the shelf area of the GOM, but are most common off central and southern Florida. This species occurs over hard irregular bottoms, such as coral reefs and near the edge of shelves and banks. Spawning occurs February through October (peaks in February - April and September - October) in offshore areas. Information on eggs, larvae, and postlarvae is sparse and represents an area of needed research. Juveniles are found in nearshore nursery areas over vegetated sandy substrate and in muddy shallow bays (NOAA, 1985). Thalassia beds and mangrove roots

are apparent Proposed habitat for early juveniles. Late juveniles apparently select shallow reef areas as primary habitat. Adults are found from shallow waters to depths of 183 m but generally are taken in less than 50 m depths. Adults are considered to be semi-pelagic wanderers over reef habitat.

Wenchman

Wenchman occupy hard bottom habitats of the mid to outer shelf where they feed mainly on small fish. They are found at depths ranging from 19 to 378m, but are most abundant between 80 and 200m.

Vermilion Snapper

Vermilion snapper are found throughout the shelf areas of the GOM. The species is demersal, occurring over reefs and rocky bottom from depths of 20 to 200 m. Spawning occurs from April to September in offshore waters. Juveniles occupy reefs, underwater structures and hard bottom habitats in 20 to 200 m depths (NOAA, 1985).

9.2.7.6 Malacanthidae-Tilefishes

Species list	Goldface tilefish	*Caulolatilus chrysops*
	Blackline tilefish	*Caulolatilus cyanops*
	Anchor tilefish	*Caulolatilus intermedius*
	Blueline tilefish	*Caulolatilus microps*
	(Golden) Tilefish	*Lopholatilus chamaeleonticeps*

Species-specific habitat use:

Goldface tilefish, Blackline tilefish, Anchor tilefish and Blueline tilefish

Blueline tilefish are distributed mainly on the eastern / southeastern GOM and the Campeche-Yucatán outer continental shelf, shelf edge and upper slope. Anchor tilefish are most common in the northern and western Gulf. Blueline tilefish are found over irregular bottom, including troughs and terraces, sand, mud and rubble, and shell hash. They may be associated with goldface tilefish and blackline tilefish and occur in the same habitat/ fish assemblage as snowy, warsaw and yellowedge groupers, silk and vermilion snappers and *Pagrus pagrus* the common seabream. They construct burrows in soft sediments and may also utilize existing holes and crevices. Blueline tilefish are epibenthic browsers; feeding primarily on benthic invertebrates, and also some demersal fishes. Larger adults and feed increasingly on fish.

Tilefish

Tilefish (also known as golden tilefish) occur throughout the deeper waters of the GOM. The species is demersal, occurring at depths from 80 to 450 m, but is most commonly found between depths of 250 to 350 m. Preferred habitat is rough bottom and steep slopes. Spawning occurs in the months of March to November throughout the species range. Eggs and larvae are pelagic; early juveniles are pelagic-to-benthic. Nursery areas are throughout the species range (NOAA, 1985). Late juveniles burrow and occupy shafts in the substrate. Adults also dig and occupy burrows along the outer continental shelf and on flanks of submarine canyons.

9.2.7.7 Serranidae-Groupers

Species list	Dwarf sand perch	*Diplectrum bivittatum*
	Sand perch	*Diplectrum formosum*
	Rock hind	*Epinephelus adscensionis*
	Speckled hind	*Epinephelus drummondhayi*
	Yellowedge grouper	*Epinephelus flavolimbatus*
	Red hind	*Epinephelus guttatus*
	Goliath grouper (jewfish)	*Epinephelus itajara*
	Red grouper	*Epinephelus morio*
	Misty grouper	*Epinephelus mystacinus*
	Warsaw grouper	*Epinephelus nigritus*
	Snowy grouper	*Epinephelus niveatus*
	Nassau grouper	*Epinephelus striatus*
	Black grouper	*Mycteroperca bonaci*
	Yellowmouth grouper	*Mycteroperca interstitialis*
	Gag	*Mycteroperca microlepis*
	Scamp	*Mycteroperca phenax*
	Yellowfin grouper	*Mycteroperca venenosa*

General habitat use:

The serranids form a large and important element of the tropical marine fish faunas around the world. Of the species included in the Reef Fish FMP, most are carnivorous bottom dwellers, associated (as adults) with hard-bottomed substrates, and rocky reefs, with the exception of the sand perches, which are found on soft bottoms and grassy areas.

Species-specific habitat use:

Dwarf sand perch

Adult dwarf sand perch are found on soft bottoms (Cervigón et al 1992).

Sand perch

Adult sand perch inhabit bays, coastal grassy areas and shallow banks in the northern GOM, particularly off the coast of Florida. They are solitary and retreat into shelter when frightened.

Rock hind

The rock hind occupies shallow hard bottom habitats, including rocky reefs; rock piles, oil well rigs, high profile-steep crevices and ledges. Adults occur from 2 to 100 m, but larger adults are more common in deeper waters (50-100 m). The species is usually captured in waters more than 30 m deep off the west Florida shelf. They feed on crustaceans, (especially crabs) and fishes. Rock hind grow faster and are shorter-lived than most other groupers.

Speckled hind

The speckled hind is a deep water grouper distributed in the North and eastern GOM on

offshore hard bottom habitats, including rocky bottoms and both high and low profile hard bottoms. Adults are considered to be an apex predator on midshelf reefs, feeding on a variety of fishes, invertebrates and cephalopods. They occur between 25 to 183 meters and are most common at 60-120 meters depth. Juveniles are most commonly found in the shallow portion of the depth range.

Yellowedge grouper

Yellowedge grouper is another deep water species found throughout the Gulf continental shelf, with areas of high abundance off of Texas and west Florida. On the outer continental shelf the species occupies high relief hard bottoms, rocky out-croppings and is often found co-occur with snowy grouper and tilefish. Both adults and juveniles are also known to inhabit burrows. Major components of the diet comprise brachyuran crabs, fishes and other invertebrates. The species depth range is from 35 to 370 m with adults most common in waters greater than 180 meters deep.

Red hind

Within the GOM, the red hind is most abundant in southeastern reef areas. It occupies reefs, stony coral, and actively seeks holes and crevices. It may also be found on sandy bottoms with isolated coral patches and low-relief habitats. The species depth range is 18 to 110 m, with inshore populations being mostly female. Juveniles occupy patch reefs, coral and limestone rock, and move deeper as they increase in size. The diet comprises crustaceans (especially brachyuran crabs), fishes and other invertebrates. Spawning occurs in late spring and summer on the Florida Middle Grounds, where fish aggregate on the seaward side of submerged ridges. Individuals of this species are known to return to same spawning site.

Goliath grouper (jewfish)

Goliath grouper are a protected species found in the shallow waters of the GOM and are most abundant on the southwest Florida and Campeche Banks. Younger adults are found inshore around docks, bridges and jetties, reef crevices, while large adults prefer offshore ledges and wrecks. The species depth range in the Gulf is ranged down to 95m, with the highest abundance at 2-55m. Early juveniles are found in bays and estuaries, inshore grassbeds, canals, and mangroves. Larger juveniles are also found around ledges, reefs, and holes in shallow waters. Adults feed mainly on crustaceans, (especially lobsters), fish, and mollusks (cephalopods). The diet of juveniles is mainly blue crabs and other crustaceans. Spawning occurs from June to December with peaks between July and September. Spawning occurs off southeast and southwest Florida, and other parts of the Gulf around offshore structures, wrecks and patch reefs. Spawning aggregations can contain 10-150 individuals when formed and have been reported from depths of 36-46m.

Red Grouper

The red grouper is demersal and occurs throughout the GOM at depths from 3 to about 200 m, preferring 30 to 120 m depths. It is particularly abundant off west Florida and the Yucatan coasts. Spawning occurs at depths of approximately 25 to 90 m on the Florida Banks with peaks during April and May. Eggs are pelagic and require at least 32 ppt salinity for buoyancy. Larvae leave the planktonic stage to become benthic at about 20 mm standard length. Late juveniles select inshore hardbottom to depths of about 50 m, seeking shelter in crevices and other hiding places. Favored nursery areas for juveniles are

grass beds, rock formations, and shallow reefs. Juveniles remain in the nursery areas until mature before moving to deeper Gulf waters (NOAA, 1985). Adults select rocky outcrops, wrecks, reefs, ledges, crevices and caverns of rock bottom, as well as "live bottom" areas, in depths of 3 to 190 m. Spawners occur in offshore coastal waters in depths of 20 to 100 m.

Misty grouper

Misty Grouper is a deep-water grouper found offshore throughout the Gulf on hard-bottom slope and shelf substrates, including high-relief rocky ledges and pinnacles. Adults occur mainly between 100 and 400 m, with juveniles distributed in shallower water. Adults feed on crustaceans (especially crabs), fishes and cephalopods. Spawning occurs April through July in the Gulf.

Warsaw grouper

Habitat associations of the warsaw grouper are similar to those of the misty grouper. Both are deep-water species distributed throughout the GOM, in association with hard bottoms. Warsaw grouper occur from 40 to 525 m, more commonly down to 250 m, and prefer rough, rocky bottoms with high profiles such as steep cliffs and rocky ledges. Adults feed on crabs, shrimp, lobsters, and fish. Early juveniles occur in shallow nearshore habitats and may enter bays, moving into deeper water as they grow.

Snowy grouper

In the GOM, snowy grouper are found in largest numbers in deep waters off of South Florida and the northwestern coast of Cuba. They occur on rocky bottoms, well offshore, such as around boulders and ridges, and relief up to 10 m interspersed with sand shell and rock fragments. They are common on Florida Oculina reefs and are often found with other deep-water species such as yellowedge grouper and tilefishes. Adults feed on fish, crabs and other crustaceans, cephalopods and gastropods. As with other groupers, the young occur in shallower habitats, such as nearshore reefs, and move into deeper water with growth.

Nassau grouper

According to Sadovy & Eklund (1969) Nassau grouper are found in the Florida Keys, but are absent from the GOM being replaced by red grouper. Nassau grouper is a protected species that occupies reefs and crevice caves down to about 100m depth. Older fish tend to occur deeper. The diet is not particularly specialized, comprising crustaceans and fish. Spawning aggregations are formed in areas of soft corals, sponges, stony corals, and sand from December to February coordinated with the times of the full moon. Early juveniles associate with inshore seagrass beds, macroalgal mats, tilefish mounds and small coral clumps. Later juveniles become piscivorous at 20-25cm TL and move to offshore reefs at 30-35cm TL.

Black Grouper

The black grouper is found along the eastern GOM and Yucatan Peninsula, but is considered rare in the western half of the Gulf. The species is demersal and is found from shore to depths of 150 m. Adults occur over wrecks and rocky coral reefs, irregular bottoms, ledges and high-to- moderate relief habitat. Spawning occurs from late winter

through to spring and summer throughout all adult areas. Ripe females were found in May on Campeche Banks, and late winter- spring in eastern Gulf with peak activity in January to March. Spawning aggregations have been observed in the Florida Keys at 18 to 28 m depth. Juveniles occupy shallow water reefs and rocky bottoms and patch reefs. They may also be found over muddy bottoms of mangrove lagoons and may venture into estuaries occasionally (NOAA, 1985). They move to deeper water with growth.

Yellowmouth grouper

In the GOM, yellowmouth grouper occur off of Campeche Banks, the west coast of Florida, Texas Flower Garden Banks, and northwest coast of Cuba. They occupy rocky bottoms and coral reefs and feed on Primarily fishes, and also crustaceans and other invertebrates. Spawning occurs primarily in spring and summer, with peak in April and May off of west coast of Florida. Juveniles commonly occur in mangrove-lined lagoons and move into deeper water as they grow.

Gag

Gag are demersal and most common in the eastern Gulf, especially the west Florida shelf. Adults occupy hard bottom substrates, including offshore reefs and wrecks, coral and live bottoms, and depressions and ledges. Spawning adults form aggregations in depths of 50 to 120 m. Spawning occurs December - April with a peak in the early spring (March - April) on the west Florida shelf, a major spawning area. Eggs are pelagic, occurring in December - April, with areas of greatest abundance offshore on the west Florida shelf. Larvae are pelagic and are most abundant in the early spring. Postlarvae and pelagic juveniles move through inlets into coastal lagoons and high salinity estuaries in April - May where they become benthic and settle into grass flats and oyster beds. Late juveniles move offshore in the fall to shallow reef habitat in depths of one to 50 m. Adults are found in deeper waters (10 to 100 m) on hardbottoms, offshore reefs and wrecks, coral, and live bottom.

Scamp

Scamp are demersal and widely distributed throughout shelf areas of the Gulf, especially off Florida. As with many of the reef species, detailed information on habitat relationships is sparse. Adults occupy ledges and high relief hard bottoms in depths of 12-189 m, but most are captured at 40-80 m depths. They prefer complex structures such as Oculina coral reefs. They are primarily piscivorous, but also feed on crustaceans and cephalopods. Spawning adults have been taken at depths of 60-100 m. Spawning occurs from late February to early June in aggregations. Scamp prefer to spawn at the shelf edge and have been observed in apparent spawning locations used by gag grouper. Oculina formations are a key spawning habitat. Eggs and larvae are pelagic, occurring offshore in the spring. Early and late juveniles occur on inshore hard bottoms and reefs in depths of 12-33 m.

Yellowfin grouper

The yellowfin grouper is not common in the GOM, occurring primarily in the southern Gulf and West Indies. Its habitat comprises rocky bottoms and coral reefs from the shoreline to mid-shelf depths. These groupers prefer reef ridge and high-relief spur and groove reefs. Adults feed primarily on fish, but also on squid and shrimp. This species is able to capture swift-moving fish. Juveniles occupy shallow seagrass beds and move to deeper rocky bottoms with growth. Spawning takes place from March to August in the

eastern Gulf. Juveniles occupy shallow seagrass beds and move to deeper rocky bottoms as they increase in size.

9.2.8 Ecosystem Engineering Considerations for Managed Species

Many species interact with their environment by directly modifying their habitat, to the benefit of not only the species doing the modifying, but others as well. Such organisms are known as ecosystem engineers. The term was coined by Jones et al. (1994), and is defined as,

> "Organisms that directly or indirectly control the availability of resources…by causing physical state changes in biotic or abiotic materials"

Species in the reef fish management unit can benefit from the activities of ecosystem engineers. For example, in subtidal zones, oysters, through repeated settlement and growth in an area, form mounds that grow both vertically and laterally, creating reefs that can reach heights of up to four meters and be several hectares in area. These reefs increase biodiversity, a key component for healthy ecosystems, by providing habitat for species that would not normally survive on the sandy, sparsely covered bottom, such as gag. Their presence affects current speeds and patterns, which in turn affects turbidity and sedimentation. In addition, oysters act as a filter for the water, in the process helping to control eutrophication (Harraman 2002).

In addition to benefitting from the actions of others, some reef fish species are themselves ecosystem engineers. These species include tilefish and groupers in the family *Epinephelus*. In addition, these species are top-level predators, increasing their importance to the ecosystem. Coleman and Williams (2002) wrote:

> "As top-level predators, tilefish and grouper are integral components of the shelf-edge and slope environments that they inhabit. Thus, their biotic interactions are likely to influence the structure and function of their communities. As ecosystem engineers, their abiotic interactions leverage their ecological influence even further. This is particularly true if, by providing essential architectural structure in an otherwise less complex habitat, they support diverse communities of organisms. In addition, their burrowing behavior could potentially exert a major influence on sediment biogeochemistry and the breakdown and processing of deposited organic matter. With these dual trophic and engineering influences, they could have an extremely complex role in maintaining ecosystem structure and function."

In deep-water, the reef fish species tilefish *Lopholatilus chamaeleonticeps,* blueline tilefish *Caulolatilus microps* and yellowedge grouper *Epinephelus flavolimbatus* burrow in soft (clay) sediments along the continental shelf edge and upper slope (80–440 m depths). In shallower depths (30-150 m), red grouper *Epinephelus morio* excavate sandy substrata to expose carbonate rock. These excavations can serve as refuge for many species of fish and invertebrate species, including snowy grouper *Epinephelus niveatus,* vermilion snapper *Rhomboplites aurorubens,* black grouper *Mycteroperca bonaci* and spiny lobster *Panulirus argus* (Coleman and Williams 2002).

The tilefish burrows are among the larger burrows known in the ocean. They can range in size from 0.3 to 5 meters in diameter and over a meter in depth. Tilefish have been know to form virtual condominiums of burrows that are oriented horizontally in vertical cliffs.

These burrows likely have a significant influence in the recycling of organic matter. The burrows increase the surface area of the sediment in contact with the water, the movement of organisms in and out of the burrows circulates the water and increases aeration within the burrows, and the sediment within the burrows often have higher concentrations of microorganisms than do adjacent sediments, leading to more rapid recycling of organic matter (Coleman and Williams 2002).

Current methods for setting optimum yield are based on choosing the maximum levels at which a stock's biomass can be removed from the ecosystem with a low probability of exceeding MSY, without consideration of how this removal affects the ecosystem itself. Non-consumtive uses are generally given low importance when setting allowable catch levels. However, the Magnuson-Stevens Act states in part that optimum, with respect to yield, means MSY as reduced by any relevant economic, social, or ecological factor. Given the importance of red grouper, tilefish, and other ecosystem engineers to their habitat and to other species sharing that habitat, allocation of a portion of the sustainable yield for purposes of protecting and maintaining the habitat may be appropriate.

9.3 Social and Economic Environment

9.3.1 Description of the Fishery

Participants in the grouper fishery in the GOM include commercial fishermen utilizing different types of gear: bottom longline, vertical line gear (handline and bandit gear), fish traps, cast nets and powerheads for spearfishing. The fishery also includes various classes of recreational fishermen: private anglers as well as charter, head and party-boat operators and their customers who in many cases are tourists. For the years, 1986-1999, commercial landings are about 77% of total red grouper catch while recreational harvest was about 55% of total catch of gag grouper. For the years, 1996-99, commercial landings of red grouper were 87% of the total red grouper catch and recreational landings of gag grouper were 61% of the total gag catch. The grouper fishery occurs along the northeastern Gulf coast primarily along the west coast of Florida. The vast majority of the human activity related to the grouper fishery occurs in Florida. (U.S. Department of Commerce, 2001)

9.3.1.1 Commercial fishery

Bottom longlining and buoy vessels annually caught an average of 3.7 MP of grouper (mostly red grouper) valued dockside at $7.1 million (Waters, 2001; U.S. Department of Commerce, 2001). There was an average of 165 bottom longlining vessels taking an average of 1,410 trips per year from 1993-2000. On average there were 894 vessels using vertical line gear from 1993-2000. The catch (mostly gag) averaged about 2.6 MP valued dockside at $5.4 million per year. These vessels took 7,600 trips per year on average. There were on average 60 vessels using powerheads yearly between 1993-99 that caught a total of 3,000 pounds of grouper for a value of $6,000. There were no grouper reported caught with powerheads in 2000. As of May 1998, there were 86 fish trap endorsements issues by NMFS Amendment 16A); currently there are 65 fish trap permits. Between 1997-00, vessels fishing with traps caught an average of 800 thousand pounds valued at over $1.4 million, while spear fishermen caught an average of 69 thousand pounds of grouper valued at over $153,000.

The economic and social characteristics of the participants and the vessels in the reef fish fishery have been described in previous studies. Most of the studies focused on either the commercial sector or the recreational sector of the fishery.

Cato and Prochaska (1977) interviewed fishermen on 20 Florida-based reef fish vessels fishing for snapper and grouper in the GOM to analyze financial performance of the vessels in 1974-75. Vessels in their study used manually powered or electrically powered rod and reels. They were separated into those vessels fishing the northern Gulf (Panama City to Pensacola, Florida) and those fishing the southeastern Gulf (Tarpon Springs to Madeira Beach). The vessels' fishing operations ranged from Texas and the Campeche Shelf (Mexico) to along the west Florida shelf. The data for 1974 showed relatively smaller vessels with smaller crews fishing out of the southeastern Gulf ports than those out of the northern Gulf ports. Data on costs and net returns by vessel size in both areas indicated that the determinants of net revenues to captain and crew were the mix of species in the catch (e.g. snappers in the northern areas and grouper in the southeastern areas) and differentials in cost variables such as docking fees, insurance and interest rates.

Waters (1996) updated and extended the socioeconomic profile of the commercial reef fishery in the GOM with a vessel survey of 196 vessel owners and crew based on data from 1993. Fishermen from each state along the GOM were interviewed: 139 from Florida, 4 from Alabama, 1 from Mississippi, 22 from Louisiana and 30 from Texas. The survey included 1) more respondents using gear types such as bottom longlining and fish traps which had been under represented in earlier surveys; 2) vessels from around the Gulf: Collier County, Florida to Cameron County, Texas; and 3) demographic information on the fishermen.

Waters' (1996) survey divided the vessels into high volume and low volume depending on whether or not they landed enough pounds to be in the top 75% of all vessels with a particular gear type in the fishery. The survey included vessels that reported using multiple types of gear. "Fishermen that primarily used fish traps for reef fishes tended to cite the use of fish traps, stone crab traps, rods and reels and gill nets, among others. Respondents with vertical hooks and lines in the eastern Gulf used bandit reels, electric reels and rods and reels. Respondents that primarily used bottom longlines for reef fishes also tended to cite experience with vertical hook and line gear" (Waters, 1996). The survey asked vessel owners to report on their two most important kinds of trips for reef fish, even if a non-reef fish alternative contributed more to the annual revenues of the boat. Comparisons were drawn between high volume and low volume boats within each category and between those in the northern Gulf and the eastern Gulf.

In the northern Gulf, catches differed by gear with vessels using vertical lines catching primarily snapper (red and vermilion) and vessels using bottom longlines catching primarily yellowedge grouper. Vessels in the eastern Gulf used bottom longlines, vertical lines, and fish traps; they caught primarily groupers. The vessels with vertical lines in the northern Gulf were longer on average (50 feet) than those in the eastern Gulf (38 feet). Longliner vessels averaged about 42-44 feet in length and vessels using fish traps averaged about 38 feet. The average horsepower across gear types was about 280 hp, the lowest with the longliner vessels and the highest with vessels using fish traps. High volume longliner vessels had the highest fuel capacity out of a range of 32-6000 gallons. Vessels in the survey that had a fuel capacity of less than 1250 gallons numbered 159. The average fuel capacity was 689 gallons.

Waters' (1996) study also reported demographic characteristics of the commercial Gulf reef fish vessel owners and crew. Respondents reported having lived an average of 25 years in their current county or parish of residence; the overall average age of respondents was about 47 years with the mode at the 40-49 age group; 141 (72%) graduated from high school or had more than 12 years of formal education. Household size ranged from 1-9

persons with an average of 3 persons. Household incomes ranged from less than $10,000 to more than $150,000 with approximately 50% of the respondents citing household incomes of $30,000 or less. Respondents averaged approximately 44% of household income from commercial fishing for reef fishes, 21% from other types of commercial fishing and 35% from all other sources including incomes earned in non-fishing jobs held by other household members, pensions, investments and other sources. The respondents had an average of 19 years experience fishing, with 13.6 years of that experience in the positions they held at the time of the survey. Only 5 of the 196 respondents reported seasonal employment in other jobs. Typically, respondents from high volume vessels earned between 69-75% of household income from commercial fishing while, except for bottom longlining vessels, respondents from low volume vessels earned 25-39% of household income from commercial fishing (Waters, 1996). This suggests that fishermen who are catching the most are supplying the most income for their households.

Dokken et al. (1998) assessed several ports along the Texas coastline for economic development potential and employment generation. They estimated that over 250,000 persons were employed in all commercial fishery-related occupations (commercial fishing, processing, wholesaling and retailing) along the GOM. They then allocated this employment to Texas coastal counties and estimated the potential for growth from fishery-related activity for these counties.

Lucas (2001) estimated the economic impact on Madeira Beach, Florida of the one and two-month closure of the grouper fishery; a one-month closure occurred in 2001, and a two-month closure was a potential alternative. About 135 vessels offloaded in Madeira Beach on a regular basis, landing about $6.7 million in grouper per year. There were an estimated 87 bottom longliner vessels and 48 bandit rigged/vertical line vessels off loading in Madeira Beach. These represent about 60-70% of the reef fish bottom longlining fleet and about 6% of the vertical line fleet identified by Waters' (1996) survey. Four reef fish dealers, and about 401 fishermen (crew and captains) and 40 office workers were employed in fishery related activity. About 70% of all grouper landed in Madeira Beach are consumed within about 40 miles of Madeira Beach while 30% was sent to other parts of Florida, out of state and to Canada. Closure of the grouper fishery for one month (February 15-March 15) would reduce catches by about 10% to this market and would reduce annual revenues by about 10%. A two-month closure would result in a 17-22% reduction in annual landings and a 19-23% reduction in annual revenues. Estimates were based on using landings and revenues in 1999 and 2000 as proxies for 2001 landings and revenues annually. If the one month closure remains permanently, there would be 73 full time jobs lost and as many as 400 full time jobs lost annually in Pinellas County and the State of Florida. Appendix G of the Council's Generic SFA Amendment contains community related fisheries data for Monroe County Florida.

9.3.1.1.1 Dealers

There are about 227 dealers possessing permits to buy and sell reef fish species. Based on mail address data, most of them are located in Florida (146), with 29 in Louisiana, 18 in Texas, 14 in Alabama, 5 in Mississippi and 15 out of the Gulf States region. More than half of all reef fish dealers are involved in buying and selling grouper. Between 1997-2000, there were on average 123 reef fish dealers actively buying and selling in the grouper market. Of these, 101 or 82% sold more than $30,000 per year worth of domestic grouper on a regular basis. These dealers may hold multiple types of permits and because we do not know 100% of the business revenues, it is not possible to determine what percentage of their business comes from grouper fishing activity.

Grouper sales take place at several locations along the Gulf coast but are concentrated in Florida. In 2000, more than 8 MP of grouper valued dockside at over $18 million were landed on the Florida west coast. The top ten counties ranked by dockside value of grouper sales in 2000 are all in Florida: Pinellas ($8.06 m), Bay ($2.24m), Franklin ($1.25m), Citrus ($1.09m), Lee ($1.05m), Collier ($0.93m), Manatee ($0.78m), Monroe ($0.66m), Levy (0.43m), Okaloosa ($0.32m). The top five counties account for over $12 million in landings while the top 10 counties account for over $16 million in landings of grouper (U.S. Department of Commerce, 2001).

9.3.1.2 Recreational

The recreational component of the grouper fishery in the GOM includes charter boats, headboats (or party boats), and private anglers fishing from shore or private or rental boats. In 1999, recreational grouper catches totaled about 5.3 MP. Of this, gag grouper comprised about 57% and red grouper about 36% (Holiman 2001). Most of these grouper are caught by anglers using private or rental boats; charter boats make up the next largest catch.

9.3.1.2.1 Private Anglers

There are about 2.1 million anglers estimated to be fishing for marine species in the GOM. These anglers targeted drum about 35% of the time and spotted sea trout about 33% of the time. Red snapper is the most common reef fish targeted by approximately 4.5% of intercepted anglers. Red grouper and gag are targeted by about 1% and 4% of anglers respectively (Holiman, 1999). There are over 500,000 anglers (resident and non-resident) with saltwater licenses in counties in Florida where grouper are landed (Bay, Charlotte, Citrus, Collier, Dixie, Escambia, Franklin, Hernando, Hillsborough, Lee, Levy, Manatee, Monroe, Okaloosa, Pasco, Pinellas, Santa Rosa, Sarasota, Taylor, Wakulla and Walton) (Florida Fish and Wildlife Commission, 2001b). The highest numbers of total, resident and non-resident licenses are in Monroe (79,030), Lee (54,777) and Pinellas (49,080) counties. Numbers of licenses by resident and non-residence status are presented by county in Table 7.7.

Social and economic characteristics of private anglers are collected periodically by the Marine Recreational Economics Survey with an economic add-on survey. The economic data add-on conducted during 1997-98 have been summarized in Holiman (1999) and Holiman (2000). The typical angler in the Gulf region is 44 years old, male (80%), white (90%), employed full time (92%), with a mean annual household income of $42,700. The mean number of years fished in the state was 16 years for GOM anglers. The average number of fishing trips taken in the 12 months preceding the interview was about 38 and these were mostly (75%) one-day trips where expenditures on average were less than $50. Seventy-five% reported that they held saltwater licenses, and 59% of them owned boats used for recreational saltwater fishing.

Those anglers who did not own their own boat spent an average of $269 per day on boat fees (Holiman, 1999) when fishing on a party/charter or rental boat. About 76% were employed or self-employed and about 23% were unemployed, mostly due to retirement.

9.3.1.2.2 Charter Boats, Headboats and Party Boats

There are about 1,907 charter boats/headboat/party boat with both reef fish and charter permits for both reef fish and coastal pelagic fish distributed across the Gulf States. The

majority of these permits, 1,194 are in Florida, followed by Texas with 300, Louisiana with 162, Alabama with 159 and Mississippi with 92 (NMFS, as of June 2001).

Most of the discussion below is taken from two recent studies of the industry: "Operation and Economics of the Charter and Headboat Fleets of the Eastern GOM and South Atlantic Coasts" by Stephen M. Holland, Anthony J. Fedler and J. Walter Milon (1999) and "A Cross-Sectional Study and Longitudinal Perspective on the Social and Economic Characteristics of the Charter and Party Boat Fishing Industry of Alabama, Mississippi, Louisiana and Texas," By Stephen G. Sutton, Robert B. Ditton, John R. Stoll and J.Walter Milon (1999). This latter study has been criticized by some industry participants and the GOM Fishery Management Council's Socioeconmic Panel is currently reviewing this study. The criticisms focused on the financial sections of the study.

Overall, about 37% of charter boats reported targeting grouper in the Florida Gulf in 1998. About 60% of headboats reported targeting snapper and grouper (gag and red) in the Florida Gulf in 1998. In the Florida Gulf, the species receiving the most effort from charter boats were grouper, king mackerel and snapper. Gag, red grouper, and snapper species received the most effort from the head boats. In the western Gulf, grouper were not identified by either charter or party boat operators as a target species. The species receiving the largest percentage of total effort for both these groups of fishermen was snapper (Holland et al., 1999).

Between 1987 and 1997 the number of charter boats in the Gulf increased about 16% to 615. Most of this growth occurred along the Florida peninsula coast; in contrast, the number of charter boats in the Panhandle region decreased by 8%. The number of headboats increased about 20%, mostly along the southwest Florida coast. Charter passenger trips remained stable at about 848,458 passengers on 180,523 trips in 1997 (please note that this total is low, since the MRFSS data do not include Texas), while headboat passenger trips increased to 1,137,362 passengers on 44,655 trips in 1997 (Holland et. al. 1999).

9.3.1.2.2.1 Florida Charter and Headboat Industry

Holland et al. (1999) estimated there were 615 charter and 53 headboats located along the Florida Gulf in 1998 (excluding the Keys). Of the boats sampled in 1998 (not the entire fleet), 52.9% of the charter boats held Gulf reef fish charter permits, 56.8% held coastal migratory pelagic permits, 14.3% held South Atlantic snapper/grouper permits, 5.2% held swordfish permits, 7.8% held shark commercial permits, 26.6% held hind and Spanish mackerel commercial permits, 6.5% held South Atlantic snapper/grouper commercial permits, 13.7% held red snapper commercial permits, and 22.1% held commercial Gulf Reef fish permits. Seventy six and one half% of the Headboat operators held Gulf fish reef permits, zero held Gulf reef fish commercial permits, and 70.6% held coastal migratory pelagic fish permits. Major activity centers for charter boats in Florida are: Destin, Ft Myers, Ft Myers Beach, Islamorada, Key West, Marathon, Naples, Panama City, Panama City Beach, and Pensacola, The average charter boat was 37 feet in length and carried a maximum of 6 passengers. Most (88%) had fiberglass hulls, were diesel fueled (76%) with single (41%) or dual engines (59%). Most offered one half-day trips and full-day trips but only 15% offered overnight trips. Average boat fees were $348 for half day; $554 for full day and $1,349 for overnight trips. Of the total number of Florida trips, 47% were half-day, 50% were full day and 3% were overnight trips.98% of all headboat trips were made to federal waters (Holland et al., 1999).

The mean age of Florida headboat operators was 48 years with 84% between the ages of 31-60. 78% were married and 11% were divorced. Florida headboat operators had an average of 13 years of education, with 100% having at least 12 years of education and 22% with 16 years or more. About 86% of the operators were male. All operate on a full-time basis and about 92% reported that 100% of their household income was from their headboat business. Ninety-four% have lived in their homeport county for more than 10 years and operated their boat out of their homeport county for an average of 19 years. Eighty-one% of them were members of their local chamber of commerce and 44% were members of a local headboat association (Holland et al., 1999).

Major activity centers for headboats in Florida are: Clearwater, Destin, Ft. Myers, Ft. Myers Beach, Islamorada, Key West, Marathon, Panama City and Panama City Beach. The average headboat in Florida was 62 feet in length and carried a maximum of 61 passengers. About 51% had fiberglass hulls and are diesel fueled (97%) with single (8%) or dual (92%) engines. Most (86%) offered half-day trips and full-day (64%) trips but one in the survey offered overnight trips. Average Florida headboat fees were $29 for half-day and $45 for full day trips. Of the total number of trips, 80% were half-day and 20% were full day. About two-thirds of these trips were in federal waters offshore and 36% of the headboats took 100% of their trips in federal waters (Holland et. al., 1999).

The mean age of Florida charter boat operators was 46 years with 82% between the ages of 31-60. 63% were married and 15% were divorced. Florida charter boat operators had an average of 13 years of education, with 95% having at least 12 years of education and 34% with 16 years or more. About 98% of the operators were male. Most (90%) operate on a full-time basis and about 61% reported 100% of their household income was from the charter business. 80% have lived in their home port county for more than 10 years and have operated their boat out of their home port county for an average of 15 years. 24% of them belonged to their local chamber of commerce and 34% belonged to their local charter boat association (Holland et. al., 1999).

9.3.2 Social and Economic Features

"Fishing community" is defined in the M-S Act amended in 1996 as "a community which is substantially dependent on or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (Magnuson-Stevens Act section 3(16)). In addition, the National Standard guidelines (May 1, 1998; 63FR24211) define a fishing community as a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent service and industries (for example, boatyards, ice suppliers, tackle shops).

This section reviews the literature on fishery dependent communities and presents a listing of fishing communities that are related to grouper fishing. From this literature, places previously identified as fishing communities along the GOM are in Florida: Apalachicola, Carrabelle, Cedar Key, Clearwater, Cortez, Destin, Ft. Myers, Ft. Myers Beach, Key West, Madeira Beach, Marathon, Naples, Panacea, Panama City, Pensacola, St. Petersburg, Steinhatchee, Tampa and Tarpon Springs; in other Gulf states: Biloxi, MS, Freeport, TX, Galveston, TX, Orange Beach, AL, Port Aransas, TX, South Padre, TX.

This section also includes a baseline profile for many of the impacted communities. This identification process and the baseline profiles used available data from previous studies

as well as NMFS databases on landings, permits and dockside values and data for the U.S. Census.

9.3.2.1 Fishing Dependent Communities: Previous and Continuing Studies

The literature on fishing dependent communities addresses three areas: identification of the communities, selection of variables appropriate for assessment and the assessment method itself. Community identification and selection criteria can be very complex or very simple. A simple first level approach would involve examining social and demographic variables at the county level where some fishing activity occurs. A more complex approach involves attempting to gather data and information on as small an entity as possible that qualifies as a fishing community. As the definition of community moves farther from traditional economic or political entities, less official data are available and more field research is required to complete the baseline profile and include relevant social and cultural value data.

The Pacific Fishery Management Council's web site presents some baseline fishery descriptions of the West Coast Marine Fishing Communities. These communities are counties where any activity related to Council regulated fisheries occurs. These descriptions provide U.S. Census, county level statistical and demographic data about communities engaged in federally or state regulated fisheries in California, Oregon and Washington. These data include recent and projected populations, age structure, ethnic and racial characteristics, educational attainment, employment characteristics, labor and proprietor income information, export bases, landings data and ex-vessel revenue information (http://www.pcouncil.org).

Jacob et al. (2001) developed a protocol for defining and identifying fishing dependent communities in accordance with National Standard 8 through a current project titled "Defining and Identifying Fishing-Dependent Communities: Development and Confirmation of a Protocol," funded by the Marine Fisheries Initiative (MARFIN) program. The project used central place theory to identify communities. A central place is where services, goods and other needs are met for the residents in the central place, as well as for those in surrounding hinterlands (Richardson, 1979). It differs from using an administrative unit such as county boundaries, which may distort smaller communities or locality data as it is aggregated. The authors believed central place theory works well for defining and identifying fishing-dependent communities or localities as it provides a geographic basis for including multiplier effects that capture forward and backward linkages. In most fishing communities, forward linkages include those businesses that handle the fish once it is brought to the dock, such as fish houses, wholesalers, exporters, and seafood shops and restaurants. Backward linkages are the goods and services that fishermen depend upon such as boat building and repair; net making and repair; marinas; fuel docks; bait, tackle and other gear venders (Jacob et al. 2001).

Jacob et al. (2001) compiled data for Florida from the U.S. Census, Florida Fish and Wildlife Conservation Commission, NMFS, Bureau of Economic Analysis, and Bureau of Labor Statistics by zip code, then aggregating the zip code data by population centers and their surrounding hinterlands into central places. They conducted personal interviews with key informants in a subset of possible fishing dependent communities in order to evaluate the usefulness of combining central place theory with the zip code based empirical approach. The authors expected that their approach would produce a typology of commercial and recreational fishing dependent communities. This typology could be used to generate development strategies for these communities as they adjust to changes in

management, the environment, and demographics.

Using their protocol of defining fishing-dependent communities, Jacob et al. (2001) initially determined 5 communities as commercially fishing dependent and 7 communities as recreationally fishing dependent. Further investigations resulted in validating 5 communities as commercially fishing dependent. The authors expressed little confidence in the data used and indicators developed based on such data to confirm the other communities as recreationally fishing-dependent communities. The five commercially fishing-dependent communities are: Steinhatchee, Apalachicola, Panama City, Ochopee/Everglades City, and Panacea.

Kusel's (1996) approach is to define a forest-dependent community as a place with a traditional geographical sense but combine that definition with a measure of place identity. That is, how do people in that place relate to the natural resource base beyond economic or social measures found in the U.S. Census. (e.g., population, education achievement, poverty) Kusel and Doak (1996) examined six forestry regions in California. They used community workshops to involve local expert knowledge. They began with census block groups and built up to the county levels and then explored the levels of identity that various groups had with particular definitions of community. One of their major findings was that socioeconomic data were not a good predictor of community identity.

Dyer and Griffith (1996) conducted a baseline study of communities dependent on the multispecies groundfish fishery (MGF) in New England and the mid-Atlantic. The study examined the deterioration of social, human and cultural capital that would occur with a complete collapse of the MGF. Dyer and Griffith (1996) drew on the concept of Natural Resource Community (NRC) as a basis of their definition of a fishery dependent community. NRCs exist where individuals have dependence on a "renewable natural resource and are rooted in local history and local traditions and derive social and cultural identity from a sense of place whose life rhythms rise and fall with populations of fish, seasonal conditions at sea and the increasingly complex regulatory environment entangling their tradition". They also consider that this fishing activity may be embedded in wider communities and towns contributing to the cultural diversity of those communities and towns (Dyer and Griffith, 1996).

Dyer and Griffith (1996) researched major MGF communities as well as smaller ports. The research areas were initially selected using licensing data, vessel tonnage listings, permit data and information from key informants such as state enforcement personnel, NMFS port agents and local industry members. Additional social and economic data were collected during community visits.

In order to compare the various fishing communities, Dyer and Griffith (1996) developed a Fishery Dependence Index using measures of infrastructure and support related to fishing such as: numbers of repair and supply facilities, fish dealers and processors; the presence or absence of religious and secular art and architecture dedicated to fishing; and numbers of MGF permits and vessels. Variations in fishery dependency both between and within ports were assessed. Ports that were more isolated and less flexible in terms of using other fish stocks and gear types were more fishery dependent; ports where particular classes of fishermen within the industry were not well integrated into other fisheries or economic entities (e.g. tourism) were ranked more dependent on the MGF fishery. Ports with historical and cultural indicators of reliance on fishing (mariner museums etc.) were ranked more dependent. Competition and conflict amongst participants reflected

perceptions that the resource was scarce and therefore the participants more dependent on it (Dyer and Griffith, 1996).

Wilson et al. (1998) conducted a social and cultural impact assessment of the Highly Migratory Species (HMS) Fishery Management Plan (FMP) and the amendment to the Atlantic Billfish FMP. This report combines baseline descriptions of demographic, social, cultural and economic aspects of affected fishing communities with an analysis of potential impacts--both quantifiable and qualitative--on these communities. The study selected a sample of fishing communities in Puerto Rico, Louisiana, Florida, North Carolina, New Jersey and Massachusetts to illustrate the range of potential impacts of the proposed regulatory changes. The communities were selected partly by examining landings data, but with a recognition that the fishing fleets employing particular gears are dispersed geographically; this is to say that concentrated landing sites and the location of non-centralized fishing communities often are not identical. The existence of previous studies and the suggestions of HMS and Atlantic Billfish industry Advisory Panels also influenced the choice of which communities were studied.

Wilson et al. (1998) outlined three categories of impacts on their selected communities: those that "affect the volume of money that is going through the community;" those that "affect the flexibility of the fishing operations;" and those that "impose direct costs on fishing operations." The following table summarizes the categories of regulatory impacts:

	Category of impact on fishery operation:		
	Volume	Flexibility	Direct Costs
Type of regulation:	Quotas	Derby organization of quota systems	VMS
	Size limits	Time closures	Permits
	Bycatch limits	Area closures	Reporting
		Controls on soak time	Industry-financed observers
		Gear prohibitions and restrictions	

In order to measure social and cultural impacts, they refer to the "economic vulnerability" of the fishery in terms of competition faced in supply and marketing and the extent of social capital or community networks available. Social capital are those aspects of a community's social structure which allow people with little financial capital to accumulate the symbolic and material means to participate in an economic activity. Social capital consists of trust, relationships and support institutions such as churches and other means that enable economic capital to make necessary connections (Wilson et al., 1998).

Wilson et al. (1998) measured fishery dependence with demographic variables, percentage of employment in fishery related industries, income for those industries, landings by species, fishing related businesses (marinas, boat rental shops, dive shops, boat dockage and repair facilities, tackle and bait shops, tourism related to fishing). He also documented the social capital of the fishing community with numbers of recreational or commercial fishing associations the fishermen belonged to or met at. Wilson's study identified several fishing dependent communities along the Gulf coast.

Griffith (1996) categorized fishermen's dependence on resources in North Carolina by examining: 1) motivation for fishing (e.g., income, recreation, subsistence); 2) percentage of income derived from fishing; 3) time commitment (months/years of experience); 4) flexibility index, from low to high, measuring the numbers of gears, fisheries and species

with which the fisherman is engaged; 5) number of different kinds of vessels; 6) number of crew involved in fishing operations; 7) relationship to the seafood marketing/processing sector; 8) principal social problems; 9) principal biological issues; 10) most desired regulations; and 11) most disruptive regulations. Using this system, fishermen were grouped into 7 categories on a continuum from full time, owner operator commercial fisherman to affiliated recreational fisherman (angler). This classification scheme goes beyond simple ranking by income earned from the fishery and introduces economic relationships with crew and market. Ethnographic data also were included in this analysis, including investigations of fishermen's main social and biological concerns related to fishing; these data contributed to an evaluation of how the various categories of fishermen would be affected by a range of proposed licensing systems.

Griffith (1996) also used cultural mapping of fishing locales throughout North Carolina, questionnaires and in-depth interviewing, and the use of focus groups. Secondary sources also were consulted, such as fishery organization membership lists and data collected by the N.C. Department of Marine Fisheries. Among the respondents were recreational anglers, charter boat captains and other personnel, commercial fishermen and families, seafood processing employees, and employees and collaborators of regulatory agencies in North Carolina and other states. To reduce bias introduced by conflicting political perspectives on given topics, Griffith (1996) also triangulated the qualitative data, which were collected. This is a process by which the researcher confirms data by hearing it reported from more than one interviewee.

In summary, McCay (2000) suggests that assessments of regulatory impacts on fishing-dependent communities consider not only geographic definitions of communities and economic characteristics therein, but also the level of vulnerability or resilience, of fishing communities and operations. That is, questions of fishing dependence and "sustained participation" in fisheries must consider how able participants in a given fishery can move among fishery sectors, and how able they are to move out of the fishery altogether into alternative employment opportunities. The studies reviewed took into account not only the economic characteristics but also the demographic and social characteristics of the areas where fishing activity occurs. Several of them developed strategies for assessing and or ranking these characteristics and variables. The following table summarizes the various measures of fishing dependence.

Social, Cultural and Economic Indicators of Fishing Dependence

Measures of fishing dependence from Wilson et al. (1998):

- Economics, including percent employment in fishery-related industries, and unemployment levels, and income
- Fisheries characteristics, including landings by species by various sectors
- Fishing-related businesses, for example numbers of marinas, rentals, snorkel and dive shops, boat dockage and repair facilities, tackle and bait shops, fish houses, and lodgings related to recreational fisheries industry
- Fishing-related activities, such as fishing tournaments and seafood festivals
- Presence of organizations, such as recreational or commercial fishing associations.

Measures of fishing dependence from Dyer and Griffith (1996):

- Numbers of permits compared to operational vessels
- Numbers of suppliers of equipment
- Numbers of dealers/ processors

For seafood handling sectors (icing, shipping, processing), percentage of business derived from the fishery in question, and average employment per plant
Isolation or integration of the fishery into alternative economic sectors. Do the fishers represent a political-economic enclave or are they integrated into the community?
Vessel types (large, small, mixed?)
Percent of population in fishery or fishery-related industry
Level of competition within a port between different components of the MGF fishery

Measures of fishing dependence from Griffith (1996):

Motivation for fishing (income, subsistence, recreation)
Percentage of income derived from fishing
Time commitment (number of months per year, and number of years of experience, etc.)
Flexibility index (number of species able to fish, gears/vessels, territories, etc.)
Number of different kinds of vessels
Number of others (e.g. crew) involved in fishing operations
Relationship to the seafood marketing/processing sector
Seasonal variation in fishing activity
Vessel sizes and sizes of crew by port/ dockage site
Diversity of species targeted, gear, type and size and vessel by port/ dockage site
Diversity/ flexibility of individual fishermen
Degree of localization; i.e., commitment to a particular dockage site and landing facility
Nature of a fishing site's "cultural foci." These foci are instrumental in "anchoring, directing, and orienting fishing behaviors in ways that both confine fishermen to specific territories and fishing practices and provide them with opportunities to expand those fishing practices" (Griffith, 1996)
Examples of "cultural foci":
- fish houses (icing and packing of seafood)
- processing establishments
- clusters of fishing vessels and gear, usually near launching facilities
- private family fishing locations

Spatial patterns and organizational features (Are fishing operations concentrated around processing/marketing facilities, or dispersed? Are fishing operations household-organized or organized by seafood dealers and processors?). These features will affect fishing behaviors and responses to new regulations.

9.3.2.2 Identification of fishing communities that may be impacted by Secretarial Amendment 1 of the Reef Fish Fishery Management Plan

The red grouper rebuilding plan will potentially affect a wide range of users of the grouper resource. To build a comprehensive list of geographical locations which may be impacted, data were used from: state and federal licensing data (NMFS permit records as of May 2001; NMFS logbook data as of April 2001); NMFS landings records and sales records for dealers; sites identified in other published studies; informal telephone conversations with persons knowledgeable about the reef fish fishery such as fishermen, dealers, data collectors, personnel at state fish and wildlife commissions.

The following criteria were used to include communities. There are some additional cities/locations where grouper sales are significant (e.g. over $100,000 per year) which

could reasonably be included in this list after additional analysis. This list should be considered a preliminary effort at designating these communities. First, the area was included if it was associated with commercial vessel reef fish permit holders using these gears: longlining, spears, traps, or vertical lines. Second, the area was included if it was associated with greater than 10 charter, party or headboat reef fish permit holders. Third, the area was included if it was in the top 20 locations for grouper sales in the GOM (top 85%). Fourth, the area was included if it was identified as a fishing community or activity center by a previous study; Fifth, the area was included if there were more than 20,000 private anglers holding licenses in the county where the proposed area was located. Using these criteria, we identified 38 cities/ports around the GOM where any of these types of grouper activity occurred. Being included in this universe does not imply that a significant amount of grouper related fishing activity occurred in the area, simply that some activity potentially occurred and that activity might be impacted by the rebuilding plan or other regulations in Secretarial Amendment 1. Port and site visits can further verify and rank which of these areas will be impacted the most from the proposed regulations.

The permit owner addresses for the 156 bottom longline vessels are clustered in Florida: Cortez, Madeira Beach, Miami, St. Petersburg, and Tampa.

The permit owner addresses for 894 vertical line vessels are clustered in: Apalachicola, Carrabelle, Cedar Key, Clearwater, Crystal River, Destin, Ft. Myers, Indian Rocks, Madeira Beach, Marathon, New Orleans, Panacea, Panama City, Pensacola, Nokomis, St. Petersburg, Steinhatchee, Tampa, Tarpon Springs, and Yankeetown in Florida; Orange Beach, AL; Pascagoula, MS; and Houston, TX.

As of May 1998 there were 86 fish trap endorsements to the commercial reef fish permit and currently (as of November 2001) there are 65 endorsements. The permit owner addresses for vessels using fish traps are clustered in these areas: Destin, Homosassa, Naples, Steinhatchee, and Tarpon Springs, FL. Vessels using diving to catch reef fish do not show a clear cluster but are found in several areas of the Gulf. There are more than three reef fish permitted dealers with a facility in these locations: Cameron, LA; Galveston, TX; and Destin, Ft. Myers Beach, Key West, Madeira Beach, Marathon, Panama City, Pensacola, St. Petersburg, Tampa, and Tarpon Springs, FL.

The permit owner addresses for charter/headboat holders of reef fish permits were clustered in these areas: Apalachicola, Biloxi, Carrabelle, Chauvin, Clearwater, Destin, Freeport, Galveston, Houston, Marathon, Naples, Orange Beach, Panama City Beach, Pensacola, Port Aransas, Sarasota/Nokomis/Englewood. In June 2001 a charter vessel/headboat permit moratorium was submitted to NMFS for approval and implementation. Note in NMFS data files, some owners listed ports where vessels were documented rather than actual home ports.

The top 20 cities in terms of grouper sales together accounted for over $18 million of grouper sales in 2000. This is over 85% of all grouper sales in the Gulf for 2000. The sales, coming from various numbers of vessels and dealers in each location, represent a minimum of $200,000 per year per area. The ranking of the cities presented here change relatively little over the period, 1997-2000. These cities are in order of sales ranking: Madeira Beach, Panama City, Apalachicola, St. Petersburg, Tarpon Springs, Crystal River, Ft. Myers Beach, Key West, Tampa, Naples, Clearwater, Steinhatchee, Miami, Cortez, Destin, Homosassa, Panacea, Everglades, Golden Meadow, Stock Island.

The U.S. Census periodic economic survey does not collect economic data (such as

numbers of businesses, industry employment by NAISC industrial code) for entities with under 2500 population or for census-designated places. A census-designated place (CDP) is a place recognized by the census but unincorporated as a governmental area. For example, economic data from the US Census economic survey exist for Madeira Beach, FL with a population of about 4,400 while no such data exist for Steinhatchee, FL because it is unincorporated. Data do exist for Cortez, FL because it is a CDP. For places without Census data, other data sources for example by county or by zip code (when the whole area is included in one zip code such as Steinhatchee) may provide information. Otherwise, the data need to be collected through interview and site visits. Data for numbers employed in agriculture, forestry, and fisheries need to be interpreted carefully. Fishermen (captains and crew) would be counted in this number while persons working in wholesale (e.g. processing, fish houses) may be counted in the general category of wholesale rather than in fishery employment.

In general these areas have small populations, many with less than 7,000 persons (Apalachicola, Carrabelle, Cedar Key Cortez, Homosassa, Ft. Myers Beach, Everglades City, Madeira Beach, Stock Island). Several of these areas have an unusually high rate of less than high school graduation, some as high as 50%. With exceptions (Carrabelle, 13.6% and Cedar Key, 12.2%) many of the areas have relatively low percentages, 2-3% counted as employed in agriculture, forestry and fishing. These types of demographic statistics give an idea of the background and labor market conditions within which the various fishing activities operate. Small, isolated areas with low educational attainment among the labor force indicate relatively few alternatives for the labor force. In these cases, losing fishing activity would impact the area relatively more than an equally situated areas with a more educated workforce.

In order to assess the impacts of Secretarial Amendment 1 on various communities both social and economic data need to be analyzed. Some of this is available for these communities in Lucas (2001) for Madeira Beach and in Wilson et al. (1998) for communities along the GOM affected by Billfish regulations. Many cities in Wilson et al. 1998 are the same as listed here: Apalachicola, Clearwater, Madeira Beach, St. Petersburg, Tampa, Destin, Ft. Myers, Ft. Walton Beach, Gulf Breeze, Panama City, Pensacola, Tarpon Springs. Additional field research would be needed to complete the assessment of the impacts.

In general such an assessment would examine the vulnerability of a community to particular regulations. That is, there needs to be an attempt to measure the species dependency of the community while considering a number of other issues such as:

How resilient are markets for fish as well as for tourism to supply interruption? If tourists come to Florida expecting an experience that includes catching a grouper and there are few alternatives, that tourist may go elsewhere if grouper are not available. If restaurants expect to receive fresh grouper from vessels or dealers and that grouper is not available for certain times of the year, the way is open for imports to displace domestic sales to those restaurants. If markets and institutional connections between buyers and sellers (tourists and providers) are weakened by regulations, they may not be able to recover. The less resiliency the market has, the greater the impact on the community.

How integrated is this fishing into the community? For example, do tourists gather around to watch the fish being unloaded or is the fishing activity relatively isolated? Such tourism may not depend on the exact number of fish being unloaded but rather the existence of the activity. This fishing activity may generate tourist revenues in addition to

employment and income in the fishing sector. Tourists may come to the area to participate in fishing activity. The fishing activity may create relatively large amounts of income moving through the community, which is translated into employment in other sectors. The more integrated an activity is into the community, the greater the impact if that activity is lost.

If catches are reduced, how much flexibility do the fishermen have? This flexibility is measured as ability to switch to other gear, other fisheries, and other means of livelihood. If other fisheries and gears are already tightly regulated such as red snapper and shark are along the Gulf Coast then the opportunities for fishermen are fewer than if there were more opportunity. Flexibility is also constrained by time or area closures and fuel, ice and other costs may increase with increasing distances to fishing grounds. The less flexibility that some fishermen have, the greater the impact from regulations, which further reduce that flexibility. Communities with more than one type of vessel, several fish houses and recreational operations often have shared infrastructure. Elimination of one of the groups could make the infrastructure (marines, fish houses, tackle shops, restaurants) more vulnerable in economic terms. The flexibility and ability of the infrastructural firms to respond may be reduced under certain regulations.

Are there indirect social costs to some regulations? These indirect effects impact repair shops, tackle ships, marinas, fish houses and other economic relationships dependent on the vessels' activities. Fisherman institutions such as International Gamefish Association, National Association of Charter Boat Operators, Coastal Conservation Association, Various Guide Associations, and Southern Offshore Fishing Association (SOFA) may be weakened by a loss of membership due to regulations. The more indirect relationships that are destabilized by the regulation, social or economic, the greater the impact on the community from the regulations.

Some of these impacts are more easily measured than others. Absolute economic impacts can be derived from available data. The direct inflow of sales into particular communities from grouper sales tells us something about the absolute impact on an area. These impacts should be placed in the context of a particular community. Losing $300,000 from an area the size of Cortez, FL would have much more of an economic impact on the community than losing the same amount from a larger more economically diversified area such as Miami. The relative impacts on communities are not ranked here, due to a lack of information or confidentiality constraints. The absolute economic impacts on certain areas related to certain fishing activities are ranked below. Some of these communities would be impacted under more than one type of regulation.

In absolute terms, reducing grouper catches from longliners will have absolute impacts on certain communities. Primary economic impacts from regulation of longlining gear would be felt in order of ranking: Madeira Beach, St. Petersburg, Panama City and in smaller amounts in: Cortez, Ft. Myers Beach and Miami (Marathon).

In absolute terms, reducing grouper catches from vertical line vessels will have absolute impacts on certain communities. Primary economic impacts from regulation of vertical line catches would be felt in order of ranking: Panama City, Tarpon Springs, Apalachicola, Ft. Myers Beach and in smaller amounts in: Clearwater, Madeira Beach, Crystal River, Steinhatchee, Panacea, Destin.

In absolute terms, reducing grouper catches from vessels that use pots and traps will have absolute impacts on certain communities. Economic impacts from regulation of pots and

traps would be felt in order of ranking: Naples, Crystal River, Steinhatchee, Everglades City, and Yankeetown.

In absolute terms, reducing grouper catches from dive operations using powerheads will have absolute impacts on certain communities. Economic impacts from this regulation would be felt in order of ranking: Tampa, Key West, and Stock Island.

In absolute terms, reducing grouper catches from charter/headboat/party boats will have absolute impacts on certain communities. Primary economic impacts from regulation of recreational catches would be felt in order of ranking: Panama City, Destin, Orange Beach and secondarily in: Port Aransas, Biloxi, Galveston, Naples, Marathon.

9.4 Administrative Environment

9.4.1 Fishery Management Under the FMP

The Magnuson-Stevens Act was originally passed by Congress in 1976. Section 302 of the Act created eight regional fishery management councils, including the Council, to develop Fishery Management Plans (FMPs) to regulate fisheries in an effort to prevent overfishing. Councils prepare FMPs for each fishery under its jurisdiction, and submit these plans to the Secretary of Commerce for final approval.

Membership on Councils includes the directors of state fishery organizations, the Regional Director of NMFS, and knowledgeable citizens appointed by the Secretary of Commerce as voting members and representatives from the U.S. Fish and Wildlife Service, Coast Guard, regional Marine Fisheries Commission, and Department of State as nonvoting members.

During the process of developing FMPs, the Magnuson-Stevens Act directs the Councils to conduct public hearing to provide opportunities for input from the affected public. The Magnuson-Stevens Act also establishes a Scientific and Statistical Committee to assist with statistical, biological, economic, social, and other scientific information, and Advisory Panels to provide information and to assist in development and review of management plans and plan amendments.

When a council approves a plan, it forwards the plan to NMFS for review and approval. NMFS, NOAA, and NOAA General Counsel (GC) assure that the plan or amendment meets various federal requirements. Following this internal review, the plan or amendment continues on a two-part track. One part leads to approval of the management plan or plan amendment, and the other leads to a final rule that establishes regulations.

For the management plan or plan amendment, NMFS publishes a Notice of Availability that starts a 60-day public comment period. Following the comment period, NMFS and NOAA GC conduct a final evaluation, and usually the plan is approved disapproved or partially approved at the National level. In rare cases the Regional Administrator (in the case of Council plans, the Southeast Regional Administrator) takes over this function.

To implement a plan or amendment, NMFS develops a Proposed Rule (PR) that also goes through NMFS, NOAA, NOAA GC, and public review. After internal review, NMFS publishes the PR in the Federal Register to start a 45-day public comment period. The Regional Administrator responds to the public comments, and then completes a rulemaking package for the Final Rule (FR). The FR undergoes further federal review and

approval by NMFS, and gets published in the Federal Register.

9.4.2 National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) requires all Federal actions to be evaluated for potential environmental and social and economic environment impacts, and for these impacts to be assessed and reported to the public. As it applies to the formulation of fishery management plans, the NEPA process should ensure that the potential environmental ramifications of actions determined necessary to manage a fishery are fully considered. Thus, proposed regulations that may set size or bag limits, limits on the number of permits or vessels, quotas, allowable gears, closed seasons or areas and any other measure is reviewed for its potential affect on the broader marine environment, in addition to its affect on the specific fishery being managed.

Councils initially conduct an Environmental Assessment (EA), which is a concise statement that determines whether the FMP (and subsequently any proposed amendment to the plan) will have a significant impact on the environment. If there is no potential significant impact, a "Finding of No Significant Impact," or FONSI, is issued.

If there is a determination that the action will result in a significant impact, then a full Environmental Impact Statement (EIS) is required. In this determination, the Council must consider the context and intensity of the action or activity, both short term and long term effects, impacts that may be beneficial or adverse, and effects on locality and society as a whole. Generally, the EIS is drafted concurrently with the FMP and it lays out the proposed action(s), alternatives to the proposed action(s), and the environmental consequences for each alternative. The Draft EIS is sent to the EPA for a 45-day review period, and subsequently its availability is announced in the Federal Register. The public is afforded an opportunity to comment on it, generally concurrently with the public comment period for the FMP itself. The EIS is submitted to the Secretary of Commerce along with the FMP for final approval.

9.4.3 Endangered Species Act (16 U.S.C. Section 1531 et seq.)

The Endangered Species Act (ESA) protects animals and plants threatened with extinction. When a project is proposed that affects a listed threatened or endangered species, the ESA requires all regulatory agencies to consult with the Fish and Wildlife Service (and in some cases, NMFS for jointly managed species) prior to issuing any permit or taking any other action that would harm the listed species. Consultations are concluded informally when proposed actions may affect but are not likely to adversely affect endangered or threatened species or designated critical habitat. Formal consultations, including a biological opinion, is required when proposed actions may affect and likely to adversely affect endangered or threatened species or designated habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives.

Information on endangered and threatened species in the Gulf of Mexico is located in Section 9.2.2. Although no reef fish species in the GOM are listed as threatened or endangered, four species are on the NMFS candidate list of species for possible future listing. These species are speckled hind (*Epinephelus drummondhayi*), goliath grouper (formerly known as jewfish) (*E. itijara*), warsaw grouper (*E. nigritus*), and Nassau grouper (*E. striatus*).

9.4.4 Marine Mammal Protection Act (16 U.S.C. 1361 et seq.)

The Marine Mammal Protection Act (MMPA) established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States. Under the MMPA, the Secretary of Commerce (authority delegated to NMFS) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea and marine otters, polar bears, manatees and dugongs.

Part of the responsibility that NMFS has under the MMPA involves monitoring populations of marine mammals to make sure that they stay at optimum levels. If a population falls below its optimum level, it is designated as "depleted," and a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. This amendment required the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction, development and implementation of take reduction plans for stocks that may be reduced or are being maintained below their optimum sustainable population levels due to interactions with commercial fisheries, and studies of pinniped-fishery interactions.

The MMPA requires all commercial fisheries to be placed in one of three categories, based on the relative frequency of incidental serious injuries and mortalities of marine mammals in each fishery. Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing; Category II designates fisheries with occasional serious injuries and mortalities; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities. The GOM reef fish fishery (all gear types) is listed in Category III, as there have been no documented interactions between this fishery and marine mammals (68 FR 41725).

9.4.5 Non-fishery Management Laws & Regulations

The implementation of a number of federal, state, and local laws, regulations, and policies have a direct effect on habitat and waters that may be considered essential habitat or habitat of particular concern to the fish species managed under the GOM Reef Fish FMP. The designation of essential fish habitat (EFH) allows the Council and NMFS to intervene in decisions on non-fishing activities that may affect essential habitat, and requires other federal agencies with responsibility for proposed non-fishing actions to consult with NMFS on projects with potential adverse impacts on EFH. The responsible federal agency must respond in writing to NMFS with the rationale for whatever mitigation it authorizes.

The following laws and regulations are those that permit non-fishing activities for which the Council and NMFS may potentially intervene. Brief descriptions of the intent of the law is provided. Much of these descriptions have been taken from A Guide to Protecting Wetlands in the Gulf (Goldberg, et al. 2001).

9.4.5.1 Federal

9.4.5.1.1 The Clean Water Act (33 U.S.C. Section 1251 et seq.)

In 1972, Congress passed the Clean Water Act (CWA) - also known as the Water Pollution Prevention and Control Act - to protect the quality of the nation's waterways including oceans, lakes, rivers and streams, aquifers, coastal areas, and wetlands. The law sets out broad rules for protecting the waters of the United States; Sections 404 and 401 apply directly to waters and wetlands protection.

9.4.5.1.1.1 Section 404 of the Clean Water Act

Section 404 of the Clean Water Act (often referred to as "Section 404" or simply "404") forbids the unpermitted "discharge of dredge or fill material" into waters of the United States. Section 404 does not regulate every activity in wetlands or coastal areas, but requires anyone seeking to fill any area to first obtain a permit from the Army Corps of Engineers (ACOE). Constructing bridges, causeways, piers, port expansion, or any other construction or development activity along a waterway or in a wetland generally requires a 404 permit. When a fill project is permitted, there is usually mitigation required to replace lost wetlands.

9.4.5.1.1.2 Section 401 of the Clean Water Act

Section 401 of the Clean Water Act requires that an applicant for a Section 404 permit obtain a certificate from their state's environmental regulatory agency that the activity will not negatively impact water quality. This permit process is supposed to prevent the discharge of pollutants (pesticides, heavy metals, hydrocarbons) or sediments into waters, that may be above acceptable levels, because decreased water quality may endanger the health of the people, fish, and wildlife. However, acceptable pollutant levels have not been established for many wetlands, which makes it difficult for state agencies to fully assess a project's impact on water quality.

9.4.5.1.1.3 National Estuary Program

The National Estuary Program, established by Congress in 1987 by amendments to the Clean Water Act, identifies estuaries of national significance and establishes a management conference to develop a comprehensive management plan for the estuary. The management conference often involves representatives from NOAA and/or NMFS. It is given the responsibility to: assess and characterize trends in water quality, pollutants, natural resources, uses of the estuary, and causes of environmental problems; develop a comprehensive conservation and management plan (CCMP) that recommends priority corrective actions and compliance schedules addressing point and nonpoint sources of pollution to restore and maintain the chemical, physical, and biological integrity of the estuary, including restoration and maintenance of water quality, a balanced indigenous population of shellfish, fish, and wildlife.

Implementation of the CCMP is completely voluntary, rather than regulatory, but the process allows consideration and incorporation of many issues such as protection or restoration of EFH. Additionally, similar to the language in the Coastal Zone Management Act, the management conference is supposed to review all Federal financial assistance programs and development projects in accordance with the requirements of Executive Order 1372, as in effect on September 17, 1983, to determine whether such assistance

program or project would be consistent with and further the purposes or objectives of the CCMP.

9.4.5.1.2 Section 10 of The Rivers and Harbors Act (33 U.S.C. Section 403)

The Rivers and Harbors Act was created in 1899 to prevent navigable waters of the United States from being obstructed. Section 10 of the Act requires that anyone wishing to dredge, fill, or build a structure in any navigable water and associated wetlands obtain a permit from the ACOE. An activity affecting wetlands may require a Section 404 and Section 10 permit, thus both sections are often included together in a permit notice. When these activities are permitted, and there is direct loss of submerged habitat, such as seagrasses, then mitigation is often required to compensate for this loss.

9.4.5.1.3 The Coastal Zone Management Act (16 U.S.C. Section 1456(c))

In 1972, Congress passed the Coastal Zone Management Act (CZMA) to protect the nation's coasts by helping states regulate activities in the coastal zone. The CZMA encourages states to develop a Coastal Zone Management Plan (CZMP) in which they define permissible land and water uses within the state's coastal zone. The coastal zone generally extends 3 miles seaward (state waters) and inland as far as necessary to protect the coast. In the GOM, state waters for both Texas and Florida extend approximately 9 miles (3 nautical miles). The program is administered at the federal level by the Coastal Programs Division (CPD) within NOAA's Office of Ocean and Coastal Resource Management (OCRM). States with approved CZMPs receive federal funding to help them protect and improve the quality of their coastal areas. All five states bordering the GOM have approved CZMPs.

The CZMA requires that any applicant for a federal permit obtain a determination from the state that the activity is consistent with its CZMP, if the activity may affect the natural resources in the coastal zone. This process is called a "consistency determination." Thus, a Section 404 permit that may affect a state's coastal zone cannot be issued unless the state certifies that the activity is consistent with its CZMP. Each state has a procedure for obtaining CZMP consistency determinations and includes an opportunity to obtain comments from state and local agencies, as well as the public. If a state fails to act on an application for a consistency determination within 6 months, it is presumed that the activity is consistent with the CZMP.

9.4.5.1.3.1 National Estuarine Research Reserves System

The National Estuarine Research Reserves System was established by the Coastal Zone Management Act of 1972, as amended. It is a network of 25 protected areas that represent different biogeographic regions of the United States. It helps to fulfill NOAA's stewardship mission to sustain healthy coasts by improving the nation's understanding and stewardship of estuaries.

Each reserve is a "living laboratory" in which scientists conduct research and educators communicate research results. Reserve staff members work with local communities and regional groups to address natural resource management issues, such as nonpoint source pollution, habitat restoration and invasive species. Four NERRs are established in the GOM: Apalachicola Bay and Rookery Bay in Florida; Weeks Bay Reserve in Alabama, and Grand Bay in Mississippi.

9.4.5.1.4 The Coastal Wetlands Planning, Protection, and Restoration Act (Public Law 101-646, Title III)

The Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) of 1990 sets aside millions of dollars every year for voluntary wetland restoration projects in coastal states. The state of Louisiana receives approximately 70% of the funding from CWPPRA, while other states may receive money through wetland conservation grants from the U.S. Fish and Wildlife Service, or from the Secretary of the Interior under the North American Wetlands Conservation Act. Agencies and citizens can take part in the CWPPRA process by proposing projects of local concern and providing input on proposed restoration projects. Local ACOE district offices and regional Fish and Wildlife Service offices maintain information on projects being funded under CWPPRA.

9.4.5.1.5 The Fish and Wildlife Coordination Act (16 U.S.C. 661, 666c)

The Fish and Wildlife Coordination Act protects the quality of the aquatic environment needed for fish and wildlife resources. The Act requires the ACOE to consult with the FWS or NMFS to ensure that the environmental value of a body of water or wetland is taken into account in the decision-making process as it reviews permit applications. Consultation is generally initiated when the Corps sends the FWS or NMFS and the states a public notice of a Section 404 permit. FWS or NMFS may file comments on the permit stating concerns about the negative impact the activity will have on the environment and suggesting measures to reduce the impact.

9.4.5.1.6 Title III of the Marine Protection, Research and Sanctuaries Act of 1972

The National Marine Sanctuaries Program was created in Title III of the Marine Protection, Research and Sanctuaries Act of 1972. Today, there are 13 national marine sanctuaries protecting some 18,500 square miles of ocean and coasts. Of these, two are located in the GOM: the Flower Gardens Banks and Florida Keys National Marine Sanctuaries.

The Flower Garden Banks National Marine Sanctuary was designated on January 17, 1992. The area containing both the East and West Banks equals 41.7 square nautical miles in size and contains 350 acres of reef crest. Four years later in October 1996, Congress expanded the sanctuary by adding a small third bank. Stetson Bank, also a salt dome, measures about 800m long and 300m wide and is located about 70 nautical miles south of Galveston, Texas.

The waters immediately surrounding the entire archipelago (1,700 islands) of the Florida Keys have been designated as a national marine sanctuary since 1990. It includes the productive waters of Florida Bay, the GOM and the Atlantic Ocean, and cultural resources are also contained within the sanctuary. The sanctuary extends 220 miles in a northeast to southwest arc between the southern tip of Key Biscayne, south of Miami, to beyond, but not including, the Dry Tortugas Islands. Authorized by Congress, this 2,800 square nautical mile sanctuary was established to stem mounting threats to the health and ecological future of the coral reef ecosystem.

Staff from the NMFS are involved in the federal management teams that develop the sanctuary management plans to ensure coordination with regard to fisheries management, and protection of vital fishery resources and fishery habitats.

9.4.5.2 State Laws and Policies

States often have their own permitting processes for any activities that may affect wetlands, waters, and other environmentally-sensitive habitats and ecosystems. States have the ability to be more stringent than federal laws on the same issue. Additionally, states may have their own land/water protection program with defined designations such as aquatic preserve, marine reserve, wildlife refuges, and wild and scenic river, to name a few. Each state sets its own parameters, with regard to the types of activities or development that may occur in these designated areas, and will usually require that proposed activities be reviewed to ensure that they will not cause environmental harm. Some states require that a permit be obtained before the activity can proceed. However, there is no process for the Council or NMFS to provide comments or review of state permitting activities to ensure adequate safeguards to protect EFH, unless there are concurrent federal permits required.

9.4.5.3 Local Land Use Regulations and Policies

The manner in which land and waterways are used, maintained, and developed is an important component in promoting and ensuring the integrity of natural resources. Many areas throughout the GOM have and continue to experience significant declines in water quality and substantial losses of important wetlands and coastal areas due to growth and development pressures. Much of this loss can be attributed to the failure of local communities to sufficiently plan for growth by ensuring that development occurs in a way that protects important natural resources.

Local land use zoning regulations, ordinances, and growth management policies direct the way land is developed by designating areas suitable for business, residential, and industry, and by establishing appropriate management practices for construction activities. Regulations can also prohibit business development in certain areas, identify unique open space areas that should be protected and remain undeveloped, or require establishment of easements and natural corridors around wetlands or along waterways, in order to protect water quality and fish and wildlife habitat. Thus land use regulations have a major impact on the quality of environmental resources.

Just as with state activities, there is little opportunity and no designated process for input from the Council or NMFS, unless there are concurrent federal permits required.

9.4.6 Artificial Reef Management

9.4.6.1 Federal Policy

A National Artificial Reef Plan, developed under the Secretary of Commerce by direction of the National Fishing Enhancement Act of 1984 and the Environmental Protection Agency based upon federal and international law, provides guidance for development of artificial reefs. Also, guidance is provided by the Coastal Artificial Reef Planning Guide adopted by the Gulf, Atlantic, and Pacific States Marine Fisheries Commissions, and Guidelines for Marine Artificial Reef Materials produced by the Gulf States Marine Fisheries Commission.

The Gulf States, Atlantic States, and Pacific States Marine Fisheries Commissions asked NMFS to allow the states to develop revisions to the National Artificial Reef Plan. Now awaiting approval by NMFS, the revised plan places stronger emphasis on the habitat

implications of artificial reefs than on other functions or outcomes. The revised plan does not list approved material for artificial reef construction, but specifies criteria for materials. The revised plan recommends that only state marine fisheries management agencies hold artificial reef permits, to ensure compatibility with fishery management plans, and to provide a permanent entity to assume liability. The revised plan also recommends conducting baseline and follow-up evaluations and monitoring to determine if reefs meet objectives set for them. Under the revised plan, artificial reefs may be used to restore and enhance habitat, as sanctuaries, as reef management areas for effort control, or to resolve spatial and use-conflict.

A cooperative program among the MMS, NMFS, Texas A&M University, and the oil industry developed a program to increase understanding of the recreational use of oil and gas platforms (Dauterive 2000). The cooperative program had five objectives: 1) to develop a national policy that recognizes the artificial reef benefits of oil and gas platforms; 2) to prepare a Rigs-to-Reefs (RTR) program plan for the GOM; 3) to establish a standard procedure to ensure and facilitate timely conversion of obsolete platforms as reefs; 4) to identify research and studies necessary to optimize the use of platforms as reefs; and 5) to identify legal restrictions that may prevent use of obsolete platforms as artificial reefs.

9.4.6.2 Florida State Artificial Reef Program

The Florida artificial reef program is the only state program in the GOM that is not exclusively run at a state agency level where the state holds all the reef area permits (Dodrill 2000). Because of the extent of coastline and statewide involvement in reef activities, the state program continues as a cooperative partnership started over twenty years ago with local coastal governments. Today some local coastal cities, and most recently, qualified non-profit corporations also work directly with the Florida Fish and Wildlife Commission (FWC) in artificial reef development and monitoring activities.

Thirty-four of 35 Florida coastal counties spread along 8,426 miles of coastline are or have been involved in artificial reef development. More than 1600 documented public artificial reefs have been placed in state and federal waters off these counties since 1920. Most of the reef development has taken place in the last 15 years. Local coastal governments hold all but two of the more than 300 active artificial reef permits off both Florida coasts. About half of these sites are in federal waters. Two counties, Escambia and Okaloosa, have large COE general permit areas like those in Alabama. Fishing clubs, non profit corporations, and interested private individuals work through the local governments as the liable permit holders to provide input into public reef building activity.

Under the program, reefs have been constructed with one or more of the following intended objectives: 1) enhance private recreational and charter fishing and diving opportunities; 2) provide a socio-economic benefit to local coastal communities; 3) increase reef fish habitat; 4) reduce user conflicts; 5) facilitate reef related research; and, 6) while accomplishing objectives 1-5, do no harm to fishery resources, EFH, or human health. Other reef building objectives undertaken in Florida but outside the FWC include mitigation or restoration reefs to replace hard bottom habitat lost through such activities as beach renourishment.

10.0 ENVIRONMENTAL CONSEQUENCES

10.1 Introduction

This chapter provides the scientific and analytic basis for the comparisons of the alternatives, and describes the probable consequences of the alternatives on the affected environment.

The purpose and need for action for this Secretarial Amendment are contained in Section 3, and are incorporated in this section by reference. The proposed and rejected alternatives, including rationale and discussion, are in Section 6 and contain additional discussion which is also incorporated in this section by reference.

The discussion and analysis of the impacts of each of the alternatives addressed throughout this section is in addition to that contained in Section 6, which is hereby incorporated herein by reference.

10.2 Overview of Environmental Consequences of Management Alternatives

Potential environmental consequences of the management alternatives will arise from those actions aimed at addressing red grouper rebuilding. The red grouper rebuilding alternatives are further divided into measures to define and set the harvest limits and measures to constrain catches to within those limits. The alternatives for the management actions are described in Section 6.

The overfished condition of red grouper requires specific management actions to begin rebuilding of the stock and consists of three sets of alternatives. The first set of alternatives works together to determine the amount and schedule of allowed harvest. The second set defines a general strategy to end overfishing and rebuild the red grouper stock, and provides examples of combinations of alternatives to achieve the preferred strategy by restricting fishing activities to keep the harvest within the allowable limits. The third set is the full scope of management measures under consideration from which combinations of measures can be put together instead of or in addition to the examples in the second set.

The first set of alternatives derives from stock assessment analyses, and defines MSY, F_{MSY}, SS_{MSY}, MSST, MFMT, OY, and the rebuilding schedule. These science-based values set biological ground rules for the red grouper stock, based on Magnuson-Stevens Act requirements and regulations implemented by NMFS to apply those requirements.

The second set addresses the strategy for rebuilding the stock. These strategies range from a constant catch strategy to a constant fishing mortality rate strategy, with variations and combinations of these approaches comprising the remaining alternatives. The selection of a specific strategy determines the initial reduction in red grouper harvest that is needed to effect a recovery.

The third set provides a full range of management measures for restriction harvest which, individually or in combination, can supplement or replace the scenarios presented in the second set.

Several alternatives in the Secretarial Amendment may impact deeper water species. Actions to reduce red grouper harvest could cause fishing effort to shift toward deep-water

groupers and tilefish. Other alternatives apply to both commercial gears, and depending on the alternative, to the recreational fishery. These alternatives would not reallocate within the commercial fisheries, but could favor recreational or commercial fisheries.

10.3 Physical Environment

10.3.1 Consequences of Management Alternatives

From a geological point of view, the management measures of the Secretarial Amendment have minor impacts on the physical environment. None of the alternatives considered will change the general bathymetry, geological configuration, or water quality of the Gulf of Mexico. Reduced harvest levels in the red grouper fishery will occur as a result of rebuilding, until the biomass reaches the level capable of supporting MSY. A net decrease in effort would cause less contact with the bottom and reduce potential physical damage. A net increase in effort could potentially increase physical damage. Damage to coral or other vertical structure with organisms attached may occur from longlines, but damage will accrue to the biota more than the physical structure. In addition to the following analysis, potential impacts are addressed in Section 6.

10.3.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

10.3.2.1 MSY, F_{MSY} and B_{MSY}

The alternatives in this section do not directly affect fishing activities, and they have no direct impact on the physical environment. Indirectly, the selection of parameters could lead to a management strategy that benefits the physical environment by restricting the season or area where fishing activities that affect the bottom may occur. Such impacts are described in the section discussing the impacts of closed seasons.

10.3.2.2 Minimum Stock Size Threshold

The alternatives in this section do not directly affect fishing activities, and they have no direct impact on the physical environment. Indirectly, the selection of minimum stock size threshold could lead to a management strategy that benefits the physical environment by restricting the season or area where fishing activities that affect the bottom may occur. Such impacts are described in the section discussing the impacts of closed seasons.

10.3.2.3 Maximum Fishing Mortality Threshold

The alternatives in this section do not directly affect fishing activities, and they have no direct impact on the physical environment. Indirectly, the selection of maximum fishing mortality threshold could lead to a management strategy that benefits the physical environment by restricting the season or area where fishing activities that affect the bottom may occur. Such impacts are described in the section discussing the impacts of closed seasons.

10.3.2.4 Optimum Yield

The alternatives in this section do not directly affect fishing activities, and they have no direct impact on the physical environment. Indirectly, the selection of optimum yield could lead to a management strategy that benefits the physical environment by restricting the season when fishing activities that affect the bottom may occur. Such impacts are

described in the section discussing the impacts of closed seasons.

10.3.3 Rebuilding Overfished Stocks

10.3.3.1 Rebuilding Strategy

The alternatives in this section do not directly affect fishing activities, and they have no direct impact on the physical environment. Indirectly, the selection of a rebuilding strategy may result in management actions that benefit the physical environment by restricting the season where fishing activities that impact the physical environment may occur. Such impacts are described in the sections discussing the specific management measures.

10.3.3.2 Rebuilding Scenarios

Each of the scenarios in this section is a combination of alternatives from Section 6.4 (Shallow-Water Grouper Quota), 6.5 (Additional Alternatives to Reduce Fishing Mortality) and 6.6 (Deep-Water Grouper and Tilefish Quotas). A discussion of the expected impacts of each action individually is given in the review of the individual alternatives.

10.3.4 Shallow-Water Grouper Quota

10.3.4.1 Shallow-Water Grouper Quota Adjustments

The setting of a quota does not, by itself, have any impact on the physical environment. Increases or decreases in quota will tend to cause increases or decreases in effort and gear. While grouper fishing gears may affect the biota on the ocean bottom, as discussed under Biological Environment, they will not have significant impacts on the physical environment.

10.3.4.2 Shallow-water Grouper Quota Actions

The quota action alternatives define whether other grouper species may continue to be fished and in what geographical areas if the red grouper commercial quota is caught before the shallow-water grouper quota is filled (or vice-versa). Bottom longlines and fish traps directly contact the bottom and may have some impact on hard bottom habitat. Potential impacts by hook-and-line gear on the physical environment include entanglement of lines or impact from fishing weights that can break fragile corals. Individually, such impacts are very small, but over time the cumulative effect could result in significant impacts to the physical environment (Barnette 2001). Alternatives 1 and 3 extend the time when the gears may be in use, increasing the potential impact on the physical environment. Alternative 2, sub-options a and b limit closure actions to the eastern Gulf, reducing physical impacts. Alternative 2(a) covers the entire area where fish traps are allowed and where the longline/buoy gear boundary is 20 fathoms and will reduce impacts on hard bottom from these gears, but if longlines are moved to 50 fathoms, their impact will be minor to begin with. Alternative 2(b) covers a portion of the fish trap and 20-fathom longline area, and will have less impact than Alternative 2(a). Alternative 2(c) will have little additional benefits to the physical environment over 2(a) because in the Gulf west of Cape San Blas longlines are already restricted to 50 fathoms and fish traps are prohibited.

10.3.5 Additional Alternatives to Reduce Fishing Mortality

10.3.5.1 Commercial Shallow-Water Grouper Closed Seasons

Closed seasons reduce the fishing time available to fishermen and will likely reduce the time that longlines and fish traps may impact the physical environment. However, short season closures may encourage more intensive fishing before and after the closed season as fishermen attempt to make up for lost time. If this results in fishermen fishing less cautiously, the physical impacts of longline and fish trap gear, which are considered to have minor impacts under normal conditions, may increase even if the actual time in use deceases.

10.3.5.2 Commercial Grouper Trip Limits

Trip limits will have a greater impact on fishing vessels with a larger capacity. Although not all longline vessels have a higher capacity than other vessels, longline vessels on average land more grouper than vessels fishing other gears. If trip limits reduce the use of longlines more than they do other gears, and longline vessels are allowed to remain fishing within 20 fathoms east of Cape San Blas, the benefit of trip limits to the physical environment may be disproportionately higher. If longlines are moved to 50 fathoms (which will be considered under Reef Fish Amendment 18), then trip limits will have little impact on the physical environment since the only other grouper fishing gear that may impact the bottom, fish traps, is a minor component of the grouper fishery.

10.3.5.3 Recreational Grouper Closed Seasons

Potential impacts by hook-and-line gear on the physical environment include entanglement of lines or impact from fishing weights that can break fragile corals. Individually, such impacts are very small, but over time the cumulative effect could result in significant impacts to the physical environment (Barnette 2001). In addition, anchoring over reefs can harm benthic organisms such as hard corals, sponges, and octocorals (NOAA National Marine Sanctuaries website[7]). Recreational closed seasons reduce the amount of time that the physical grouper habitat is exposed to recreational hook and line gear and anchoring, which may provide a cumulative positive impact.

10.3.5.4 Recreational Grouper Bag Limits

Potential impacts by hook-and-line gear on the physical environment include entanglement of lines or impact from fishing weights that can break fragile corals. Individually, such impacts are very small, but over time the cumulative effect could result in significant impacts to the physical environment (Barnette 2001). Recreational bag limits may reduce the amount of time that some of the better recreational fishermen spend fishing before filling their bag limits, but such fishermen are also less likely to fish their gear in a manner that results in physical impacts. The average grouper fisherman does not often fill his bag limit, and bag limit adjustments are therefore unlikely to have much impact on an average recreational fisherman's fishing time or on the potential impact of his hook and line gear on the physical environment. However, it should be noted that the lower the bag limit the greater the likely reduction in effort and subsequent impact on the physical environment.

[7] NOAA National Marine Sanctuaries website: http://www.sanctuaries.nos.noaa.gov/

10.3.5.5 Red Grouper Minimum Size Limits

Changes to the minimum size limit will not change the fishing methods used nor the interaction between the fishing gear and the habitat. However, changing the minimum size limit may result in a decrease in effort which would have a positive impact on the physical environment.

10.3.6 Commercial Reef Fish Fishing Year

The alternatives in this section determine whether a fishing season that is subject to both a fixed closure and a quota closure has a single combined closed season or two shorter closed season. The total time of the closed season or seasons does not change, so there will be no net change to the amount of time that bottom fishing gear is in use and no change to the impact on the physical environment.

10.3.7 Deep-Water Grouper and Tilefish Quotas

Tilefish, yellowedge grouper, and possibly other deep-water groupers live on firm clay bottoms suitable for burrowing. Most of the fishing for deep-water grouper and tilefish is by bottom longline. Longline gear is thought to have minor impact to sand, mud, or clay habitat areas (Barnette 2001). Therefore, the alternatives in this section have minor impacts on the physical environment.

10.4 Biological Environment

10.4.1 Consequences of Management Alternatives

The management alternatives will affect the amount of fish harvested by commercial and recreational fisheries. The alternatives may also increase or decrease the harvest of non-targeted or prey species as substitute species to fill market demands or for the use as bait. Choice of alternatives will detract from or enhance maintaining reef fish stocks at or rebuilding reef fish stocks to optimum yield levels. The alternatives will also increase or decrease the effects of fishing on essential fish habitat. Choice of alternatives will have generally minor impacts on fish habitat, although larger impacts will occur for some alternatives. The Council does not regulate fishing or gear in state waters, which are under the jurisdictions of state agencies.

10.4.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

10.4.2.1 MSY, F_{MSY} and B_{MSY}

The selection of levels of MSY, F_{MSY} and B_{MSY} are central to determining the appropriate level of red grouper harvest. Setting MSY and F_{MSY} too high and B_{MSY} too low relative to their true values is risk prone and will lead, at best, to a failure to achieve MSY on a continuing basis, and at worst, to a long term decline in the red grouper stocks even if management follows the best available scientific advice. Setting MSY and F_{MSY} too low and B_{MSY} too high relative to their true values is risk averse. This will result in utilization of the resource at levels that will allow the yield to be sustained on a continuing basis and will maintain biomass above the true B_{MSY} level. The 1999 red grouper stock assessment (Schirripa et al. 1999) made estimates of F_{MSY} by multiplying an estimated equilibrium recruitment at a given F level by the yield-per-recruit at a given F. More recent reef fish stock assessments conducted by the NMFS/SEFSC have used F_{MAX} (the F that produces

maximum yield-per-recruit) as a proxy for F_{MSY}. This is considered to be a conservative estimate of F_{MSY} when F_{MSY} cannot be estimated directly. Setting the MSY, F_{MSY}, and B_{MSY} parameters to the range of estimates produced by the most likely model runs rather than a single value allows greater flexibility for management than setting single values in determining appropriate management measures.

10.4.2.2 Minimum Stock Size Threshold

To allow for natural year-to-year fluctuations in biomass, without triggering the need for a rebuilding plan, the NMFS Technical Guidance allows MSST to be set slightly lower than B_{MSY}. When the stock size drops below MSST, a stock is considered to be overfished. The recommended default rule for setting MSST is the greater of the percentage value representing 1-M (M=natural mortality rate), or 50% of the stock size at MSY. For red grouper, M=0.2, thus the MSST would be (1 - 0.2) or 80% of the stock size at MSY. The minimum allowed level of MSST is 50% of B_{MSY}, below which there is a danger of recruitment overfishing for many species. However, red grouper are protogynous hermaphrodites, which begin life as females and then change to males. The scientific community is divided over whether this life history strategy makes red grouper more susceptible or less susceptible to overfishing. Due to this uncertainty, setting MSST at the minimum of 50% of B_{MSY} is risk-prone, and this alternative was rejected by the Council. Under the NMFS technical guidance default recommendation that MSST be set at (1-M)* B_{MSY} (80% of B_{MSY}), stock levels should remain high enough to avoid both the possibility of recruitment overfishing and of year-class failure due to insufficient male biomass.

10.4.2.3 Maximum Fishing Mortality Threshold

The current fishing mortality for red grouper exceeds the fishing mortality value proposed for all alternatives to set MFMT. Setting MFMT at a level higher than F_{MSY} is inconsistent with the NMFS technical guidance, and will result in overfishing and reduction in biomass below the B_{MSY} level. Alternatives to set MFMT at these unacceptably high levels were rejected by the Council. Setting the threshold at F_{MSY} will prevent overfishing from occurring, provided that the estimate of F_{MSY} is not set above true F_{MSY}. A more risk averse approach would be to set MFMT at a level lower than F_{MSY}. However, once the stock is recovered, the management target will switch to F_{OY}. Provided that F_{OY} is more conservative than the F_{MSY} estimate, it is unnecessary to adopt a double-conservative approach to maintain fishing rates at levels that avoid long-term declines in the stock.

10.4.2.4 Optimum Yield

The Proposed Alternative of setting OY at the NMFS Technical Guidance recommendation of 75% of F_{MSY} produces a stock biomass in a recovered fishery of 125% TO 131% of B_{MSY} and a yield of about 98% of MSY (SEFSC 200). This is a risk averse approach that should prevent the stock from entering an overfished condition once it is recovered. Due to confusion about calculating the OY level associated with a given F, the Council initially recommended that OY be set at 90% of MSY. However, this would result in cutting the fishing mortality to 55% of F_{MSY}, and is far more risk averse than recommended by the NMFS technical guidance. Setting OY equal to MSY does not comply with the recommendation that OY be measurably different than MSY and was rejected by the Council. This approach would be risk averse only if the selection of the F_{MSY} estimate were risk averse.

10.4.3 Rebuilding Overfished Stocks

10.4.3.1 Rebuilding Strategy

All of the alternatives for rebuilding strategies except Alternative 6 (status quo) are designed to rebuild the stock to its B_{MSY} level within 10 years or less, and will have a positive impact on the biological environment. Alternative 2, constant fishing mortality strategy, and Alternative 5, rebuild in less than 10 years, may be considered slightly more risk averse than the other alternatives since they place most or all of the rebuilding in the initial part of the maximum 10-year rebuilding period. The Proposed Alternative 3, three-year interval strategy, is intermediate in risk between a constant F strategy with annual TAC changes and a constant catch strategy with no TAC changes. Alternative 6, status quo, would be acceptable only if it could be assumed that the strong landings since 1999 represent strong year classes that will continue and will be sufficient to restore the stock without further regulation. Under the results of the 2002 stock assessment and a three-year interval rebuilding strategy, approximately a 9.4% reduction in harvest from the 1999-2001 average is needed during the first three years to implement a 10-year rebuilding plan.

10.4.3.2 Rebuilding Scenarios

The Proposed Scenarios represent regulations that will effect the current, less restrictive, harvest reductions needed under the 2002 stock assessment. The alternatives will, except as noted below, reduce harvest of red grouper and all other shallow-water grouper and will provide biological benefits to these other stocks as well. Interactions between closed seasons and other management measures used in combination are accounted for by reducing the expected impact of the other measures over the year depending upon the length of the closed season and proportion of annual harvest affected. These alternatives do not attempt to adjust for changes in fishermen's behavior, i.e., effort shifting. Effort shifting could reduce the impact of the scenarios by an unknown amount. Reducing harvest of red grouper and other shallow-water grouper could result in increased fishing pressure on other species. Species mentioned as possible alternates include the deep-water grouper and tilefish, greater amberjack, and king mackerel.

The scenario sub-options to limit closed seasons to the region east and south of Cape San Blas, would have little effect, since only a minor amount of shallow-water grouper, and almost no red grouper, are caught west of Cape San Blas. However, it could create an enforcement problem with vessels fishing east of Cape San Blas, but landing their catch west of Cape San Blas. Vessel monitoring systems, which will be considered under Amendment 18, are one way to address this enforcement issue.

10.4.4 Shallow-Water Grouper Quota

10.4.4.1 Shallow-Water Grouper Quota Adjustments

The shallow-water grouper quota was exceeded in 2001. However, a quota adjustment for the shallow-water grouper complex will provide a positive biological benefit by constraining the commercial sector to its quota of the TAC. However, experience with the red snapper fishery shows that depending on quota closures to constrain harvest runs the risk of creating a derby fishery, in which fishermen increase their effort during the open season in order to catch as many fish as possible before the season closes, resulting in progressively shorter seasons as the stock recovers and the quota is filled more quickly.

On the other hand, not adjusting the quota in order to avoid the derby fishery could result in continued overfishing of the red grouper stock.

10.4.4.2 Shallow-Water Grouper Quota Actions

Any of the alternatives that allow some shallow-water grouper to continue to be harvested while others are closed will result in increased release mortality of the closed species, since the red grouper range overlaps that of the other shallow-water groupers. If such differential closures are implemented, the increase in red grouper release mortality can be constrained by the sub-options in Alternative 2 to close areas to all commercial shallow water fishing where red grouper are common. Sub-option (a), the area east and south of Cape San Blas, encompasses most of the red grouper range but also includes a substantial part of the gag range. Sub-option (b), the area south of Tampa, will provide less geographical protection for red grouper but will allow gag harvest to continue throughout most of the range where gag are common. Sub-option (c), throughout the Gulf of Mexico EEZ, provides the greatest protection against release mortality for both red grouper and gag, but may result in the shallow-water quota not being harvested if a total shallow-water grouper closure is tied to the red grouper quota being filled. This would provide the greatest biological benefits to both red grouper and the other shallow-water grouper species, but could be the most disruptive to the commercial fishing industry. Alternative 5 is a modification of Alternative 2 suboption (c), and closes the commercial shallow-water grouper fishery when either the commercial quota of red grouper (5.31 MP) is reached or the commercial shallow-water grouper aggregate (8.80 MP) is reached; which ever occurs first. The red grouper stock is undergoing overfishing and management measures are needed to end overfishing and rebuild the red grouper stock. Thus, the rebuilding plan seeks to achieve approximately a 9.4% reduction in total red grouper harvest by reducing the red grouper harvest from the 1999-2001 average commercial catch (5.86 MP) to 5.31 MP, and specifies this as an quota for the commercial sector. Closure of the fisheries when either the shallow-water grouper aggregate quota or the red grouper commercial quota is reached may result in one or the other not being filled. Additionally, these actions will reduce the fishing mortality rate on red grouper and perhaps other shallow-water grouper species such as gag; allows the red grouper stock to rebuild; and reduces bycatch mortalities on the shallow-water grouper and red grouper stocks when the fisheries are closed simultaneously.

10.4.5 Additional Alternatives to Reduce Fishing Mortality

10.4.5.1 Commercial Shallow-Water Grouper Closed Seasons

Commercial shallow-water grouper closed season alternatives except Alternative 3 (no closed season) will benefit the red grouper, gag, black grouper and other shallow-water grouper resources by reducing the annual harvest rate. In the case of red grouper, which is undergoing overfishig, trip limits as part of an overall management plan can help to stop overfishing and implement a rebuilding plan. For other shallow-water grouper whose status is not overfished or is unknown, closed seasons can provide precautionary protection. If applied only to red grouper, gag, and black grouper, closed seasons will still provide a substantial benefit to other shallow-water groupers, because many fishermen are unlikely to find it cost-effective to fish for the other shallow-water groupers during a closed season. However, to the extent that fishermen do try to fish for other shallow-water grouper species, there will be an increase in bycatch mortality of red grouper, gag, and black grouper. Alternative 3 (no closed season) will provide no reduction in harvest.

With short closed seasons, such as the current February 15 - March 15 closed season for gag, black grouper and red grouper, fishermen may be able to replace some of the fishing effort lost to the closure by fishing more days and hours in the weeks before and after the closed season, reducing the effectiveness of the closed season. The current closed season was originally projected to reduce red grouper harvest by up to 8% and gag harvest by up to 10% based on historical distribution of commercial landings by month. However, the actual harvest reduction in the months of February and March was just 2% for the years that the closed season has been in effect (2001-2002). For the entire year, grouper landings actually increased in those years at least partly as a result of a strong year red grouper class.

If closed seasons are timed to coincide with part or all of the spawning seasons, there could be some benefit to spawning success of aggregations, although some species are less likely to form large aggregations (e.g., red grouper) than others (e.g. gag), and the effect of a spawning-season closure vs. non-spawning-season closure would be less pronounced. The current February 15 - March 15 closed season for gag, black grouper and red grouper is timed to occur during part of the peak spawning season for gag.

Commercial shallow-water grouper closed seasons may reduce the cumulative time that bottom fishing gear contacts hard bottom and other habitats, and concomitantly reduce the small potential for damage and provide increased time for recovery of biota damaged by fishing gear.

10.4.5.2 Commercial Grouper Trip Limits

Commercial trip limits will not directly affect the grouper stocks if the management regime maintains the total harvest at the quota. By reducing the per-trip fishing mortality, trip limits spread out the harvest over a longer period. If fishermen continue fishing in the same areas for other reef fish found in the same habitat as grouper, there could be in increase in grouper release mortality from regulatory discards. Under some market conditions, combined with reduced on-the-water fisheries enforcement due to re-prioritization of missions by the US Coast Guard since the September 11, 2001, terrorist attacks, some fishermen have an incentive to circumvent the trip limits and illegally land additional fish. To the degree that fishermen can catch higher quantities than the trip limit, unaccounted-for fishing mortality will cause an underestimate of landings, errors in the stock assessment, and potentially decrease or prevent rebuilding.

Trip limits set only for red grouper (Alternative 1) may increase release mortality of red grouper due to incidental catch as fishermen direct their effort toward other species after filling the red grouper trip limit. A trip limit on the total shallow-water grouper catch (Alternative 2) avoids the bycatch problem.

10.4.5.3 Recreational Grouper Closed Seasons

Recreational closed seasons will benefit the grouper species subject to the closure by reducing the fishing mortality rate. However, release mortality will increase from fishermen targeting other species during the closed season. This is particularly likely if the season is closed only to red grouper, gag, and black grouper. Even though these three species accounted for 98% of the recreational shallow-water grouper harvest during 1996-1999 (source: data from NMFS/SERO), some fishermen may still target the remaining shallow-water groupers during a closed season on just red grouper, gag, and black grouper.

Even if a closed season applies to all grouper, some recreational fishermen may continue targeting shallow-water grouper under catch-and-release fishing, resulting in an increase in recreational release mortality.

Closed recreational seasons timed to coincide with part or all of the spawning seasons are less likely to benefit the spawning success of aggregations because spawning aggregations for many of the species occur further offshore than many recreational fishermen fish (gag, for example, spawn in about 40 fathoms), although there may be pre-spawning aggregations in shallower waters.

Without an economic incentive, it seems reasonable to assume that a private recreational fisherman is less likely than a commercial fisherman or charter vessel/headboat operator to increase effort in the weeks before and after the closed season to make up for lost time

10.4.5.4 Recreational Grouper Bag Limits

Reduced recreational bag limits for grouper species are expected to decrease recreational harvest. The impact on the resource reduction will not be proportional to the amount by which the bag limit is reduced, because most fishermen already come in with no more than one or two grouper. If only Alternative 1 or Alternative 2 is selected, there could be a shift in effort from red grouper to gag, or vice-versa. This would result in negative impacts on one of them, and could increase bycatch mortality associated with regulatory discards. In addition, there could be some increase in release mortality if fishermen continue to fish catch-and-release after filling the bag limit.

10.4.5.5 Red Grouper Minimum Size Limit

Increasing the red grouper minimum size limit will reduce commercial and recreational harvest in the initial year of implementation. It takes red grouper about one year to grow from 20 to 22 inches, so as the fish grow into the new size limit, harvest levels can be expected to increase. However, an increased average size for red grouper will result in increased reproductive capability for the stock. As the stock recovers, it will be able to sustain increased yields. After three years, a new stock assessment will reevaluate the status of the stock and determine the new ABC range for the next three years. Yield-per-recruit analyses for various levels of release mortality was evaluated in the 1993 red grouper stock assessment. Based on this analyses and an assumed 10% release mortality for the recreational sector and 33% release mortality for the commercial sector, it appears that yield- per-recruit is maximized at 22 inches total length for the recreational fishery. Although yield-per-recruit will be slightly reduced for the commercial sector, it will remain with 95%-99% of maximum.

Increasing the red grouper minimum size limit will result in increased numbers of red grouper that are discarded both dead and alive. Provided that the assumed release mortality rates are correct (10% for recreational fishing and 33% for commercial fishing), the net impact to the resource will be positive. However, alternative measures, such as bag limits, can achieve the needed harvest reduction with impacts on fewer fishermen.

10.4.6 Combined vs. Separate Fixed Closed Season and Quota Closures

The Council currently has fixed closed seasons for some reef fish (red grouper, black grouper, gag, greater amberjack). If a fishery reaches its quota, then two closed periods can occur. If the fishing year starts at the end of the closed season, then one longer

closure occurs. With two shorter closed seasons, it is more likely that the effectiveness of the fixed closure may be decreased by increased fishing effort before and after the closure.

During shallow-water grouper closed seasons, fishermen may shift effort to other fisheries, such as deep-water grouper or mackerel. The extent of such shifting depends upon whether the fishing vessel and gear is suitable for the other fishery, whether the fishermen have the proper permits, and whether the season for the other fishery is open during the shallow-water grouper closure. A single long closed season that combines quota and fixed closures could increase the likelihood of fishermen re-gearing to fish in another fishery during the closure.

10.4.7 Deep-Water Grouper and Tilefish Quotas

Most of the fishing for deep-water grouper and tilefish is by bottom longline. Longline gear is thought to have minor impacts on the sandy or muddy habitat areas occupied by these species groups (Barnette 2001). Therefore, the alternatives in this section are likely to make little change to impacts on fish habitat. Alternatives that combine quotas for tilefish and deepwater grouper could lead to over-harvest of one group or the other. Because grouper currently bring a higher price than tilefish, greater focus on this species group could lead to overall catches of grouper less than the combined grouper/tilefish quota, but greater than the OY for deepwater grouper alone. This could lead to overfishing of the resource.

The status of the deep-water grouper and tilefish stocks is not well known. However, two deep-water grouper species, warsaw grouper and speckled hind, are on the NMFS candidate species list for possible future listing under the Endangered Species Act. Anecdotal information suggests that pelagic longline vessels displaced from the Atlantic swordfish fishery may be entering the Gulf reef fish fishery. The alternatives in this section will provide pro-active protection for deep-water grouper and (except for status quo) for tilefish while more information is gathered on the sustainability of these stocks.

No other economically important bottom fisheries occur at these depths and distances from shore. Therefore, the alternatives in this section are not expected to impact other fisheries.

10.5 Social and Economic Environment

10.5.1 Consequences of Management Alternatives

Under the red grouper rebuilding plan, red grouper harvest will decline from present catches. While the MSY is around 7.56 MP (GW), harvest during the initial three years of rebuilding will likely be around 6.55 MP. Using the average catch of 7.248 MP from the base years of 1999 to 2001, catch reductions of roughly 10% are needed. This will affect the income, time spent fishing, and selection of alternative target species for fishermen, and may cause disruptions to the fresh grouper market, both short-term (reduced availability to the market due to harvest restrictions and interruptions in availability due to quota closures) and long-term (market switch to alternative sources).

More discussions on the consequences of management alternatives on the social and economic environment have previously been presented in Sections 6.2, 7.5, 8.0, and 9.3, which are incorporated here by reference.

10.5.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

10.5.2.1 MSY, F_{MSY} and B_{MSY}

These items define the average annual allowable harvest. As the quantity goes down during rebuilding, fishermen will average less catch and less revenue. Catch, and probably revenue, will increase after rebuilding.

10.5.2.2 Minimum Stock Size Threshold

Minimum stock size threshold (MSST), in combination with the assessment of the status of the stock, determines whether a stock is classified as overfished, triggering a mandatory rebuilding plan. In actuality, a stock is growth overfished anytime the biomass level is below B_{MSY}, so ideally the stock should not drop below 100% of B_{MSY} (Alternative 2). However, a stock that is managed at or near the B_{MSY} level can be expected to periodically drop below the threshold due to natural fluctuations in stock biomass. To allow such fluctuations without triggering a mandatory rebuilding program, the NMFS Technical Guidance allows the threshold to be set below B_{MSY}. At the recommended level of (1-M)* B_{MSY}, (e.g., 80% of B_{MSY} for red grouper, Alternative 1), red grouper was classified as overfished as of 1997, but requires a less severe rebuilding plan than if recovery was from the 50% level. Setting MSST at the lowest allowed level (e.g. 50% of B_{MSY}, Alternative 3) results in red grouper not being officially classified as overfished as of 1997, but it will require more restrictive management measures if the stock drops below the threshold. Even if the stock does not drop below the 50% threshold, it will still be classified as undergoing overfishing, and will require a plan to end overfishing. Depending on how a plan to end overfishing is implemented, it could result in relatively small changes to the fishing regulations, or in changes nearly as restrictive as would be called for in an overfished rebuilding plan. More restrictive measures would tend to cause a radical change in the affected fishing communities as residents attempt to adapt to limited fishing opportunities.

10.5.2.3 Maximum Fishing Mortality Threshold

Overfishing occurs when a stock is being fished at a higher rate than MFMT. Unlike the MSST threshold, the NMFS technical guidance allows no leeway for periodically exceeding this threshold, therefore, setting MFMT at the current rate (Alternative 2), while the least disruptive to the social and economic environment, is not legally acceptable. The lack of leeway may be because, ultimately, the target fishing mortality rate is the more conservative F_{OY}, around which fishing mortality is allowed to fluctuate. Setting MFMT at a more conservative level than F_{MSY} (Alternative 3) may appear to be precautionary at first glance, but it will likely result in the stock periodically entering a condition of undergoing overfishing even if the stock is managed under the more conservative F_{OY} target, and is unnecessary if OY is set more conservatively than MSY. Setting MFMT at F_{MSY} (or the F_{MSY} proxy) reduces the likelihood of the fishing mortality rate fluctuation above the overfishing threshold when management under F_{OY}, resulting in the least disruption to the social and economic environment of those alternatives that can be legally adopted.

10.5.2.4 Optimum Yield

Optimum yield is the target yield and fishing mortality rate for a stock that is not overfished. The National Standards, while explicit about the use of overfished thresholds

for rebuilding to B_{MSY} within a specified time period, are more ambiguous about how to use OY targets. The National Standard Guidelines state:

> "Exceeding OY does not necessarily constitute overfishing. However, even if no overfishing resulted from exceeding OY, continual harvest at a level above OY would violate National Standard 1, because OY was not achieved on a continuing basis" (50 CFR, Subpart D, 600.310(f)(5)(i)).

The Reef Fish FMP's Framework Procedure for Setting TAC is more explicit. For stocks that are not overfished, it states that the RFSAP shall specify, "a range of ABC for each stock or stock complex that is in need of catch restrictions for attaining or maintaining OY. The ABC's are catch ranges that will be calculated for those species in the management unit that have been identified by the Council, NMFS, or the working panels as in need of catch restrictions for attaining or maintaining OY." The framework procedures call on the Council to set TAC within or below the first ABC range or to set a series of annual TACs to obtain the ABC level within the first three years or less.

Under the MSST Proposed Alternative of 80% of B_{MSY}, red grouper were classified as overfished in 1997. Although the stock has rebounded to approximately 84% of B_{MSY}, it remains overfished until it recovers to 100%, since the national standard guidelines call for rebuilding to the B_{MSY} level. Optimum yield for red grouper has been defined as the yield defined by the fishing mortality rate consistent with the rebuilding strategy to B_{MSY} within the allowable rebuilding period. After achieving the rebuilding target, OY shall be the yield corresponding to a fishing mortality rate that produces 75% of F_{MSY}: produces 98% of MSY (Alternative 3)(SEFSC). This relative small reduction in harvest beyond MSY is considered to be sufficient to prevent the stock from dropping below MSST or to be fished above MFMT while providing the least disruption to the social and economic environment. Setting OY at 90% of MSY (Alternative 1) is more precautionary, but requires that the fishing mortality rate be cut nearly in half of the F_{MSY} level, and is more disruptive to the fishery. Setting OY equal to MSY (Alternative 2) allows the greatest possible harvest level, but any upward fluctuation in fishing mortality will drive the fishery into an undergoing overfishing status. Because it results in a high risk that overfishing will occur and require new management measures to end overfishing, this alternative provides the least stability to the social and economic environment.

Although the socioeconomic implications of the various OY Alternatives have been discussed in Section 6 of this amendment, the setting itself of each OY alternative is based on biological as well as socioeconomic grounds. This has been somewhat mitigated by the functional, as opposed to numerical, definition of OY implying that OY as a level of harvest may change depending on results of future stock assessments. In addition, economic and social factors were introduced in the choice of the proposed OY.

10.5.3 Rebuilding Overfished Stocks

10.5.3.1 Rebuilding Strategy

The red grouper rebuilding strategy offers several ways to move from current conditions to a rebuilt stock. All alternatives have the same biological target. In general, the constant catch strategy requires the smallest initial catch reductions, but does not allow for increased catches as stocks rebuild. Conversely, a constant F strategy requires the largest initial reductions, but allows for increased catch as the stock rebuilds. Combinations of constant catch-constant F provide intermediate impacts. The Proposed Alternative 3 and

Alternatives 1 and 4 provide a stable ABC over a period of years. Alternative 5 would create the greatest negative impact on the social and economic environment during the recovery (by causing the greatest reductions in catch), but for a shorter time period.

10.5.3.2 Rebuilding Scenarios

The alternatives for red grouper rebuilding scenarios determine how the rebuilding will be achieved and what measures will apply to various components of the fishery. These alternatives determine the way in which the guidance provided by the assessment will be implemented, and they have a direct effect on the social and economic environment, specifically the fishermen, crew, and processors because they change the way in which the resources are harvested. These alternatives tend to reduce efficiency of harvesting, by forcing fishermen (recreational or commercial) to fish in sub-optimal ways and thereby incur higher costs to harvest the same quantity of fish. Extended closed seasons may allow fishermen to continue fishing efficiently during the open season, but during the closures fishermen may switch to alternate fisheries, and markets may seek alternative, more consistent sources of grouper, such as imports. Trip limits can reduce the rate of harvest of shallow-water grouper and may delay or prevent quota closures, but such measures will affect mainly the larger vessels. Some of these vessels may replace the harvest of shallow-water grouper foregone due to trip limits by moving further offshore to fish for deep-water grouper and tilefish.

10.5.4 Shallow-Water Grouper Quota

10.5.4.1 Shallow-Water Grouper Quota Adjustments

All the alternatives in this section reduce the shallow-water grouper quota below current annual harvest. In the absence of additional measures to control the fishing rate, this could lead to quota closures and the potential for derby fishing.

10.5.4.2 Shallow-water Grouper Quota Actions

The alternatives in this section determine whether a portion of the shallow-water grouper fishery can continue to be harvested when the red grouper quota is filled before the shallow-water grouper quota, and vise-versa. These alternatives would allow a more continuous supply of fresh grouper to the market, but some alternatives would force fishermen to release a significant portion of their grouper catch, resulting in increased bycatch mortality and inefficient use of the resource.

10.5.5 Additional Alternatives to Reduce Fishing Mortality

10.5.5.1 Commercial Shallow-Water Grouper Closed Seasons

Commercial closed seasons, particularly those that result in short open seasons, can encourage fishermen to increase their effort to compensate as far as possible for the period when they cannot fish. Increased catch taken during shorter openings often creates a temporary glut of fish, which lowers price to the fishermen. Because seasonal closures are known in advance, fishermen have an opportunity to change their work pattern accordingly. For example, they can target other species or to conduct maintenance work on their vessels during the period of closure. During public testimony prior to adoption of the existing closed season (February 15 to March 15), several fishermen indicated that they could accept a one or three month closure, if necessary, but not anything longer.

Other fishermen opposed any closure because of the fear that grouper imports would increase and possibly replace domestic grouper in the market place, thereby damaging the market for domestically caught fish. Some combinations of sub-options under Alternative 2, and Alternative 4, could result in closed seasons longer than three months.

10.5.5.2 Commercial Grouper Trip Limits

A single trip limit will negatively impact larger vessels more than smaller vessels, and longline vessels more than vertical line gear vessels. In general, larger vessels have greater running and overhead expenses and therefore, need more harvest per trip to generate a profit. However, trip limits by vessel size category or by gear type could equalize the impacts across the fleet. Trip limits also disproportionately impact the more successful fishermen, who without limits tend to catch more per trip than other fishermen. However, trip limits may reduce the need for closed seasons or quota closures, and can help maintain a supply of grouper to consumers for all or most of the year. They may also discourage owners of large longline vessels that were displaced from the HMS pelagic longline fishery from entering the reef fish fishery. Fishermen who find ways to illegally land fish in excess of the trip limits and avoid detection will benefit economically at the expense of honest fishermen.

10.5.5.3 Recreational Grouper Closed Seasons

Recreational closed seasons will reduce the choice of recreational fisheries available during the closures, but will not eliminate recreational fishing for other species. To the extent that customers are willing to pay to fish for other species, there will be less negative impact on the recreational for-hire sector. Alternatives to closed seasons, such as reduced bag limits, may also result in lost business. While other types of management restrictions can create year-round impacts, closed seasons would intend to create negative impacts only during the time period of the closure itself. However, the impacts could be so great that fishermen go out of business or seek other employment. If recreational fishermen reschedule their trips for periods when the grouper fishery is open, there would be positive economic impacts during the open season. However, this would also reduce the effectiveness of closed seasons with respect to harvest reduction. Recreational fishing is a discretionary activity, and to the degree that restrictions make red grouper fishing less attractive, time and money previously committed to fishing would shift to other activities. In many cases, the new activities may not involve fishing. While total discretionary spending will not likely decrease, the amount spent on fishing activities, especially for red grouper, probably will.

10.5.5.4 Recreational Grouper Bag Limits

Reduced recreational bag limits may result in some local recreational fishermen foregoing grouper fishing. A greater proportion of the overall grouper catch would then be taken by tourists and visitors in charter and headboats, compared to local fishermen in private boats, as was seen in the red snapper fishery. If the bag limit reduction were severe, even the charter vessel and headboat fishery would experience a reduction, if customers choose not to go fishing. Recreational fishing is a discretionary activity, and to the degree that restrictions make red grouper fishing less attractive, time and money previously committed to fishing would shift to other discretionary activities, which may not involve fishing. While total discretionary spending will not likely decrease, the amount spent on fishing activities, especially for red grouper, probably will.

10.5.5.5 Red Grouper Minimum Size Limits

An increased size limit will result in a lower harvest rate and an increased discard rate of red grouper for both recreational and commercial fishermen. In areas where there is an overlap of red grouper and gag stocks, a 22 inch TL minimum size limit could eliminate some confusion for recreational fishermen over the appropriate minimum size limit, since the three most commonly caught species, black grouper, gag, and red grouper, will all have the same size limit. However, there will still be grouper species with different size limits (20 inches for yellowfin grouper and 16 inches for scamp), plus no size limit for the remaining allowable groupers (yellowmouth, rock hind, red hind, yellowedge, misty, snowy, speckled hind, and warsaw). In public testimony, both recreational and commercial fishermen indicated that, given a choice between size limit increases or closed seasons, increasing the minimum size limit was a less disruptive way to reduce harvest than closed seasons.

10.5.6 Combined vs. Separate Fixed Closed Season and Quota Closures

Alternatives for the reef fish fishing year will determine if a single long closure or two shorter closures will occur. The action alternative in this section would result in consecutive quota closure and fixed closed season, resulting in a single long closed season. The status quo alternative could result in having two closed seasons, one for the quota closure and one for the fixed closed season. Two shorter closed seasons spreads out the fishing more evenly over the year, and may be less disruptive to the fishermen and to the market. A single longer closed season would concentrate the fishery into one part of the year, and may be preferable for fishermen who are able to work in another fishery or job during the closure. It is difficult to determine which option would most encourage grouper imports.

10.5.7 Deep-Water Grouper and Tilefish Quotas

Deep-water grouper and tilefish appear to be a source of supplemental income for commercial fishermen, rather than a primary fishery. If quota reductions or closures occur while other fisheries are open, there will be only a minor impact on fishermen and processor incomes. However, if the deep-water reef fish closures coincide with closures in the shallow-water grouper fishery, these alternatives could reduce the flexibility of fishermen to switch to alternate fisheries. Combined tilefish-deep-water grouper quotas give fishermen more flexibility than separate quotas for tilefish and deep-water grouper, because the fishery would not close as a result of the catch of just one of the species groups.

10.6 Administrative Environment

10.6.1 Consequences of Management Alternatives

Most of the alternatives will require normal administrative actions from the Council and NMFS for justification, implementation, and explanation to the public. Several management issues will involve more or less activity by the NMFS Permit Section. Many decisions by the Council will improve or diminish the ability of NOAA, the Coast Guard or the Gulf states to enforce fishery regulations.

As a result of the terrorist attacks of September 11, 2001, the U.S. Coast Guard has shifted its primary emphasis to homeland security. While the Coast Guard will continue on-the-water fisheries enforcement, it will likely be more of an opportunistic than targeted effort.

Under these conditions, management measures that can be enforced through administrative means (e.g., VMS and logbook records) or by dockside enforcement are more likely to be effective than measures which must be enforced at sea.

10.6.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

10.6.2.1 MSY, F_{MSY} and B_{MSY}

No enforcement or permitting impacts. This section simply establishes the biological parameters under which subsequent actions will be taken.

10.6.2.2 Minimum Stock Size Threshold

Red grouper status determination criteria, MSST, MFMT, and OY provide the biological roadmap for the recovery of the resource. These items will not affect administrative activities of NOAA Enforcement or NMFS Permit Section. Application of management measures to initiate red grouper rebuilding will require restrictions on fishermen that will require enforcement activity. These rebuilding measures do not have permit implications.

10.6.2.3 Maximum Fishing Mortality Threshold

See remarks under Minimum Stock Size Threshold (Section 10.6.2.2)

10.6.2.4 Optimum Yield

See remarks under Minimum Stock Size Threshold (Section 10.6.2.2)

10.6.3 Rebuilding Overfished Stocks

10.6.3.1 Rebuilding Strategy

The selection of a rebuilding strategy determines the amount of harvest reduction needed. A constant F strategy begins with the lowest TAC, which may need the greatest level of enforcement. However, as the stock recovers and TAC is increased annually, the incentive for fishermen to violate harvest restrictions will decrease. Conversely, a constant catch strategy allows the highest initial TAC and the least initial incentive to violate harvest restrictions, but as the stock recovers with no concomitant increase in TAC, enforcement will become increasingly problematic. The Proposed Alternative to set TAC at three-year intervals is intermediate between constant F and constant catch, and the enforcement consequences will also be intermediate.

The Proposed Alternatives requires that a new stock assessment be conducted before the first three years are up in order to determine the appropriate TAC for the next three years. The constant catch and constant F strategies could conceivably be carried out with no further stock assessment analyses until the 10 years are up, since each strategy provides a full 10-year projected yield stream. However, the accuracy of projections 10 years out is highly suspect, and to base an entire 10-year recovery on a single stock assessment would be risk-prone. It is expected that NMFS would carry out periodic assessments or assessment updates throughout the rebuilding period regardless of which strategy is selected. The only administrative impact of selecting a three-year interval strategy is that the periodic assessment updates are a required part of the rebuilding program, rather than optional depending upon the level of acceptable risk.

10.6.3.2 Rebuilding Scenarios

The sample scenarios depend upon combinations of quota reductions, closed seasons and trip limits to reduce commercial harvest, and closed seasons, and bag limits to reduce recreational harvest. These are routine management measures and introduce no administrative burdens. However, with the recent shift in U.S. Coast Guard mission priorities, effective enforcement may require the implementation of VMS systems (under consideration in draft Amendment 18), which would increase the administrative burden and cost for both the fishermen and NMFS.

10.6.4 Shallow-Water Grouper Quota

10.6.4.1 Shallow-Water Grouper Quota Adjustments

The shallow-water grouper quota was exceeded in 2001. A quota adjustment for the shallow-water grouper complex will provide a positive biological benefit by constraining the commercial sector to its allocation of the TAC and prevent future quota over runs. However, experience with the red snapper fishery shows that depending on quota closures to constrain harvest runs the risk of creating a derby fishery, in which fishermen increase their effort during the open season in order to catch as many fish as possible before the season closes, resulting in progressively shorter seasons as the stock recovers and the quota is filled more quickly. On the other hand, not adjusting the quota in order to avoid the derby fishery could result in continued overfishing of the red grouper stock. As the fishery approaches its quota, additional administrative effort will be required by NMFS to monitor landings and close the fishery before it exceeds its allowable catch.

10.6.4.2 Shallow-water Grouper Quota Actions

All of the alternatives except Alternative 4 (status quo) and Alternative 5 allow a portion of the shallow-water grouper fishery to continue when the red grouper quota is filled but not the shallow-water grouper quota, or vice versa. This will result in a more complicated administrative and enforcement environment, since the shallow-water grouper will be subject to closed areas and seasons by species rather than by aggregate. The status quo alternative continues to manage the shallow-water grouper quota as a single aggregate quota throughout the EEZ, and will not result in any additional administrative impacts. Alternative 5 will close the shallow-water grouper fishery when the red grouper commercial quota is reached or the shallow-water grouper quota is met, which ever occurs first. As the fishery approaches its quota, additional administrative effort will be required by NMFS to monitor landings and close the fishery before it exceeds its allowable catch.

10.6.5 Additional Alternatives to Reduce Fishing Mortality

10.6.5.1 Commercial Shallow-Water Grouper Closed Seasons

Effective enforcement of commercial closed seasons requires establishing specifications of when fishermen can fish for and possess red grouper and other species included in a seasonal closure. Specification by the Council of the following items will add to the administrative burden but will allow improved enforcement of closed areas:

- when vessels must be off the fishing grounds (tied to the dock) at the end of the closure;
- when fishermen must no longer possess fish (off-loading complete) at the end of the closure;
- when fishermen can leave for the fishing grounds after the beginning of a

season; and
- when fishermen can offload after the beginning of a season.

10.6.5.2 Commercial Grouper Trip Limits

Commercial trip limits for red grouper and other species can be effective only if a sufficient level of contact by enforcement agents with fishermen consistently occurs to prevent landings above the trip limit. Designating a limited number of offloading sites, requiring daily dealer reports of landings, and check-in contacts by fishermen prior to landing trip-limit fish would help enforcement agents to improve the level of contact.

10.6.5.3 Recreational Grouper Closed Seasons

Effective enforcement of recreational closed seasons requires establishing specifications of when fishermen can fish for and possess red grouper and other species included in a seasonal closure. Specification by the Council of the following item will add to the administrative burden but will allow improved enforcement of closed areas:
- when fishermen must or may possess fish at the beginning or end of the closure.

10.6.5.4 Recreational Grouper Bag Limits

Since bag limit regulations can be enforced either at-sea or by examining the catch upon landing, changing the recreational grouper bag limits will not increase the administrative burden. However, enforceability of bag limit regulations may be reduced due to the shift in U.S. Coast Guard mission priorities at-sea, and the large number of landing locations for recreational fishermen relative to the number of NOAA enforcement agents. Enforceability would be improved if states adopted compatible regulations and/or state marine enforcement agencies work with NOAA Enforcement to enforce the bag limit regulations.

10.6.5.5 Red Grouper Minimum Size Limits

Since any change would involve a change to an existing minimum size limit rather than implementation of a new size limit, there would be no increase in the administrative burden nor to enforceability.

10.6.6 Combined vs. Separate Fixed Closed Season and Quota Closures

The selection of alternatives for commercial reef fish fishing year only determine whether there may be one long or two short closed seasons, and has the same impacts as described for commercial closed seasons alternatives. However, the fishing year currently begins on January 1 for all reef fish. Changing the fishing year to coincide with a fixed closed season will result in having to keep track of different fishing years for different species.

10.6.7 Deep-Water Grouper and Tilefish Quotas

Development of combined or separate quotas will require additional monitoring of landings. While the Council and NMFS have established a quota for deep-water grouper, they have not established one for tilefish. On the water enforcement of deep-water reef fish regulations is more difficult than for shallow-water reef fish, due to the increased distance from shore. However, illegal landings during quota closures can be monitored from the dock.

10.7 Effects of Proposed Management Measures on Other Fisheries

10.7.1 Consequences of Management Alternatives

Red grouper is part of a multi-species fishery, including gag and other groupers. The rebuilding strategy, in combination with the setting of a minimum stock size threshold and an OY target, will likely require that there be some mandated reduction in red grouper harvest for up to ten years. If the resulting management measures are applied to the shallow-water grouper fishery in aggregate, the other groupers will also benefit from reduced fishing pressure, but alternative species such as deep-water grouper, greater amberjack or king mackerel may receive additional fishing pressure from effort shifting. If management measures are applied specifically to red grouper, other shallow-water grouper may have increased fishing pressure due to effort shifting. Further, these same management measures may also increase or decrease the harvest of non-targeted or prey species as substitute species to fill market demands or for the use as bait.

10.7.2 Red Grouper Biological Reference Points and Stock Status Determination Criteria

10.7.2.1 MSY, F_{MSY} and B_{MSY}

The selection of red grouper MSY, F_{MSY} and B_{MSY} parameters has no direct effect on other fisheries. Indirectly, the selection of parameters could lead to a management strategy that increases fishing pressure on other species through effort shifting as a result of restricting the season or area where fishing activities that affect red grouper may occur. Such indirect impacts could be either positive (for example, including other species in a closed season to prevent effort shifting) or negative (for example, a longline/buoy gear boundary move that could result in increased effort on deep-water reef fish species. These impacts are discussed in the sections discussing individual management measures.

10.7.2.2 Minimum Stock Size Threshold

The setting of MSST has no direct effect on other fisheries, although the regulations implemented to maintain or rebuild red grouper stock size may affect other species. These impacts are discussed in the sections discussing individual management measures.

10.7.2.3 Maximum Fishing Mortality Threshold

The setting of MFMT has no direct effect of other fisheries, although the regulations implemented to maintain or reduce red grouper fishing mortality may affect other species. These impacts are discussed in the sections discussing individual management measures.

10.7.2.4 Optimum Yield

The setting of OY has no direct effect of other fisheries, although the regulations implemented to maintain or achieve red grouper OY may affect other species. These impacts are discussed in the sections discussing individual management measures.

10.7.3 Rebuilding Overfished Stocks

10.7.3.1 Rebuilding Strategy

The section of a rebuilding strategy determines the initial red grouper TAC. This by itself has no direct effect of other fisheries, although the regulations implemented to implement the TAC may affect other species.

10.7.3.2 Rebuilding Scenarios

The rebuilding scenarios suggested in this section consist of combinations of commercial shallow-water grouper closed seasons, longline boundary changes, commercial trip limits, recreational grouper closed seasons, and recreational bag limit changes. The closed seasons will benefit all shallow-water grouper, but may result in increased fishing effort on alternative species such as greater amberjack, king mackerel, sharks, and commercial harvest of deep-water grouper and tilefish. Effort shifting by commercial fishermen into other fisheries may be constrained by permit moratoria or limited entry systems in those fisheries.

The scenario sub-options to limit closed seasons to the region east and south of Cape San Blas, will have little effect, since only a minor amount of shallow-water grouper, and almost no red grouper, are caught west of Cape San Blas.

10.7.4 Shallow-Water Grouper Quota

10.7.4.1 Shallow-Water Grouper Quota Adjustments

The alternatives in this section reduce the shallow-water grouper quota below current annual harvest, and may lead to quota closures. Consequently, fishing vessels may shift their effort to other species such as deep-water groupers or sharks (which are under a license limitation system). The ability of vessels to shift depends on the vessel being capable of safely reaching the fishing grounds for the alternate fishery, having the necessary permits, and the alternate fishery being open. Since the alternate fisheries have the same fishing years as shallow-water grouper, quota closures may be concurrent, negating effort shifting. Even if the alternate fisheries are open, license limitation systems, other regulatory restrictions, or the unsuitability of some vessels to fish on the alternate fishing grounds (for example, deep-water grouper) will limit the impact on other fisheries from effort shifting.

10.7.4.2 Shallow-water Grouper Quota Actions

Allowing some shallow-water grouper to be caught while closing the season to other species is likely to result in increased bycatch mortality of the species that is closed. A total closure may result in effort shifting to other species as described for closed seasons, but permit moratoria and limited entry systems may limit fishermen's ability to effort shift.

10.7.5 Additional Alternatives to Reduce Fishing Mortality

10.7.5.1 Commercial Shallow-Water Grouper Closed Seasons

During shallow-water closed commercial seasons, fishermen may shift effort to other fisheries, such as deep-water grouper or sharks. The extent of such shifting depends upon whether the fishing vessel and gear is suitable for the other fishery, whether the fishermen have the proper permits, and whether the season for the other fishery is open during the shallow-water grouper closure. The status of many of the alternate fisheries is unknown (e.g., deep-water grouper) or overfished (e.g., large coastal sharks). Thus, seasonal closures, while benefitting shallow-water grouper, could increase fishing pressure on other fisheries. Other fisheries with quotas will not see additional catch, but the quota may be reached sooner.

10.7.5.2 Commercial Grouper Trip Limits

If fishermen stop fishing and return to port when they have caught their trip limit of grouper, there will be no impact on other fisheries. However, if fishermen expand fishing effort for other species during or after filling their trip limits, there will be an increase in fishing mortality on these other fisheries.

10.7.5.3 Recreational Grouper Closed Seasons

A seasonal closure of the recreational fishery could shift effort to other recreationally targeted species, such as non-grouper reef fish or mackerel, during the closure. This could impact not only species under federal management, but also coastal species under state management.

10.7.5.4 Recreational Grouper Bag Limits

Bag limit reductions in grouper could result in fishermen shifting their target to other species. This could impact not only species under federal management, but also coastal species under state management.

10.7.5.5 Red Grouper Minimum Size Limits

Increasing the red grouper minimum size limit could result in effort shifting to other groupers or to other reef fish species found in the same habitat as red grouper. In the recreational fishery, the average red grouper harvest per angler trip is less than two, so any effort shifting to other species is likely to be minor.

10.7.6 Combined vs. Separate Fixed Closed Season and Quota Closures

Long closed seasons or combining quota and fixed closed seasons to produce a longer single closed season could increase the likelihood of fishermen re-gearing to fish in another fishery during the closure.

10.7.7 Deep-Water Grouper and Tilefish Quotas

There are no other economically important bottom finfish fisheries at these depths and distances from shore. Therefore, the alternatives in this section are not expected to impact other fisheries.

10.8 Cumulative Impacts of Past and Proposed Actions

The actions proposed in this amendment include:

a. Establish biological reference points and stock status determination criteria (MSY, F_{MSY}, MSST, MFMT, and OY) for the red grouper stock based on the 2002 stock assessment;
b. Adopt a 10-year rebuilding plan for red grouper, with the annual ABC to be adjusted at three-year intervals. The ABC for the first three-year interval is 6.56 MP GW. The remaining proposed actions are management measures to achieve this ABC and limit effort shifting to other stocks;
c. Reduce the commercial shallow-water grouper quota from 9.35 MP GW to 8.80 MP GW;
d. Close the commercial shallow-water grouper fishery when the commercial quota of red grouper (5.31 MP) is reached, or the commercial shallow-water grouper aggregate (8.80 MP) is reached, whichever occurs first;
e. Maintain the February 15-March 15 closed season on red grouper, black grouper, and gag;

f. Set a recreational bag limit of no more than two red grouper out of the five-grouper aggregate bag limit;
g. Reduce the commercial deep-water grouper quota to 1.02 MP GW;
h. Set a commercial tilefish quota of 0.44 MP landed weight.

Relevant actions previously taken in the Reef Fish FMP are described in Section 2.0, History of Grouper Management, and are incorporated in this section by reference.

The Reef Fish Amendment 1 actions, implemented in 1990, resulted in immediate sharp reductions in most sectors of grouper harvest. From 1989 to 1990, red grouper harvest dropped 36% commercially (from 7.6 to 4.8 MP) and 46% recreationally (from 2.5 to 1.3 MP). Gag harvest increased by about 9% commercially from 1.6 to 1.8 MP (possibly due to increased escapement from the recreational fishery) but decreased 49% recreationally (from 2.8 to 1.4 MP) (Table 6.3). Such reductions in commercial harvest for red grouper were accompanied by reductions in ex-vessel revenues, from about $13.6 million in 1989 to $10 million in 1990. The increase in commercial harvest for gag resulted in an increase in ex-vessel revenues, from about $1.6 million in 1989 to $2.0 million in 1990 (Waters 1999).

Landings, except for the commercial gag fishery, quickly increased in subsequent years. Post-Amendment 1 commercial red grouper landings peaked in 1993 at 6.4 MP, valued at about $14.1 million, before beginning a decline that lasted until1998, when 4.0 MP were landed, valued at $8.6 million. In 1999-2000, commercial red grouper landings rebounded to about 5.9 MP each year, valued at about $13.3 million. Recreational red grouper harvest peaked at about 3 MP in 1992 and remained in the 2-3 MP range through 1995. However, during 1996-1998, recreational red grouper harvest dropped dramatically, with less than 1 MP harvested each year. The reason for this sudden drop has not been determined. However, in 1999-2000, recreational red grouper landings increased to 1.2 and 1.6 MP respectively (Table 6.3).

Commercial gag landings have remained fairly stable since 1990, within a range of 1.5 to 2.0 MP per year, valued respectively at $3.9 million and $4.5 million (except for 1998 when 2.4 MP were harvested, with an ex-vessel value of $6.4 million). Recreational gag harvest rebounded sharply in 1991, from 1.4 to 2.1 MP, and remained in a narrow range of 1.7 to 2.1 MP per year until 1996. Beginning in 1997, however, recreational gag harvest has sharply increased. The 1998-2000 recreational gag harvest has been over 3.0 MP each year, and has been 9%-17% higher than the pre-Amendment 1 landings in 1989 (Table 6.3).

The 2002 red grouper assessment results incorporate the stock status through 2001, and the gag assessment incorporates stock status through 1999.

In 2000, new rules were implemented to reduce the fishing mortality rate on gag and to protect some of the gag spawning aggregations and a portion of the older male gag population. These actions included raising the minimum size limit for gag from 20 inches to 24 inches commercial and 22 inches recreational (a Council proposal to further raise the recreational minimum size limit to 24 inches was disapproved by NMFS), closing the commercial fishing season for gag, black, and red grouper during part of the gag spawning season from February 15 to March 15, and creating two no-take areas where gag spawning aggregations were know to occur (Madison/Swanson and Steamboat Lumps Marine Reserves). The expected results from these measures have been incorporated with the expected results from the proposed actions in this amendment to describe the expected cumulative impacts.

The following paragraphs are condensed in part from the discussion of the combined impacts provided under Section 6.3.2, Rebuilding Scenarios.

Commercial Proposed Scenario

The Proposed Commercial Scenario reduces the shallow-water grouper quota. This action is intended to reduce commercial red grouper harvest by approximately 9.4%.

The proposed shallow-water grouper quota of 8.80 MP GW represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest. This quota is expressed in GW rather than whole weight to reflect the condition in which commercially harvested grouper are landed, and to avoid any inaccuracies that could be introduced from applying a gutted to whole weight conversion factor. The method for calculating this quota is described in the section on shallow-water grouper quota alternatives. The method used to calculate this quota produced a less conservative estimate than the other quota alternatives considered. However, this is the least complicated and easiest calculation for most people to understand.

Note concerning commercial-to-recreational allocations:

The commercial-to-recreational ratio of red grouper caught during 1990-2000 was 76:24, little changed from the 1986-1989 pre-regulatory ratio (75:25). However, in recent years (1999-2001) the commercial-to-recreational ratio has shifted to 81:19 (Table 6.3). There are two likely reasons for this shift. First, in 2000, differential gag minimum size limits were implemented (24 inches commercial, 22 inches recreational), which allowed the recreational sector to focus more on gag. In fact, Table 6.3 shows that the recreational proportion of gag harvest increased in 1999-2001 compared to 1990-2000 (although it is still lower than in the 1986-1989 pre-regulatory period). Second, the strong 1996 year-class of red grouper entered the fishery around 1999. Since commercial sector catches predominately red grouper while the recreational sector catches predominately gag, this year-class provides more of a boost to commercial harvest than to recreational harvest. As the year-class is fished out and exits the fishery, the commercial-to-recreational ratio should revert back towards historical levels. Single-species grouper allocations are not specified in Reef Fish Amendment 1, and this amendment does not attempt to address the question of single-species grouper allocations. Instead, it achieves the needed reductions in red grouper harvest by applying the same percentage reductions to each sector, thus effectively maintaining allocations at current levels.

The overall cumulative effect of the proposed amendment is to establish the biological reference points and stock status determination criteria for the red grouper stock in U.S. waters of the Gulf of Mexico, to establish and implement a rebuilding strategy for the overfished red grouper stock, and to implement additional measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish stocks. Further, actions proposed in this amendment are intended to rebuild the red grouper to a biomass level capable of sustaining MSY on a continuing basis. These actions will provide stability to the recreational, for-hire, and commercial sectors of the reef fish fishery, reduce short-term increases in fishing mortality rates, avoid long-term economic losses to all sectors of the fishery including dependent coastal fishing communities, and allow the targeted stock to rebuild. Therefore, the rebuilding plan is beneficial to the reef fish resources of the Gulf of Mexico.

Recreational Proposed Scenario

The recreational Proposed Scenario reduces the allowable bag limit for red grouper Setting a two red grouper bag limit (out of the five grouper aggregate bag limit) is projected to produce a 9% harvest reduction in the recreational sector. It is the Council's intent that the double bag limit allowance apply on qualified for hire vessels that are out over 24 hours, i.e., a 10 grouper per person bag limit of which no more than 4 can be red

grouper. Although this percent reduction is slightly less than the 9.4% called for, the 0.4% difference is not significant since the recreational sector only accounted for 19% of the total red grouper harvest during 1999-2001. This scenario achieves close to the reduction sought while minimizing disruption to the recreational fishing industry, and it avoids possible adverse impacts on release mortality that could occur from an increase in the minimum size limit.

Taken as a whole, the combined commercial and recreational proposed actions are projected to reduce red grouper harvest in the initial year by approximately 9.4% from the 1999-2001 average. In the second and third years, the reduction may be less as a result of increasing abundance of red grouper due to the rebuilding plan, or it could be greater due to the diminishing impact of the strong 1996 year-class as it is fished out. After the third year, the status of the stock will be reevaluated and a new ABC for the next three years will be determined.

The overall cumulative effect of the proposed amendment is to establish the biological reference points and stock status determination criteria for the red grouper stock in U.S. waters of the Gulf of Mexico, to establish and implement a rebuilding strategy for the red grouper stock, and to implement additional measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish stocks. Further, actions proposed in this amendment are intended to rebuild the red grouper to a biomass level capable of sustaining MSY on a continuing basis. These actions will provide stability to the recreational, for-hire, and commercial sectors of the reef fish fishery, reduce short-term increases in fishing mortality rates, avoid long-term economic losses to all sectors of the fishery including dependent coastal fishing communities, and allow the targeted stock to rebuild. Therefore, the rebuilding plan is beneficial to the reef fish resources of the Gulf of Mexico.

Impacts on Gag Harvest

Gag, along with red grouper, are the dominant species in the shallow-water grouper aggregate, and it is therefore appropriate to consider the effects of management measures to implement a red grouper rebuilding plan on gag harvest. Based on a 2001 stock assessment, gag in 1999 appear to be neither overfished nor undergoing overfishing, but harvest has not yet been reduced to OY levels.

Based on the recommendation of the RFSAP that MSY be the yield resulting from F_{MAX} (RFSAP 2001), and the recommendation of the NMFS Technical Guidance (Restrepo et al. 1998) that F_{OY} be set at 75% of F_{MSY}, the current (1997-99 geometric mean) fishing mortality is only slightly under the overfishing threshold, and an additional 24% reduction in fishing mortality from the 1999 level is needed to achieve the OY target.

Some reduction in gag harvest can be expected to have already occurred as a result of other regulations implemented in 2000.

Size limits: The recreational minimum size increase from 20 to 22 inches was expected to reduce recreational gag harvest initially by 0%-16.35% depending upon which baseline was used. Using the longest available baseline (1990-98), a 7% recreational reduction was expected, and from the commercial sector, the minimum size increase from 20 to 24 inches was expected to reduce commercial gag harvest by 6% (GMFMC 1999). The combined gag harvest reduction was about 6.5%.

Closed Areas: The area closures of the Steamboat Lumps and Madison/Swanson sites were estimated to reduce commercial gag harvest by about 2% (GMFMC 1999). The impact on the recreational fishery was not estimated, but it would be less than the commercial impact and probably negligible due to the distance from shore of the

closed areas.

Based on the above discussion, the cumulative impacts of the 2000 regulations on gag harvest are expected to be 8% commercial harvest reduction and 6% recreational reduction, or an overall reduction (based on a post-1990 commercial:recreational allocation of 43:57) of about 7%. To reach the 24% reduction needed to achieve F_{OY} for gag, additional reduction in gag harvest is needed.

For the commercial section, data from NMFS for 1998-2000 indicates that the number of vessels with shallow-water grouper landings numbered 199 longline vessels, 50 trap vessels, and 1071 vessels with other gear, mostly vertical line. If all 199 longline vessels were to convert to bandit gear, the amount of bandit gear vessels would increase by about 18% (199/1071). An unknown amount currently have both bandit and longline gear, so the actual increase in bandit gear effort would probably be less.

The recreational sector scenario contains no measures that directly affect gag harvest. However, the bag limit of two red grouper out of the five-grouper aggregate bag limit could result in a small shift in harvest to gag in areas where the two stocks overlap. The average angler harvests fewer than two red grouper per trip, however, show any shifting due to the bag limit action is expected to be small.

Combined Commercial and Recreational Proposed Scenarios

The combined Proposed Scenarios, along with the Proposed Alternative to change the shallow-water grouper quota, are expected to produce a 9.4% total reduction in red grouper harvest levels from the 1999-2001 average. A quota closure would impact all commercial fishermen, but if the measure to reduce commercial harvest work as projected, a quota closure can be avoided.

The two-fish red grouper recreational bag limit will impact approximately 6% of the recreational red grouper fishermen.[8] The size limit increase will affect all fishermen, but as a substitute for a closed season, it will allow recreational fishing to occur year-round.

Taken as a whole, the combined commercial and recreational Proposed Scenarios will achieve the needed reduction with large impacts to some segments of the commercial and recreational sectors, but with minimal impacts to the greatest number of participants. As a side effect of the closed seasons and quota reduction, gag harvest will be reduced to levels approaching F_{OY}.

[8] According to NMFS bag limit analyses conducted in January 2001, out of 629 intercepts where red grouper were landed, 131 (21%) landed more than 1 red grouper, 39 (6%) landed more than 2 red grouper, 20 (3%) landed more than 3 red grouper, and 10 (1.5%) landed more than 4 red grouper.

11.0 FINDING OF NO SIGNIFICANT ENVIRONMENTAL IMPACT (FONSI)

NMFS is submitting the attached Secretarial Amendment 1 (Amendment) to the Fishery Management Plan for the Reef Fish Fishery of the Gulf of Mexico, U.S. Waters (FMP) for Secretarial review under procedures of the Magnuson-Stevens Act. The Secretarial Amendment was developed as an integrated document that includes an Environmental Assessment (EA), Regulatory Impact Review (RIR), and a determination of the need for an Initial Regulatory Flexibility Analysis (IRFA). Copies of the Amendment are available from the Council at the following address:

Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North
Suite 1000
Tampa, Florida 33619

11.1 MANAGEMENT MEASURES PROPOSED

Through this Secretarial Amendment, NMFS proposes to: 1) establish the biological reference points and stock status determination criteria (MSY, OY, MFMT, and MSST) for the red grouper stock in U.S. waters of the Gulf of Mexico to bring this stock into compliance with current fishery management standards; 2) to establish and implement a rebuilding strategy for the overfished red grouper stock; and 3) to implement additional measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish stocks. The proposed measures in this amendment are based on the results of a 2002 red grouper stock assessment and the measures proposed by the Council at its July 2002 meeting, and subsequently modified at its January 2003 meeting:

The Preferred Alternatives contained within this Secretarial Amendment for SFA status criteria are as follows:

Red grouper maximum sustainable yield (MSY), fishing mortality rate at MSY (F_{MSY}), and spawning stock biomass proxy at MSY (SS_{MSY}) shall be the most recent values estimated by the RFSAP (September 2002) when a spawner-recruit steepness value of 0.7 is used in the assessment model, based on the most recent red grouper stock assessment.

MSY 7.560 MP
F_{MSY} 0.306
SS_{MSY} 840 metric tons mature female gonad weight

Discussion: These are the values calculated by the NMFS SEFSC and the RFSAP (2002) for a spawner-recruit steepness value of 0.7. Although estimates for steepnesss of both 0.7 and 0.8 were calculated, the RFSAP felt that results from the steepness of 0.7 were more likely to reflect the true values, based on individual Panel members research on other groupers and other species with similar life histories.

Red grouper minimum stock size threshold (MSST) shall be 80% (1-M where M=0.2) of SS_{MSY} (This is currently estimated by proxy to be 672 metric tons mature female gonad weight).

Discussion: This alternative follows the recommendation of the NMFS Technical Guidance document (Restrepo et al. 1998), and therefore, is based on the best available scientific information.

Red grouper maximum fishing mortality threshold (MFMT) shall be F_{MSY} (currently

estimated at 0.306 in the 2002 assessment), or the F consistent with recovery to the MSY level in no more than 10 years when a rebuilding plan is required.

Discussion: This alternative allows the maximum harvest consistent with achieving MSY, and specifies it as a parameter rather than a specific value. This allows the value to be updated with future assessments if new information or improved estimation methods so warrant.

From 2004-recovery, red grouper optimum yield (OY) is the yield defined by the fishing mortality rate consistent with the rebuilding strategy to B_{MSY} within the allowable rebuilding period. After achieving the rebuilding target, OY shall be the yield corresponding to a fishing mortality rate that produces 75% of F_{MSY}: produces 98% of MSY or higher and 125%-131% of SS_{MSY}; (F_{OY} = 0.229, OY = 7.385 MP GW based on the results of the 2002 stock assessment at a spawner-recruit steepness of 0.7).

Discussion: This alternative follows the recommendation of the NMFS Technical Guidance document (Restrepo et al. 1998), and therefore, is based on the best available scientific information. Stocks managed at this OY level are expected to have no more than a 20%-30% probability of exceeding MFMT when MFMT is defined as in the Proposed Alternative in Section 6.2.3.

For the rebuilding plan, the Preferred Alternative is as follows:

Adopt a 10-year red grouper rebuilding plan based on a three-year interval rebuilding strategy. The annual ABC during the first three-year interval will be 6.56 MP GW.

Discussion: This alternative allows harvest to increase in a stepwise fashion as the stock recovers. Setting three-year intervals when harvest will be kept constant allows short-term stability in the management and matches the frequency of adjustments to the probable frequency of new stock assessments. Extending the recovery period to the full 10 years allowed under the Magnuson-Stevens Act allows the highest harvest during rebuilding and minimizes social and economic disruptions.

For the rebuilding scenarios, the Preferred Alternatives are as follows:

Proposed Commercial Red Grouper Management Measures:

8.80 MP GW shallow-water grouper quota.

Discussion: The proposed shallow-water grouper quota represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest.

Proposed Recreational Red Grouper Management Measures:

Bag limit of two red grouper out of the five aggregate grouper bag limit per person, with a double bag limit allowed for persons on qualified for-hire boats that are out over 24 hours.

Discussion: The proposed bag limit change is expected to achieve a reduction in recreational red grouper harvest of 9%. This is very close to the 9.4% reduction needed for the first three-year interval of the rebuilding plan. This bag limit will bring the total recreational harvest reduction within the range being sought, while still allowing recreational red grouper fishermen to have multi-fish harvest trips.

Other Proposed Management Measures

Proposed Shallow-Water Grouper Quota Actions

The commercial shallow-water grouper fishery will close when: 1) commercial quota of red grouper (5.31 MP) is reached, or 2) the commercial shallow-water grouper aggregate (8.80 MP) quota is reached, whichever occurs first.

Discussion: The red grouper stock is undergoing overfishing and management measures are needed to end overfishing and rebuild the red grouper stock. Thus, the rebuilding plan seeks to achieve approximately a 9.4% reduction in total red grouper harvest by reducing the red grouper harvest from the 1999-2001 average commercial catch (5.86 MP) to 5.31 MP, and specifies this as an quota for the commercial sector. Closure of the fisheries when either the red grouper quota or the shallow-water grouper aggregate quota is reached may result in one or the other not being filled. However, the likely hood of this scenario occurring is reduced when one considers that red grouper is a major component of the shallow-water grouper complex and landings of other shallow-water grouper species usually track those for red grouper. Additionally, these actions will reduce the fishing mortality rate on red grouper and perhaps other shallow-water grouper species such as gag, allows the red grouper stock to rebuild, and reduces bycatch mortalities on the shallow-water grouper and red grouper stocks when the fisheries are closed simultaneously.

Deep-Water Grouper and Tilefish Quotas

Tilefish:

Establish a gutted weight (GW) quota for tilefish (all tilefish species in aggregate), which can be subsequently adjusted through the framework procedure for setting total allowable catch. The initial quota will be set at 0.44 MP (average annual harvest 1996-2000).

Deep-water Grouper:

Reduce the deep-water grouper quota from 1.35 MP GW to 1.02 MP GW (average annual harvest 1996-2000).

Discussion: A pro-active quota adjustment on deep-water reef fishes was deemed necessary by the Council because some of the proposed measures in this document, i.e. a possession (trip) limit of shallow-water groupers and a reduction in the shallow-water grouper quota that could potentially result in quota closures, could result in effort shifting to the deep-water species.

11.2 Summary of Effects - Rationale

MSY Alternatives: The maximum sustainable yield (MSY), fishing mortality rate associated with MSY (F_{MSY}), and a proxy for the stock biomass capable of supporting MSY (SS_{MSY}) are basic stock parameters that are needed in order to determine stock recovery targets. In the case of red grouper, mature female gonad weight is used as a biomass proxy for spawning stock. The range of values is the highest and lowest values associated with the red grouper assessment model reported by the RFSAP, in its September 2002 report (RFSAP 2002). The range of values resulted from varying the steepness of the spawner-recruit curve in the projection model between 0.7 and 0.8.

The Preferred Alternative (Alternative 2) specifies MSY, F_{MSY}, and SS_{MSY} based on the low steepness value of 0.7 for the spawner-recruit curve. In its review of the 2002 red

grouper stock assessment, the RFSAP (2002) stated that, while a steepness value of 0.8 is not out of the question, it is on the high end of the range for species with life history characteristics similar to those of red grouper (Rose et al. 2001), and higher than the best fit to the limited spawner-recruit data (steepness = 0.68) currently available for this species (Schirripa et al. 1999). Moreover, because red grouper life history is made additionally complex by hermaphrodism, which has unknown consequences with respect to spawner-recruit relationships, some caution is recommended when biological benchmarks are hovering around threshold levels. This steepness level gives the stock the highest estimate of MSY, the lowest F_{MSY} to produce MSY, and requires the highest spawning stock size, SS_{MSY}, to maintain the fishery. Because it requires a lower fishing mortality rate, this is a more conservative alternative than Alternative 3, but it will ultimately result in a higher yield.

OY Alternatives: The range of alternatives for OY is 6.803 MP (55% of F_{MSY}: Alternative 1) to 7.385 MP (75% of F_{MSY}; Alternative 3). The Proposed Alternative (Alternative 3) sets OY using the method recommended by the NMFS Technical Guidance (Restrepo et al. 1998) to set OY at the yield obtained by fishing at 75% of F_{MSY}, which in a fully recovered stock, is expected to be 98% of MSY or higher (SEFSC 2003). If the management actions proposed in this amendment (quota reduction, maintaining the February 15-March 15 closed season) change the selectivity of the commercial fishery, estimates of MSY and OY could also change. In this document it is assumed that the proposed management actions will not have a significant effect on selectivity. At this OY level, there is no more than a 20%-30% probability of exceeding MFMT, according to the NMFS Technical Guidance. The functional part of the alternative is the method for setting OY, i.e., at yield corresponding to 75% of F_{MSY}. The specific numerical estimates of F_{OY} and OY may change with future stock assessments. Alternative 1 sets a specific OY yield level, i.e., 90% of the MSY yield. To accomplish this requires reducing F_{OY} to 55% of F_{MSY} and is therefore, more conservative than the Proposed Alternative. However, once it became clear that NMFS felt that 75% of F_{MSY} and 98% of MSY provided sufficient protection for the stock, the Council felt that allowing the higher harvest level would optimize benefits from the stock without incurring an unacceptable risk of overfishing. Alternative 3 sets OY equal to MSY. Although this provides the greatest possible yield from the stock, it also results in fishing the stock on the edge of overfishing. This is a risk-prone alternative which the Council did not feel was acceptable. Alternative 4 is the no action alternative. OY is a management consideration only for stocks that are not overfished.

MFMT Alternatives: The Proposed Alternative (Alternative 1) specifies that MFMT be set at F_{MSY}, which is the highest level that can attain MSY on a continuing basis. Unlike Alternative 4, it does not specify a method or proxy for determining F_{MSY}. This allows the best available scientific information and methodology to be used in determining F_{MSY} with each successive stock assessment. Alternative 2 sets MFMT at the current F (current 2001). However, this is above the F_{MSY} level, and fishing above F_{MSY} on a continuing basis is not allowed under the Magnuson-Stevens Act. It is included in order to provide a full range of alternatives for NEPA compliance. Alternative 3 sets MFMT at a level that is 80% of F_{MSY}. This is an allowable and more conservative level than the Proposed Alternative. However, the management target for a recovered stock is the fishing mortality rate associated with optimum yield (F_{OY}) rather than F_{MSY}. Provided that F_{OY} is measurably less than F_{MSY}, this alternative provides an unneeded level of conservatism. Alternative 4 sets MFMT at F_{MAX}. The RFSAP recommended this proxy for F_{MSY} for gag and for protogynous hermaphrodites in general (RFSAP 2001) over SPR based proxies for reasons explained below under biological impacts. However, F_{max} is not always a conservative estimate of F_{MSY}. In the 2002 red grouper stock assessment, a direct estimate of F_{MSY} was made, making a proxy unnecessary. F_{MAX} was also computed in the assessment and was found to be much less conservative than the direct F_{MSY} estimate (F_{MSY} = 0.306, F_{max} = 0.476) and would likely result in the stock entering or maintaining

an overfished state. Alternative 5, status quo, retains the overfishing threshold as $F_{30\% \text{ static SPR}}$ as a proxy for F_{MSY}. This level was adopted in the Generic SFA amendment based on the recommendation of the Council's second Ad Hoc FinFish Stock Assessment Panel (FSAP 1998). However, a more recent recommendation by the RFSAP (2001) suggested that SPR may not be a reasonable proxy for F_{MSY} for protogynous species, because it only relates F to female biomass, does not account for the level of older male biomass in the population, and is more likely than the other alternatives to produce a non-conservative estimate of F_{MSY}. The $F_{30\% \text{ static SPR}}$ estimate was calculated in the 2002 red grouper stock assessment at F = 0.563, making it the least conservative of all the proxies considered.

MSST Alternatives: The Minimum Stock Size Threshold (MSST) is the smallest stock size allowed before a stock is declared overfished. The Proposed Alternative (Alternative 1) follows the recommendation of the NMFS Technical Guidance, and therefore, represents the best available scientific information. The functional part of the alternative refers to the percent of SS_{MSY} that represents the threshold. The estimates by proxy are the current values of the threshold estimated by the most recent biological information, and are subject to change in future assessments. Red grouper, as with other groupers, are protogynous hermaphrodites, i.e., they initially mature as females and then transition to males. The effect of protogynous hermaphrodism on a stock's susceptibility to overfishing is not well understood, and a precautionary approach argues against setting the MSST lower than the recommended default rule.

Rebuilding Plan Alternatives: There are two basic rebuilding strategies: constant catch (Alternative 1) and constant F (Alternative 2). The remaining alternatives, including the Proposed Alternative, consist of various permutations or combinations of these two strategies. The constant catch strategy (Alternative 1) allows the highest initial harvest, but requires that the harvest be kept at that level for the full recovery period. Constant F (Alternative 2) requires a more restrictive initial harvest, but it allows the harvest to increase as the stock recovers. The Proposed Alternative (Alternative 3) is a variation of the constant F strategy, a stepwise strategy. This allows the catch to be adjusted in three-year (or other time-frame) increments, rather than every year. This allows for short-term stability in the management during rebuilding, while still allowing the catch to increase as the stock recovers. Note that although Alternative 3 specifically calls for future stock assessments, periodic reassessment would be required under any recovery program (and is therefore, implied in all of the alternatives) in order to monitor the recovery program's effectiveness and to incorporate any new biological information. Alternative 4 is a mixed-strategy, beginning as constant catch and switching to constant F after a certain number of years. The ABCs for the constant catch portion of this strategy are calculated as the average of the annual constant F ABCs for those years (from the constant F ABC, Table 6.1), and are listed in the alternative as sub-options for two to nine years of constant catch. This approach, while requiring a deeper initial harvest reduction than straight constant catch, would be less severe than under a straight constant F strategy, and it would allow ABC to increase in the transition year to constant F and the years thereafter. Alternative 5 could be used in combination with one of the other alternatives to reduce the recovery time frame. Under the National Standard guidelines, the maximum recovery period can be no longer than 10 years (unless the stock would not recover in 10 years even in the absence of all fishing mortality), but it can be shorter than 10 years. The shortest possible recovery period is two to four years, which is the recovery time estimated by the RFSAP in the absence of all fishing. For the remaining time frames (five to nine years), the ABCs are calculated as a proportional reduction from the ABCs under a 10-year plan. Alternative 6 (Status quo) could only be acceptable if the stock were determined not to be overfished.

Rebuilding Scenario Alternatives:

Commercial Proposed Scenarios

The Proposed Commercial Scenarios are for the first three years of a rebuilding plan based on the Proposed Alternatives under the section, Rebuilding Strategy. They adhere to the following conditions, and are based on attaining approximately the mid-point of the range of harvest reduction needed: 1) use a three-year interval strategy in setting TAC; 2) ABC for first three-year period is 6.55 MP; 3) 9.4% harvest reduction from 1999-2001 average (2.0% reduction from the 1990-2000 average); and 4) achieve harvest reduction for both commercial and recreational sectors. Selecting the same percent harvest reduction for the commercial and recreational sectors will preserve the existing red grouper harvest ratio of 81% commercial to 19% recreational. This ratio has changed in favor of the commercial fishery from the previous years ratio of 76:24 while gag harvest has changed in favor of the recreational fishery during the same time. The Council, at the recommendation of NMFS, decided to base its harvest reduction strategy on the baseline years 1999-2001 rather than 1990-2000 as had previously been used. The Proposed Commercial Scenarios retains the February 15 - March 15 commercial closed season for red, black and gag grouper, and reduces the shallow-water grouper quota. These actions are intended to reduce commercial red grouper harvest by approximately 9.4%. The proposed shallow-water grouper quota of 8.80 MP GW represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest. The status quo alternative (no commercial action) does have any impacts on fishing participants. Over a longer period, an effective rebuilding strategy can yield higher net benefits than the status quo. In addition, the no action alternative will fail to achieve the target SSB.

Recreational Proposed Scenarios

The Proposed Recreational Scenario reduces the allowable bag limit for red grouper. Setting a two red grouper bag limit (out of the five grouper aggregate bag limit) is projected to produce a 9% harvest reduction in the recreational sector. Although this percent reduction is slightly less than the 9.4% called for, the 0.4% difference is not significant since the recreational sector only accounted for 19% of the total red grouper harvest during 1999-2001. This scenario achieves close to the reduction sought while minimizing disruption to the recreational fishing industry, and it avoids possible adverse impacts on release mortality that could occur from an increase in the minimum size limit. Recreational Scenario 2 (status quo) would not achieve the necessary reductions in harvest unless additional harvest restrictions were placed on the commercial sector.

Combined Commercial and Recreational Proposed Scenarios

The combined Commercial and Recreational Proposed Scenarios are projected to produce a 9% reduction in recreational harvest of red grouper, and a 9.4% reduction in commercial harvest. The overall combined reduction is projected to be 9.4%. After three years, the regulations and the status of the stock will be reevaluated. The proposed shallow-water grouper quota of 8.80 MP GW represents approximately a 9.4% reduction of the commercial red grouper harvest component from the 1999-2001 average shallow-water grouper harvest. The two-fish red grouper recreational bag is projected to reduce recreational red grouper harvest by 9%. However, according to NMFS bag limit analyses done in 2001 on angler trips where red grouper were caught, the average number of red grouper taken per angler trip was only 1.2 fish, and only 6% of the angler trips caught more than two red grouper. Therefore, this proposal will have little impact on most recreational fishermen. Taken as a whole, the combined commercial and recreational Proposed Scenarios are projected to reduce red grouper harvest by 9.4%, at least in the first year. After three years, the regulations and status of stock will be reevaluated.

Shallow-Water Grouper Quota Adjustments Alternatives: The current shallow-water grouper commercial quota is 9.35 MP GW. Alternatives 1, 2 and 3 reduce the

shallow-water grouper quota which will reduce fishing mortality on all shallow-water grouper species. Given that only red grouper in the shallow-water grouper aggregate is classified as overfished, and undergoing overfishing, this could be considered conservative and pro-active with regard to the other species. However, the shallow-water grouper quota was reached in recent years (2001), and these adjustment decrease the likelihood of that re-occurring. Once there is a quota closure, there is a danger of a derby fishery developing in subsequent years, as has occurred with red snapper. This would make quota monitoring more difficult and would increase the probability of quota overages occurring again. Alternative 3 is the Proposed Alternative. It is based on achieving a 9.4% red grouper harvest reduction from the 1999-2001 average harvest. The 1999-2001 baseline was felt to be more appropriate than a longer-term baseline due to the recent increase in harvest rates, apparently due to the effect of the strong 1996 year-class. This year-class will likely continue to affect harvest for at least the next few years. Alternative 4 is status quo. Under this alternative there will be no reduction in fishing mortality through the use of quota closures. If management measures are successful in reducing the fishing mortality rate to a level consistent with the ABC ranges, the quota will not be filled and will have no biological impact. If management measures are not successful in reducing the fishing mortality rate to a level consistent with the ABC ranges, the quota will allow overfishing to occur. However, compared to having no quota, it will limit the potential rate of overfishing by providing a stop to grouper fishing if and when it is reached, although at a fishing mortality rate above the overfishing thresholds.

Shallow-Water Grouper Quota Actions Alternatives: These alternatives determine whether the commercial red grouper quota is effectively treated as a single species quota or as part of an aggregate quota, and provides ways to allow fishing for other shallow-water grouper species when the red grouper quota is reached, while minimizing red grouper fishing and bycatch mortality. The Proposed Alternative (Alternative 5) would close the commercial fishery when the commercial quota of red grouper is reached, or the commercial shallow-water grouper aggregate quota is reached, which ever occurs first. Closure of the fishery when either the shallow-water grouper aggregate quota or the red grouper quota is reached, may result in one or the other not being filled. However, these actions will reduce the fishing mortality on red grouper and perhaps other shallow-water grouper species such as gag; allows the red grouper stock to rebuild; and reduces bycatch mortalities on the shallow-water grouper and red grouper stocks when the fisheries are closed simultaneously. Alternative 4 would close the commercial fishery for shallow-water grouper when the aggregate quota is reached, and is the simplest to implement. It is a less precise management measure than the other alternatives, since the proportion of quota that each grouper species comprises can change, but it minimizes bycatch mortality that may occur when fishing while some species are open and others are closed. Alternative 1 essentially treats red grouper as a separate quota. Allowing the remaining shallow-water grouper fishery to continue will result in bycatch mortality of red grouper in areas where red grouper occurs along with other grouper species. Alternative 2 is a modification of Alternative 1, when the red grouper quota is filled before the shallow-water grouper quota, it allows the remaining shallow water grouper to be caught but only in areas where the red grouper stock is scarce or nonexistent. Alternative 3 attempts to address the reverse situation, that of the shallow-water quota being filled before the red grouper quota is taken. This alternative closes all shallow-water grouper commercial fishing except red grouper until the red grouper quota is filled. However, since red grouper is part of the shallow-water grouper aggregate, this alternative results in the aggregate quota being exceeded, and it is the most risk-prone alternative in this section.

Additional Alternatives to Reduce Fishing Mortality

Commercial Shallow-Water Grouper Closed Seasons

Lengthening the closed season (Alternatives 1 and 2) may increase its effectiveness, since

it would be more difficult for fishermen to shift the entire displaced effort. However, since some effort shifting will occur, the monthly percent impacts in Alternative 2 are still likely overestimates. Alternative 3 (Proposed Alternative) would repeal the February 15 March 15 commercial closure for red, black and gag grouper. This closure took effect in 2001. It was originally projected to reduce red grouper harvest by 8% and gag/black grouper harvest by 10% (based on the relative monthly landings during 1996-1999), and to provide protection for gag spawning aggregations during a portion of their peak spawning season. However, the number of bandit gear vessel trips in February 2001 was double that of February 2000 and 1999, despite the season being open for only half of the month. Bandit trips in April and May were also more than double those of the same months in 2000 and 1999. Longline vessel trips also increased in the months surrounding the closed season, though not to as great an extent. In addition, landings may be increasing due to the increasing impact of the 1996 red grouper year-class, of which individual fish started to become large enough to enter the fishery about 1999. Observations of harvest during February-March after the closed season was implemented in 2001 compared with 1999-2000 (no closed season) suggest that red grouper harvest during the February-March period decreased 44% during the February-March period (from a 1999-2000 average of 504.6 metric tons whole weight to 281.5 in February-March 2001). However, total annual commercial red grouper landings were nearly unchanged (from an annual average of 3162 MT whole weight in 1999-2000 to 3160 MT whole weight in 2001). The February-March contribution to the annual red grouper harvest was 16% in 1999-2000, and 14% in 2001. Thus relative catch was only 2% less in the year when the February 15-March 15 closed season was in effect. It should be noted, however, that whether these reductions in catch in red/gag/black grouper fisheries accurately depicts the effects of the closed season is difficult to ascertain. Reductions or increases in harvest levels are also influenced by external factors including the magnitude of imports, local market conditions, cost of fuel and weather, all of which could have affected fishing effort in the commercial sector.

Further, repealing the February 15-March 15 closed season (Alternative 3) will result in loss of protection for spawning aggregations of gag, which peak in February and March. This commercial closed season on red grouper, gag and black grouper was first implemented in the 2001 fishing season to provide protection for the spawning stock and reduces harvest of these species. Gag in the Gulf of Mexico spawn from December through mid-May, with a peak in February through March (Koening et al. 1996). Koening et al (1996) suggested that fishing activities on the spawning aggregations may be responsible for changes in the population size and sex-ratio. This suggestion is supported by observations of other researchers who reported that hook-and-line fishing on gag (and scamp) spawning aggregations tended to select males before females (Gilmore and Jones 1992; C. Koening, personal communications, 1996). Red and black grouper spawning stock will also receive some protection. Peak spawning for black grouper occurs from December to March (Crabtree and Bullock 1998). While peak spawning of red grouper (April and May) occurs after the proposed closure period, some red grouper are in spawning condition as early as March (Bullock and Smith 1991).

Commercial Grouper Trip Limits

Trip limits would reduce the availability of shallow-water grouper throughout the season. However, if the fishery is subject to quota closure, trip limits offer the ability for the fishery to remain open longer than without trip limits as long as the trip limit is not set too high. Alternative 1 establishes separate possession (trip) limits for longlines, fish traps, and other gears. In order to discourage vessels from having high trip limit gear onboard simply to qualify for the higher limit, the alternative applies the lowest trip limit to vessels that have multiple gear types. When the Council, at its January 2003 meeting, proposed using possession (trip) limits to control commercial harvest rates, it asked that NMFS consider fairness and equatability among different fisheries in applying this alternative.

The concern was raised that a single limit might be unfair to all sectors of the red grouper fishery, i.e., a 5,200 pound GW trip limit would reduce harvest in the handline gear fishery by less than 1%, but would reduce harvest in the longline fishery by nearly 15%, and in the fish trap fishery by 6%. The intent of the request was to suggest an average of the sector's landings be considered and then reduce their landings by a percentage that would equate to a trip limit, i.e., different sector trip limits. The trip limits in Alternative 1 are projected to reduce each gear sector's red grouper harvest by 9.4% in the absence of effort shifting. In considering this alternative, NMFS felt that multiple trip limits would increase the complexity of the regulation which would decrease compliance and enforceability. In addition, NMFS felt that multiple trip limits would encourage fishermen to convert their vessels to the gear with the highest possession (trip) limits and would ultimately increase rather than decrease harvest. Therefore, NMFS rejected this alternative. Alternative 2 sets a single possession (trip) limit for all commercial reef fish vessels at a level projected to reduce commercial red grouper harvest by 9.4%. Because this alternative is less complex than multiple gear limits, and because the deep-water reef fish will be protected from excessive harvest by the new proposed quotas, NMFS felt that this alternative provided the best approach to implementing a possession (trip) limit on shallow-water grouper. Alternative 3 (status quo-Proposed Alternative) will not produce any reduction in harvest. The harvest of red grouper (and all shallow-water grouper) will be constrained by the shallow-water grouper quota, but without trip limits, size limit increase, closed seasons, gear restrictions or other measures to reduce the rate of harvest, the likelihood of an early quota closure is increased. The expectation of a quota closure may lead to a derby type fishery, which would exacerbate the early closure.

Recreational Grouper Closed Seasons

A closed season of from less than one month to two+ months (depending upon the months selected and other recreational management measures) would be needed in order to provide the 9.4% reduction needed in red grouper harvest in the absence of other management measures. However, a closed season would have created disruption in the recreational fishery, even if limited to the geographic region where red grouper are most abundant. During the July 2001 Amendment 18 public hearings, the February 2002 Secretarial Amendment 1 public hearings, and at Council testimony during the May and July 2002 Council meetings, fishermen asked the Council to consider raising the red grouper minimum size limit as an alternate measure in order to shorten or eliminate any closed seasons. Size limit increases had not been initially considered because the red grouper size limit is already set at the level that produces maximum yield-per-recruit. Subsequent analyses by NMFS concluded that, on the assumption of a 10% release mortality for recreational fishing, a size limit increase to 22 inches total length could provide a 32% reduction in recreational harvest with minimal negative impact on yield-per-recruit. At the time, a harvest reduction of 45% was being sought based on the 1999 red grouper assessment and 2001 supplemental analyses. However, analyses based on the more recent 2002 red grouper assessment showed that the stock was in an improved condition, and only a 9.4% reduction was needed to effect a recovery to the B_{MSY} level within 10 years. This level of harvest reduction could be achieved through bag limits alone. Consequently, the Council chose to propose a harvest reduction scenario that did not include closed seasons or a minimum size limit increase.

Recreational Grouper Bag Limits

The Proposed Alternative (Alternative 1) bag limit reduction on red grouper will provide approximately a 9.0% reduction in red grouper harvest. The bag limit will impact only a small number of fishermen who might otherwise catch more than two red grouper on a trip. MRFSS data provided to the Council in January 2001 indicated that only 6% of the interview intercepts where red grouper were harvested had more than two red grouper. Most recreational fishermen testified that they were willing to accept reduced red grouper

bag limits. However, for-hire vessel operators were concerned that reducing the bag limit to less than two would make it difficult to attract customers. It should be noted that all three of the Alternatives can be adopted simultaneously, provided the sub-options are consistent. If Alternative 1 (sub-bag limit on red grouper) or Alternative 2 (sub-bag limit on gag) is adopted, it may be necessary to adopt both alternatives to prevent effort shifting from one species to the other. Most recreational fishermen do not fill their grouper bag limit. Therefore, bag limit reductions to four, three or even two fish will impact only a relatively small number of anglers, but at two red grouper or less there will be a significant reduction in harvest. A two red grouper bag limit alone is sufficient to achieve the recreational reduction needed, or a less restrictive bag limit can be used in combination with other management measures to achieve a sufficient reduction. However, a species bag limit on red grouper without a corresponding bag limit on gag (Alternative 2) may result in an increase in recreational gag harvest. The gag fishing mortality rate is currently only slightly below the overfishing threshold, or maximum fishing mortality rate, and requires an additional 24% reduction to reach the optimum yield harvest rate, based on the results of the 2001 gag stock assessment. Gag harvest will need to be carefully monitored to assure that it does not reenter a state of overfishing. Alternative 4 (status quo) would not achieve the reduction in the recreational sector necessary to reach the target SSB.

Red Grouper Minimum Size Limits

Although minimum size limit changes were not originally included in the red grouper rebuilding plan as explicit alternatives, they are specified as allowable actions under the Reef Fish FMP's framework procedure for setting total allowable catch. (This amendment was being developed as a framework regulatory amendment prior to the determination by NMFS that it would need to be submitted as a Secretarial Amendment.) In an earlier version of this Secretarial Amendment, when a 45% harvest reduction was being sought rather than the 9.4% now needed, both commercial and recreational fishermen asked that size limit increases be considered in lieu of extended closed seasons. However, with the new biological information from the 2002 red grouper assessment indicating that only a 9.4% harvest reduction (from 1999-2001 average annual landings) is needed to implement a rebuilding plan, extended closed seasons are no longer under consideration.

Raising the commercial red grouper minimum size limit to 22 inches (Alternative 2) would be projected to result in a 10.8% reduction from the handline/powerline component of the commercial (assuming a 30% release mortality of undersized fish), and a 9.4% reduction from the longline fishery (assuming a 30% release mortality). However, a 22 inch minimum size limit (Alternative 1) would produce a projected 32% reduction from the recreational fishery (assuming a 10% release mortality). For the recreational fishery, even the smallest size limit increase that could be considered, 21 inches (a 1-inch increase) would reduce harvest by over 20%, more than double the 9.4% reduction needed. If the actual release mortality is higher than assumed, then the effective harvest reduction will be less. Size limit alternatives of 21, 22, 23, and 24 inches total length (Alternatives 1 and 2) were analyzed. As would be expected, harvest reductions were greater at higher minimum size limits. At the status quo 20 inch minimum size limit (Alternatives 3 and 4), there is no reduction in harvest. A 22-inch minimum size limit for the commercial fishery would achieve the desired harvest reductions, but would also increase the amount undersized fish caught and the resulting bycatch mortality. The recreational sector generally fishes closer to shore and in shallower water on average, so release mortality is less of a factor. However, even the smallest, one-inch, size limit increase would produce a reduction in harvest more than double that needed. For the recreational sector, a minimum size limit increase cannot be used to achieve just a 9.4% reduction.

Combined vs. Separate Fixed Season and Quota Closures Alternatives: Alternative 1 (Proposed Alternative) will create one longer closed season instead of two shorter closures in years when there is a quota closure on stocks that also have a fixed closed season. Longer closed seasons are considered to be more effective than short closed seasons because it is more difficult for fishermen to compensate for the closure though additional harvest during the open season. If a fixed closed season is selected because it includes a portion of the spawning season, this alternative may increase spawning season protection in years when quota closures are applied. For this reason, Alternative 1 is expected to have beneficial biological impacts. Alternative 2 will have impacts similar to Alternative 1, but where Alternative 1 applies to all reef fish with fixed seasons and possible quota closures, in Alternative 2 the scope is narrowed to just grouper fisheries, and effectively to just shallow-water grouper, since deep-water grouper do not have a fixed closed season at this time. The Proposed Alternative (Alternative 3) will also accrue benefits to the resource from reduced fishing pressure, but, as explained above, the reductions achieved by two shorter seasons may not be as great as those achieved by one longer season, due to increases in fishing effort before and after the closures. However, status quo is an easier to understand action, which should result in higher voluntary compliance.

Deep-Water Grouper and Tilefish Quotas Alternatives: Alternative 1 provides pro-active protection for tilefish by establishing a tilefish quota based on recent years landings. Tilefish landings during 1996-2000 ranged from 255 thousand pounds GW to 508 thousand pounds GW. There currently is no quota and no information on what a sustainable harvest might be. The most conservative sub-option (90% of the baseline average) would provide a pro-active protection for tilefish, and could allow for some rebuilding of the tilefish stocks to occur. However, this is the most likely to trigger quota closures. Under sub-option b (100% of the baseline average), the proposed quota was exceeded 40% of the time, and under sub-option c, (highest landing in baseline), the proposed quota has not been exceeded. Alternative 2 reduces the existing 1.35 MP GW deep-water grouper quota to a more conservative level. The deep-water grouper quota was originally part of a total grouper quota set in 1990 in Amendment 1 as 90% of the aggregate grouper landings from 1985-1987. One would expect that, at 90% of historical landings, the quota should have been met periodically, however the quota has never been reached. This suggests that either stock levels or fishing effort has declined, or that the quota was set too high initially. The most conservative sub-option (90% of the baseline average) would provide a more conservative protection for deep-water grouper, and could allow for some rebuilding of the deep-water grouper stocks to occur. However, this is the most likely to trigger quota closures. Under sub-option b (100% of the baseline average), the proposed quota was exceeded 40% of the time, and under sub-option c, (highest landing in baseline), the proposed quota has not been exceeded. All of the sub-options are more conservative than the existing quota, and would prevent expansion of the deep-water grouper fishery.

Alternative 3 combines deep-water grouper and tilefish into a single deep-water reef fish quota. As with the previous alternatives, a range of options is provided from the most conservative (90% of baseline) to the least conservative (current deep-water grouper quota plus highest baseline tilefish landings). However, tilefish have a lower ex-vessel value than grouper, and this alternative may allow higher landings of deep-water grouper than intended if the tilefish portion of the quota is used for grouper instead. For this reason, this alternative, which was initially a Preferred Alternative, was rejected by the Council. Alternative 4 works in conjunction with Alternatives 1 and 2 (separate quotas for tilefish and deep-water grouper) by closing both fisheries when either quota is met. This alternative will eliminate bycatch and bycatch mortality of the closed season species from vessels fishing the remaining open fishery. Alternative 5 (status quo) would leave the existing 1.35 MP GW (restated from 1.6 MP whole weight) deep-water grouper quota and no quota on tilefish. This would provide some protection for deep-water grouper by capping harvest at 90% of the 1985-1987 landings, but would allow landings to increase

over recent years. It would provide no protection for tilefish.

For any of the rebuilding plan alternatives, periodic updates on red grouper, gag and other species in both the shallow-water and deep-water grouper complex would need to be requested by the Council and compiled by NMFS. The purpose of these updates would be to insure that the annual harvest by the recreational and commercial fisheries was not exceeding the expected annual harvest needed for the rebuilding plan. An additional requirement for all the rebuilding plan alternatives would be periodic stock assessments. Red grouper and gag as well as all the species in the shallow-water and deep-water grouper complex are a long-lived species and so changes in the population occur relatively slowly. Therefore, while annual updates in harvest are required to make sure the harvest required for the rebuilding plan are not exceeded, annual assessments of species like red and gag grouper are not needed and could occur at three- to five-year intervals (GMFMC, 1999). These assessments would be requested as needed when the Council and NMFS's Southeast Regional Office (SERO) develop the yearly Operations Plan, and would be subject to the availability of funds to conduct the assessment. Because the Preferred Alternative anticipates the expected harvest from the plan at three-year intervals, the logical time frame for these stock assessments to occur would be at three-year intervals just prior to when the harvest level is expected to be increased to insure that projections about the stock condition are still valid. If the assessment reveals that yield projections needed to rebuild the stock have changed (they either have increased or decreased), then management measures including, but not limited to size limits, bag limits, seasonal closures, and modifications to existing gear boundaries could be employed to adjust harvest accordingly. These would be enacted by the Council through a plan amendment, regulatory amendment, emergency action, or interim rule. What type of rule making action the Council chooses would be dictated by the severity of overages in harvest should an overage occur.

11.3 AFFECTED ENVIRONMENT AND CONSEQUENCES

11.3.1 Essential Fish Habitat (EFH)

The area affected by the proposed amendment in the reef fish fishery has been identified as EFH for the Red Drum, Reef Fish, Shrimp, Stone Crab, and Coral FMPs of the Council; Coastal Migratory Pelagics and Spiny Lobster joint FMPs of the Gulf and South Atlantic Councils; and the Tuna/Swordfish/Shark and Billfish FMPs of the NMFS Highly Migratory Species. The actions are intended to conserve and enhance the stocks reef fish by establishing ans implementing a rebuilding plan for the overfished red grouper stock, and implementing additional management measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish.

The red grouper is demersal and occurs throughout the Gulf of Mexico at depths from 3 to about 200 m, preferring 30 to 120 m depths. It is particularly abundant off west Florida and the Yucatan coasts. Spawning occurs at depths of approximately 25 to 90 m on the Florida Banks with peaks during April and May. Eggs are pelagic and planktonic, and require at least 32 ppt salinity for buoyancy. Larvae leave the planktonic stage to become benthic at about 20 mm standard length. Late juveniles select inshore hardbottom to depths of about 50 m, seeking shelter in crevices and other hiding places. Favored nursery areas for juveniles are grass beds, rock formations, and shallow reefs. Juveniles remain in the nursery areas until mature before moving to deeper Gulf waters (NOAA 1985). Adults select rocky outcrops, wrecks, reefs, ledges, crevices and caverns of rock bottom, as well as "live bottom" areas, in depths of 3 to 190 m. Spawners occur in offshore coastal waters in depths of 20 to 100 m.

The reef fish habitats and related concerns were described in the FMP/Environmental

Impact Statement (EIS) and were updated in Amendments 1, Amendment 5/SEIS and the generic amendment describing EFH for all Gulf fisheries. Reef Fish Amendment 18/SEIS, when completed by the Council, will update the description of EFH. The coastal migratory pelagic habitats and concerns were described in the FMP/EIS and updated in Amendment 1/SEIS, Amendment 3, and the generic amendment describing EFH for all Gulf fisheries.

The Council will request that NMFS conduct an consultation on the impacts of the actions in this Secretarial Amendment on EFH. However, the actions in this Secretarial amendment are not expected to have any adverse impacts on red grouper or other species' EFH.

11.3.2 Fishery Resources

Red grouper are caught mostly in the GOM from Panama City, Florida to the Florida Keys, and primarily south of Tampa. Red grouper catch statistics were no longer lumped with other grouper species in 1986 (Goodyear and Schirripa 1993). Cuban fishermen caught a significant amount of red grouper from US waters prior to extended jurisdiction in 1976. Handline/power reel fishermen caught most of the red grouper until the early 1980s when longlines increased operations and dominated the catch. Florida implemented an 18-in minimum size limit in 1985 for state waters and the Council implemented a 20-in minimum size limit in 1990 for the EEZ, which Florida matched in state waters. Goodyear and Schirripa (1993) concluded that red grouper were not overfished through the early 1990s. They estimated SPR at around 30%.

Schirripa et al. (1999) updated the previous assessment with data through 1997. By applying the ratio of red grouper to all grouper from 1986-1997 to the total US grouper catch and incorporating the Cuban red grouper catch, Schirripa et al. (1999) estimated the historical catch. Total catch, including Cuban, US commercial and recreational, peaked during the late 1940s to 1950s at 14 to 18 MP. A substantial drop in Cuban catch led to a total catch around the 8-10 million pound range from the 1960 until the exclusion of the Cuban fleet in 1977. Subsequently, the US catch fluctuated from 6-11 MP. Since 1986, the commercial handline catch of red grouper declined by about half, while the longline catch showed no trend. Trap fisheries represented a minor component. The recreational fishery peaked in the mid- to late-1980s at about 0.6-1.0 million fish retained per year. Catch dropped to 0.2 million fish in 1990 following the minimum size limit, increased somewhat in 1992-1993, and declined to 0.2-0.1 in 1996-1997. Since 1983, recreational fishermen released most red grouper, up to 80-90% in the 1990s.

In October 2000, NMFS issued a determination that the Gulf of Mexico red grouper stock is overfished and undergoing overfishing. This determination was based on the results of a 1999 red grouper stock assessment (Schirripa et al. 1999) which assessed the status of the stock as of 1997, and several subsequent analyses by the NMFS SEFSC and the Council's RFSAP. Under the Magnuson-Stevens Act, once a stock is declared to be overfished, the Council has one year to submit a plan to NMFS to end overfishing and rebuild the stock to a level capable of supporting maximum sustainable yield (MSY) on a continuing basis. If, within one year of being notified that a stock is overfished, the Council does not submit a rebuilding plan, then the Magnuson-Stevens Act requires that NMFS (on behalf of the Secretary of Commerce) within nine months prepare a Secretarial plan or plan amendment and any accompanying regulations to end overfishing and rebuild the stocks.

In 2002, a new red grouper stock assessment was prepared by NMFS and reviewed by the RFSAP. The new assessment updated the landings data to 2001, and developed a

new relative fecundity-at-age relationship that assigned slightly higher fecundities to the younger age groups. The 2002 assessment also incorporated the effect of a strong 1996 year-class which began entering the fishery in 1999, too late to have been included in the previous assessment. The RFSAP settled on a recommendation that the steepness value of the spawner-recruit relationship in the ASAP model be set at 0.7 rather than the range of 0.7 to 0.8 used in the previous recommendations. The new assessment confirmed the previous assessment's finding that the red grouper stock was below the overfished threshold of 80%*B_{MSY} in 1997, but the stock was found to be less severely overfished due to the effect of incorporating the new fecundity-at-age relationship. At a steepness of 0.7, the previous assessment had found the red grouper spawning stock biomass to be at 56% of B_{MSY} in 1997. The revised estimate from the 2002 assessment was that the stock was at 62% of B_{MSY} in 1997, and at 84% of B_{MSY} in 2001. Although the most recent status estimate now put the stock above the overfished threshold, the confirmation that it was below the threshold in 1997 left intact the overfished designation and the requirement to rebuild the stock to B_{MSY} in no more than 10 years. The Council developed the proposed amendment to address overfishing of the red grouper stock and to rebuild the stock to a level capable of supporting maximum sustainable yield (MSY) on a continuing basis.

11.3.3 Social and Economic Environment

Several benefits to the social and economic environment will result from the proposed amendment. Biological reference points and stock status determination criteria, such as MSY, MSST, and MFMT, are mainly biological in nature but have relevance to the determination of impacts on fishing participants to the extent that they provide the general benchmark for regulatory measures. Regulatory measures, such as those considered in this amendment, that flow from the choice of these sustainable fishing parameters are the ones that have immediate impacts on fishing participants. The determination of OY is mainly done on biological and socioeconomic grounds. The general impacts of these alternatives will become an important issue at such time when the red grouper stock is fully rebuilt, since OY will be the management goal.

Under the red grouper rebuilding plan, red grouper harvest will decline from present catches. While the MSY is around 7.56 MP (GW), harvest during the initial three years of rebuilding will likely be around 6.55 MP. Using the average catch of 7.248 MP from the base years of 1999 to 2001, catch reductions of roughly 10% are needed. This will affect the income, time spent fishing, and selection of alternative target species for fishermen, and may cause disruptions to the fresh grouper market, both short-term (reduced availability to the market due to harvest restrictions and interruptions in availability due to quota closures) and long-term (market switch to alternative sources).

All rebuilding scenarios are expected to result in short-term negative but long-term positive socioeconomic impacts on both the commercial and recreational fishing participants. The Proposed Alternatives for the commercial sector are expected in the short-term to have negative impacts that will be mostly borne by longlines and high-volume vertical line and fish trap vessels. Over time, all segments of the commercial sector are expected to benefit from the rebuilding strategy, except that fish traps will be completely phased out of the fishery by 2007. The Proposed Alternative for the recreational sector is expected to reduce the red grouper harvest of this sector. Since the proposed measure is specific to red grouper, anglers still have the flexibility to fish for other groupers or reef fish species. In this sense, the likelihood of trip cancellations due to the proposed measure is relatively low. The short-term negative impacts then are expected to be mainly borne by anglers, with the for-hire sector only minimally affected. Over time, benefits are expected to accrue to both anglers and for-hire operators as the red grouper stock is fully rebuilt.

In terms of initial impacts, shallow-water grouper quota adjustments and closures would not impose regulatory bias in negatively affecting the various commercial fishery participants. The eventual outcome during the rebuilding period would depend on the occurrence of derby characteristics in the fishery. If a derby does occur, it is likely to result in lower revenues and profits to the commercial sector.

For the most part, deep-water grouper and tilefish are prosecuted by fishermen who also fish for shallow-water groupers. The Proposed Alternative, which sets a quota on deep-water grouper and tilefish equal to the average landings for these species in recent years, may be expected to maintain vessel harvest and revenues from these sources.

The optional alternatives include commercial shallow-water grouper closed season, commercial grouper trip limits, recreational grouper closed seasons, and recreational grouper bag limits. For the commercial sector, a longer closed season would, in addition to the general short-term reductions in revenues and profits, likely invite more imports. This situation can stabilize prices to the consumers but may result in domestic producers losing some markets. Uniform trip limits would have differential impacts among the longline, vertical line, and fish trap segments of the fishery and between small and large vessels, with lower trip limits affecting the longliners more than others and large vessels more than small ones. For the recreational sector, closed seasons can initially result in fewer angler trips, and thus lower for-hire vessel revenues, but such negative impacts may be mitigated if effort is successfully shifted to the open months. Bag limits can effect a reduction in recreational catch if set at relatively low level, such as one-fish red grouper in the aggregate five-grouper bag limit. Closed seasons, however, are expected to effect more negative impacts on the for-hire sector than reduced bag limits, since trip cancellations are more likely to occur under a closed season than under a bag limit reduction.

Changing the commercial fishing year will start to have impacts on fishing participants if quotas are set at low levels. Alternatives 1 and 2 would allow longer closed fishing season than status quo, and such conditions may result in some market loss particularly if imports compensate for the stoppage in domestic production.

Potentially affected by the measures considered in this amendment are about 160 longline vessels, 800 vertical line vessels, and 60 fish trap vessels with home ports in Florida. Also harvesting a minimal amount of grouper are about 60 vessels using powerheads. There are about 227 fish dealers possessing federal permits to buy and sell reef fish. Of these dealers, 146 are located in Florida. There are about 1,377 for-hire vessels with reef fish and 1,437 vessels with coastal migratory pelagic permits. Of this number, 926 vessels in the state of Florida have either an active Gulf of Mexico moratorium coastal migratory pelagics permit, reef fish permit, or both.

Additional impacts from the alternatives proposed in this amendment will be borne by extended communities (i.e., support industries such as fish dealers, marinas, ship yards, maintenance facilities, gear supply firms). However, any negative impacts and the subsequent social disruption among fishery participants are not expected to be substantial or of long-term duration.

11.3.4 Effects on Endangered and Threatened Species

NMFS will conduct a consultation under Section 7 of the Endangered Species Act on the impacts of the actions in this Secretarial Amendment on endangered species and marine mammals, if the actions contained herein are determined to adversely affect listed species.

An April 28, 1989, biological opinion on the effects of commercial fishing activities in the Southeast Region found that mortalities of endangered and threatened species are uncommon from the hook-and-line and bottom longline gear used in the reef fish fishery and were not likely to jeopardize the continued existence of threatened or endangered species. Assessments of the level of take were not then considered a high priority. Informal Section 7 consultations have been conducted on the original Reef Fish FMP and for Amendments 1, 2, 3, 4, 5, 6, 7 ,8, 9, 11, 12, 13, 14, 15, 16A,16B, 17, 19 (Generic Tortugas Reserves Amendment), 20 (Reef fish, and associated regulatory amendments) and 21 (Madison-Swanson and Steamboat Lumps). They have also been conducted for the FMP's various regulatory amendments, including 21 regulatory amendments submitted from 1990 to 2001, and the two Secretarial plan amendments. These consultations all concluded that the fishery management actions were either not likely to adversely affect any threatened or endangered species under NMFS jurisdiction or had no effect. They also determined that FMP or amendment actions were not expected to change the prosecution of this fishery in a manner that will significantly alter the potential impacts to endangered and threatened species and their habitats previously considered. Amendments 10 and 18 are not included in the preceding list. A Section 7 consultation was initiated for Amendment 10, but that Amendment was not submitted to NMFS. Amendment 18 is currently under development and a Section 7 consultation will be requested at the appropriate time.

Two species of shallow-water grouper (Nassau grouper, *Epinephelus striatus* and goliath grouper, *Epinephelus itijara*) and two species of deep-water grouper (warsaw grouper, *Epinephelus nigritus* and speckled hind, *Epinephelus drummondhayi*) are on the NMFS list of candidate species for possible future listing under the Endangered Species Act. Harvest of Nassau grouper and goliath grouper is currently prohibited, and the actions in this amendment are not expected to have any significant impact on these species. The primary deep-water grouper target species is yellowedge grouper, for which a 2002 stock assessment was prepared by NMFS. As a precaution against a possible increase in fishing effort on deep-water grouper species and on tilefish, this amendment contains action to adjust the deep-water grouper quota and create a tilefish quota. None of the actions in this Secretarial Amendment are expected to jeopardize the recovery of endangered or threatened species or their critical habitat.

11.3.5 Effects on Wetlands

The proposed amendment would not affect the recreational, for-hire, or commercial sectors of the reef fish fishery which are prosecuted with hook-and-line, longline, and trap gear. The proposed amendment is not expected to alter existing fishing practices in these fisheries which do not normally occur on flood plains, wetlands, trails, or rivers therefore, the impact on these habitats is nil.

11.3.6 Unavoidable Adverse Impacts

The purpose of this Secretarial Amendment is to establish biological reference points, stock status determination criteria, and a rebuilding plan for the Gulf of Mexico stock of red grouper. The stock was declared overfished and to be undergoing overfishing by NMFS in October 2000 based on the results of a 1999 stock assessment. A 2002 assessment found that the stock was in an improved condition and was no longer overfished, but it was not yet at the biomass level capable of producing MSY. Therefore, a rebuilding plan is still needed to restore the stock to the B_{MSY} level in 10 years or less. The progress and success of the rebuilding plan will be measured through periodic NMFS stock assessments.

A secondary purpose of this amendment is to evaluate and control the impact of the red grouper rebuilding plan on other species. Gag and red grouper are the major

species in the shallow-water grouper complex, and measures to reduce red grouper harvest will likely affect gag harvest as well. Based on a 2001 gag stock assessment, gag are not overfished, nor are they undergoing overfishing. However, the gag fishing mortality rate is still in need of a reduction in order to reach the optimum yield level. Gag are only slightly under the overfishing threshold, and any effort shifting from red grouper to gag could put that stock back over the overfishing threshold.

Deep-water grouper and tilefish are likely alternate target species for fishing effort displaced from the shallow-water grouper fishery by fishing restrictions. Pro-active conservation measures to limit deep-water grouper and tilefish harvest to recent harvest levels will help to protect those stocks while more information is collected to determine appropriate harvest levels.

Thus, the actions proposed in this amendment are beneficial to the reef fish resources of the Gulf of Mexico, and therefore, there are no unavoidable adverse impacts associated with the proposed amendment.

11.3.7 Relationship Between Short Term Use and Long Term Productivity

The intent of this Secretarial Amendment is to establish the biological reference points and stock status determination criteria for the red grouper stock in U.S. waters of the Gulf of Mexico, to establish and implement a rebuilding strategy for the overfished red grouper stock, and to implement additional measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish stocks. Further, actions proposed in this amendment are intended to rebuild the red grouper to a biomass level capable of sustaining MSY on a continuing basis. Thus, these actions would enhance the long-term productivity of the reef fish resources of the Gulf of Mexico.

Further, establishing the rebuilding plan for red grouper is not expected to adversely affect the recreational, for-hire, or commercial sectors of the reef fish fisheries as it does not change current fishing practices in the industry nor does it impose any additional regulatory burdens.

11.3.8 Irreversible and Irretrievable Commitment of Resources

Actions proposed in this amendment are intended to rebuild the red grouper to a biomass level capable of sustaining MSY on a continuing basis. All rebuilding scenarios are expected to result in short-term negative but long-term positive socioeconomic impacts on both the commercial and recreational fishing participants. The Proposed Alternatives for the commercial sector are expected in the short-term to have negative impacts that will be mostly borne by longlines and high-volume vertical line and fish trap vessels. Over time, all segments of the commercial sector are expected to benefit from the rebuilding strategy, except that fish traps will be completely phased out of the fishery by 2007. The Proposed Alternative for the recreational sector is expected to reduce the red grouper harvest of this sector. Since the proposed measure is specific to red grouper, anglers still have the flexibility to fish for other groupers or reef fish species. In this sense, the likelihood of trip cancellations due to the proposed measure is relatively low. The short-term negative impacts then are expected to be mainly borne by anglers, with the for-hire sector only minimally affected. Over time, benefits are expected to accrue to both anglers and for-hire operators as the red grouper stock is fully rebuilt.

The implementation of this plan and the associated expenditures includes no additional commitment of resources beyond what is needed for its preparation, because it relies on existing administrative mechanisms for enforcement implementation. Therefore, there are no irreversible or irretrievable commitments of resources associated with the

action.

11.3.9 Cumulative Effects

The overall cumulative effect of the proposed amendment is to establish the biological reference points and stock status determination criteria for the red grouper stock in U.S. waters of the Gulf of Mexico, to establish and implement a rebuilding strategy for the overfished red grouper stock, and to implement additional measures to minimize adverse impacts from the red grouper rebuilding plan on other reef fish stocks. Further, actions proposed in this amendment are intended to rebuild the red grouper to a biomass level capable of sustaining MSY on a continuing basis. These actions will provide stability to the recreational, for-hire, and commercial sectors of the reef fish fishery, reduce short-term increases in fishing mortality rates, avoid long-term economic losses to all sectors of the fishery including dependent coastal fishing communities, and allow the targeted stock to rebuild. Therefore, the rebuilding plan is beneficial to the reef fish resources of the Gulf of Mexico. Further, establishment of the rebuilding plan not expected to adversely affect the recreational, for-hire, or commercial sectors of the reef fish fishery as it does not change current fishing practices in these fisheries..

11.4 Assessment of Significant Factors

11.4.1 Finding of No Significant Environmental Impact (FONSI)

Section 1.0 describes the proposed amendment in detail.

40§1508.27 identifies that both context and intensity need to be taken into account when evaluating the significance of impacts resulting from a major federal action.

40§1508.27(b) identifies 10 concepts that are needed to evaluate intensity. They are discussed below in conclusive form for status criteria, the rebuilding plan, and rebuilding scenarios; however evaluations of significance using these concepts for each of the sets of alternatives (MSY, OY, MFMT, MSST, the rebuilding plan, and rebuilding scenarios) are discussed under each subsection of Section 6.0.

(1) Beneficial and Adverse Impacts: The intent of this amendment is to ensure that the stock continues to rebuild and that it fully recovers to both a non-overfished and not-overfishing level within the required time frame. Once the stock has been rebuilt, the status criteria should constrain the fishery so that the stock could be maintained at a precautionary level (greater than B_{MSY}). All rebuilding scenarios proposed in this amendment are expected to result in short-term negative but long-term positive socioeconomic impacts on both the commercial and recreational fishing participants. The Proposed Alternatives for the commercial sector are expected in the short-term to have negative impacts that will be mostly borne by longlines and high-volume vertical line and fish trap vessels. Over time, all segments of the commercial sector are expected to benefit from the rebuilding strategy, except that fish traps will be completely phased out of the fishery by 2007. The Proposed Alternative for the recreational sector is expected to reduce the red grouper harvest of this sector. Since the proposed measure is specific to red grouper, anglers still have the flexibility to fish for other groupers or reef fish species. In this sense, the likelihood of trip cancellations due to the proposed measure is relatively low. The short-term negative impacts then are expected to be mainly borne by anglers, with the for-hire sector only minimally affected. Over time, benefits are expected to accrue to both anglers and for-hire operators as the red grouper stock is fully rebuilt.

(2) Public Safety: Implementation of status criteria measures and the rebuilding plan

would have no effect on public safety because the general public is not associated with fishing activities. Additionally, there would be no vessel safety issues other than general safety issues that arise from the participation in this fishery. However, as stated in Section 8.0, if a reduced quota for the commercial red grouper fishery is used to manage the fishery, a derby fishery (race to fish) could result where fishermen might place themselves at risk to maximize their share of the quota.

(3) Unique geographic areas: The alternatives considered in this amendment would not affect park lands, prime farmlands, wetlands, or wild and scenic rivers because those resources are onshore or nearshore, not in the EEZ. Reef fish fishing does occur in or adjacent to sensitive areas such as the Florida Middle Grounds HAPC, Dry Tortugas Ecological Reserve, the FKNMS, Madison-Swanson and Steamboat Lumps marine reserves, or the Flower Garden Banks National Marine Sanctuary. Most red grouper caught in the recreation and for-hire fisheries are caught with hook-and-line or spear guns that minimally impacts hard bottom habitat. Bottom longline gear has been identified as potentially damaging to hard bottom habitats; however, the extent of this damage has not been quantified. To do so would require extensive study that has not been conducted and would incur considerable expense. However, some protection is afforded by the prohibition of longline and buoy gear inside of lines approximating 50 fathoms west and 20 fathoms east of Cape San Blas, Florida. If historic or cultural resources or sites currently exist or are designated in the EEZ, it is possible that reef fish vessels could affect these sites (GMFMC, 2002). Hook-and-line gear could become entangled within those structures; however, this entanglement is likely to be minimal because fishermen would likely avoid losing fishing gear.

(4) Controversial effects on Social and economic environment: Some of the alternatives considered in this amendment may be controversial particularly the proposed reduction in the commercial red grouper quota which may result in a derby fishery (race to fish). The public had the opportunity to comment on this amendment at public hearings and through letters. Public testimony and letters received by the Council spoke in favor of establishing status criteria and adopting the rebuilding plan. Further public comment will be solicited though a Notice of Availability of the amendment and the proposed rule which will be published in the Federal Register.

(5) Uncertain, Unknown, or Unique Risks: Defining biological reference points and stock status determination criteria, and adopting a rebuilding plan for red grouper would not pose any uncertain, unknown, or unique risks to the reef fish industry or to others, other than potential economic and social impacts as discussed in previous sections. The true extent of the ecological impacts of these alternatives are unknown. As red grouper stocks increase, there could be effects to prey species or species that red grouper compete with for prey. However, these risks to individual species are likely to be minimal due to the fact that the red grouper stock biomass would be less than its unfished level.

(6) *Precedence*: The proposed actions do not establish new precedence. Biological reference points, stock status criteria measures, and rebuilding plans, have been implemented in other Gulf of Mexico fisheries.

(7) *Cumulative impacts*: The implementation of status criteria measures and the rebuilding plan in effect could cause direct, cumulative impacts to the biological or physical environment. As the red grouper stock size increases through the rebuilding plan, the effects of this population increase could affect prey species that are shared with other reef fish stocks that are also being rebuilt. A proposed rebuilding plan for red snapper and a recently enacted rebuilding plan for greater amberjack should result in higher numbers of both species and increase predation on shared prey items. The nature of such impacts, positive or negative, cannot be determined without further

research. The costs for such research would be exorbitant and take many years to complete. Although these impacts may not be precisely known, they are likely to be minimal given that for all these species, their respective stock biomass would still be below their unfished state. In addition, management actions resulting in changes of fishing patterns in the red snapper, and greater amberjack fisheries could alter fishing patterns on red grouper and visa versa.

(8) Adverse effects on resources: The effects of the proposed and rejected alternatives for implementation of status criteria measures and the rebuilding plan would not apply to any sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or cause loss or destruction of significant scientific, cultural or historical resources. Should such structures or resources be located in the EEZ, it is possible that reef fish vessels could damage these sites. Hook-and-line gear could become entangled within those structures; however, this entanglement is probably minimal because fishermen would try to avoid losing fishing gear. Resources within lines approximating 50 fathoms west and 20 fathoms east of Cape San Blas, Florida would be afforded protection from longline and buoy gear due to a prohibition of the gear within this area.

(9) Endangered Resources: NMFS Protected Resources Division of the Southeast Regional Office, will conduct a section 7 consultation regarding the proposed alternatives as to their impact on threatened or endangered species if it is determined that the measures in the plan may affect listed species. The implementation of status criteria measures and the rebuilding plan is unlikely to have any additional impact on endangered species because the fishery would not change current fishing practices.

(10) Other environmental laws: The effects of the implementation of status criteria measures and the rebuilding plan would not have an impact on state or local regulations outside the EEZ, and would not create a conflict with any other federal law or regulation applicable to the EEZ. Alternatives for biological reference points, stock status determination criteria and the rebuilding plan, to the extent that they provide additional protection for marine resources, would only compliment state and federal laws that likewise provide protection.

Based on the analyses and discussions in this document, including its EA, and in the other referenced documents and sections herein, I have determined that the proposed action would not significantly affect the physical or social and economic environment, including EFH, and that preparation of a supplemental environmental impact statement is not required by Section 102(2)(c) of NEPA or its implementing regulations.

Approved:_____ _____
Assistant Administrator for Fisheries Date

12.0 OTHER APPLICABLE LAW

Habitat Concerns

Reef fish habitats and related concerns were described in the FMP and updated in Amendments 1 and 5 and in the Generic Amendment for Addressing Essential Fish Habitat Requirements in the Fishery Management Plans of the Gulf of Mexico. Alternatives to close the recreational or commercial fishing seasons will result in less shallow-water grouper habitat hardbottom being exposed to the various gear types, which may have a minor benefit to the shallow-water habitat.

Vessel Safety Considerations

Many smaller bandit gear vessels have added longline gear and may attempt to fish offshore during shallow-water grouper closed seasons. In a survey of the Madeira Beach, Florida fishing community (Lucas and Mattice 2001), none of the 49 bandit gear vessels identified as offloading in Madeira Beach on a regular basis was greater than 50 feet in length, while 30 of the 70 longling vessels were over 50 feet. In a Coast Guard survey of commercial fishing vessel sinkings in U.S. waters between December 28, 1998 and January 18, 1999, 12 of the 20 vessels were less than 50 feet, and 5 were greater than 50 feet (3 vessels did not have the length reported) (USCG 1999). Smaller vessels appear to have a greater risk of sinking than larger vessels. Such safety impacts could be reduced by limiting entry into the longline fishery, phasing out the use of bottom longlines, or establishing a minimum vessel size to fish with longlines.

Alternatives for closed seasons and reduced quotas could shorten the open fishing season, which could trigger a derby fishery. Under a derby fishery, decreased vessel maintenance and exhaustion could reduce vessel safety. This potential impact could be reduced by other management measures that spread out the catch and reduce the possibility of quota closures, such as trip limits.

Coastal Zone Consistency

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all federal activities which directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The proposed changes in federal regulations governing red snapper in the EEZ of the Gulf of Mexico will make no changes in federal regulations that are inconsistent with the objectives of either existing or proposed state regulations.

While it is the goal of NMFS to have complementary management measures with those of the states, federal and state administrative procedures vary, and regulatory changes are unlikely to be fully instituted at the same time.

This Secretarial Amendment is consistent with the Coastal Zone Management programs of the states of Alabama, Florida, Louisiana, Mississippi and Texas to the maximum extent possible. This determination was submitted on will be submitted to the responsible state agencies under Section 307 of the Coastal Zone Management Act administering approved Coastal Zone Management programs in the states of Alabama, Florida, Mississippi, Louisiana and Texas.

Endangered Species Act

Section 7 of the Endangered Species Act (ESA) of 1973 (16 U.S.C. Section 1531 et seq.) requires federal agencies to use their authorities to conserve endangered and threatened

species and ensure actions they authorize, fund, or carry out are not likely to harm the continued existence of those species or the habitat designated to be critical to their survival and recovery. Section 7 of the ESA requires NOAA Fisheries, when proposing a fishery action that "may affect" critical habitat or endangered or threatened species, to consult with the appropriate administrative agency (itself for most marine species, the U.S. Fish and Wildlife Service for all remaining species) to determine the potential impacts of the proposed action. Consultations are concluded informally when proposed actions may affect but are not likely to adversely affect" endangered or threatened species or designated critical habitat. Formal consultations, including a biological opinion, are required when proposed actions may affect and "likely to adversely affect" endangered or threatened species or designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives. Information regarding the consultation history for this fishery, and the effects of this amendment on protected resources, is located in Section 11.3.4.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States. Under the MMPA; the Secretary of Commerce (authority delegated to NOAA Fisheries) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea and marine otters, polar bears, manatees and dugongs.

Part of the responsibility that NOAA Fisheries has under the MMPA involves monitoring populations of marine mammals to make sure that they stay at optimum levels. If a population falls below its optimum level, it is designated as "depleted," and a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. This amendment required the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction, development and implementation of take-reduction plans for stocks that may be reduced or are being maintained :below their optimum sustainable population levels due to interactions with commercial fisheries, and studies of pinniped-fishery interactions.

The MMPA requires a commercial fisheries to be placed in one of three categories, based on the relative frequency of incidental serious injuries and mortalities of marine mammals in each fishery. Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing; Category II designates fisheries with occasional serious injuries and mortalities; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities. The Gulf of Mexico reef fish fishery (all gear types) is listed in Category III as there have been no documented interactions between this fishery and marine mammals (68 FR 41725).

Effect on Essential Fish Habitat (EFH)

The generic amendment for addressing essential fish habitat requirements for fishery management plans of the Gulf of Mexico states the following with respect to red grouper EFH.

The red grouper is demersal and occurs throughout the Gulf of Mexico at depths from 3 to about 200 m, preferring 30 to 120 m depths. It is particularly abundant off west Florida and the Yucatan coasts. Spawning occurs at depths of approximately 25 to 90 m on the

Florida Banks with peaks during April and May. Eggs are pelagic and planktonic, and require at least 32 ppt salinity for buoyancy. Larvae leave the planktonic stage to become benthic at about 20 mm standard length. Late juveniles select inshore hardbottom to depths of about 50 m, seeking shelter in crevices and other hiding places. Favored nursery areas for juveniles are grass beds, rock formations, and shallow reefs. Juveniles remain in the nursery areas until mature before moving to deeper Gulf waters (NOAA 1985). Adults select rocky outcrops, wrecks, reefs, ledges, crevices and caverns of rock bottom, as well as "live bottom" areas, in depths of 3 to 190 m. Spawners occur in offshore coastal waters in depths of 20 to 100 m.

The actions in this Secretarial Amendment are not expected to have any adverse impacts on red grouper or other species EFH.

Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the Federal Government. The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The NMFS and Council do not propose, through this Secretarial Amendment, to establish any reporting requirements or burdens.

Federalism

No federalism issues have been identified relative to the actions proposed in this Secretarial Amendment. Therefore, preparation of a federalism assessment under Executive Order 12612 is not necessary.

Data Quality Act

The Data Quality Act (DQA) (Public Law 106-443), which took effect on October 1, 2002, requires the government for the first time to set standards for the quality of scientific information and statistics used and disseminated by Federal agencies. Information includes any communication or representation of knowledge such as facts or data, in any medium or form, including textual, numerical, cartographic, narrative, or audiovisual forms (includes web dissemination, but not hyperlinks to information that others disseminate; does not include clearly stated opinions).

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

Migratory Bird Treaty Act:

Under the Migratory Bird Treaty Act (MBTA), it is unlawful to pursue, hunt, take, capture, kill, possess, trade, or transport any migratory bird, or any part, nest, or egg of a migratory bird, included in treaties between the United States and Great Britain, Mexico,

Japan, or the former Union of Soviet Socialists Republics, except as permitted byregulations issued by the Department of the Interior. Violations of the MBTA carry criminal penalties; any equipment and means of transportation used in activities in violation of the MBTA may be seized by the United States government and, upon conviction, must be forfeited to it. To date, the MBTA has been applied to the territory of the United States and coastal waters extending three miles from shore. Furthermore, Executive Order 13186 (see Section 9.5.9) was issued in 2001, which directs Federal agencies, including NOAA Fisheries, to take certain actions to further implement the MBTA.

E.O. 13186: Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 directs each Federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations to develop and implement a MOU with the United State Fish and Wildlife Service (USFWS) to conserve those bird populations. The MOU will address actions taken by NOAA Fisheries that have, or are likely to have, a measurable negative effect on migratory bird populations. In the instance of unintentional take of migratory birds, NOAA Fisheries would develop and use principles, standards, and practices that will lessen the amount of unintentional take, developing any such conservation efforts in cooperation with the USFWS. Additionally, the MOU would ensure that NEPA analyses evaluate the effects of actions and agency plans on migratory birds, with emphasis on species of concern.

The required MOU is currently being developed, which will address the incidental take of migratory birds in commercial fisheries under the jurisdiction of NOAA Fisheries. NOAA Fisheries must monitor, report, and take steps to reduce the incidental take of seabirds that occurs in fishing operations. The United States has already developed the U.S. National Plan of Action for Reducing Incidental Catch of Seabirds in Longline Fisheries, and many potential MOU components are already being implemented under that plan. Development of the plan was a collaborative effort between NOAA Fisheries, USFWS, and the Department of State, carried out in large part by the Interagency Seabird Working Group consisting of representatives from those three agencies.

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14.0 PUBLIC REVIEW

Public hearings to obtain public comments on the provisions of this Secretarial amendment were scheduled beginning at 6:30 p.m. at the following locations and dates. In conjunction with the public hearings, scoping meetings were held to solicit public comments on the scope of issues to be addressed in the DSEIS for the rebuilding plan for red grouper.

Monday, February 18, 2002
Edison Community College
Lee County Campus
Corbin Auditorium
Building J-103
8099 College Parkway
Fort Myers, FL 33919
(Park in Lot #8)
(941) 489-9300

Tuesday, February 19, 2002
Tampa Airport Hilton
2225 Lois Avenue
Tampa, FL 33607
(813) 877-6688

Tuesday, February 19, 2002
MS Dept. of Marine Resources
1141 Bayview Drive
Biloxi, MS 39530
(228) 374-5000

Wednesday, February 20, 2002
Plantation Inn
9301 West Fort Island Trail
Crystal River, FL 34429
(352) 795-4211

Wednesday, February 20, 2002
New Orleans Airport Hilton
901 Airline Drive
Kenner, LA 70062
(504) 469-5000

Thursday, February 21, 2002
National Marine Fisheries Service
3500 Delwood Beach Road
Panama City, FL 32408
(850) 234-6541

Thursday, February 21, 2002
Texas A&M University
200 Seawolf Parkway
Galveston, TX 77553
(409) 740-4416

In addition to the above hearings, a public hearings were held during the Council meetings in March 2002 in Mobile, Alabama, May 2002 in Destin, Florida, and July 2002 in Sarasota, Florida.

The alternatives for deep-water grouper and tilefish quotas were not in the public hearing draft that was distributed for the above hearings, but testimony received during the hearings recommended that they be added to this amendment as a logical and necessary extension to address the shifting of effort to deep-water reef fish species resulting from moving the longline/buoy gear boundary or from implementing closed seasons on shallow-water grouper. The deep-water grouper and tilefish quota alternatives, along with all of the other alternatives in this amendment except the combination scenarios, were included in a draft of Reef Fish Amendment 18 for which public hearings were held in the following locations and dates:

- June 14, 2001 Port Aransas, Texas
- June 18, 2001 Larose, Louisiana
- June 19, 2001 Biloxi, Mississippi
- June 20, 2001 Orange Beach, Alabama
- June 21, 2001 Panama City, Florida
- June 25, 2001 Key West, Florida
- June 26, 2001 Ft. Myers, Florida
- June 27, 2001 Madeira Beach, Florida
- June 28, 2001 Crystal River, Florida
- July 11, 2001 Council meeting, Duck Key, Florida

In addition to the above hearings, a public hearing on the Secretarial Amendement/DSEIS (including the deep-water grouper and tilefish quota alternatives will be held during the Council meeting in May 2002 in Destin, Florida, and during the Council meeting in July 2002 in Mobile, Sarasota, Florida. Copies of this document may be obtained from the Gulf of Mexico Fishery Management Council office, 3018 U.S. Highway 301 North, Suite 1000, 331, Tampa, Florida 33619-2266, (813)228-2815.

15.0 LIST OF PREPARERS

This document was prepared by the Council staff with editorial review by GW staff. Most of the material in Section 9 (Affected Environments) and a significant amount of the material in Section 10 (Environmental Consequences) was written by MRAG Americas, Tampa, Florida, originally as part of the draft SEIS being prepared for Draft Reef Fish Amendment 18. The primary staff members responsible for compiling this document are:

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16.0 LIST OF AGENCIES CONSULTED

Gulf of Mexico Fishery Management Council's
- Reef Fish Advisory Panel
-Reef Fish Stock Assessment Panel
-Socioeconomic Panel
-Standing and Special Reef Fish Scientific and Statistical Committee

National Marine Fisheries Service
-Southeast Regional Office
-Southeast Fisheries Science Center

Environmental Protection Agency

17.0 RESPONSIBLE AGENCIES

National Marine Fisheries Service
Southeast Regional Office
9721 Executive Center Drive, North
St. Petersburg, Florida 33702
(727) 570-5301
(NMFS does not accept comments by e-mail)
web: http://caldera.sero.nmfs.gov/

Gulf of Mexico Fishery Management Council
The Commons at Rivergate
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18.0 TABLES

Table 5.1. Comparison of stock status estimates from phase 3 model (1986-2001data using methods of previous assessment plus sampled age composition, 33% mortality of longline releases) using each of the three new fecundity vectors. The quantities MSY, OY ($F=0.75*F_{MSY}$), and $C_{recover}$ (catch expected to permit recovery to SS_{MSY} by 2012) are in metric tons (MT) and in millions of pounds (mp). Spawning stock SS in the case of the GWTvsAGE model is in metric tons gonad weight, otherwise its is dimensionless (relative fecundity). The RFSAP selected the GWTvsAGE model as the most appropriate for status determination.

	FECvsTL		FECvsAGE		GWTvsAGE	
	h=0.7	h=0.8	h=0.7	h=0.8	h=0.7	h=0.8
MSY	3374 MT 7.438 mp	3281 MT 7.233 mp	3381 MT 7.454 mp	3276 MT 7.222 mp	3429 MT 7.560 mp	3295 MT 7.264 mp
OY	3301 MT 7.277 mp	3217 MT 7.092 mp	3308 MT 7.293 mp	3212 MT 7.081 mp	3350 MT 7.385 mp	3229 MT 7.119 mp
OY/MSY	0.978	0.981	0.978	0.981	0.977	0.980
$F_{0.1}$	0.238	0.238	0.238	0.238	0.238	0.238
F_{max}	0.476	0.476	0.476	0.476	0.476	0.476
$F_{30\%}$	0.702	0.703	0.581	0.581	0.563	0.563
$F_{40\%}$	0.437	0.437	0.343	0.344	0.354	0.354
F_{MSY}	0.329	0.382	0.312	0.371	0.306	0.364
F_{OY}	0.247	0.286	0.234	0.278	0.229	0.273
F_{OY}/F_{MSY}	0.750	0.750	0.750	0.750	0.750	0.750
$F_{current}$	0.316	0.317	0.315	0.317	0.315	0.316
$F_{current}/F_{MSY}$	0.961	0.829	1.012	0.853	1.031	0.869
$F_{current}/F_{OY}$	1.281	1.105	1.350	1.137	1.374	1.159
$F_{current}/F_{0.1}$	1.329	1.332	1.328	1.332	1.327	1.331
SS_{MSY}	5746	5086	4585	3973	840	715
SS_{OY}	6816	5998	5482	4704	1015	859
$SS_{F0.1}$	6953	6595	5430	5121	993	930
SS_{OY}/SS_{MSY}	1.186	1.179	1.196	1.184	1.208	1.201
SS_{2001}	5327	5321	4150	4146	705	704
SS_{2001}/SS_{MSY}	0.927	1.046	0.905	1.043	0.840	0.985
SS_{2001}/SS_{OY}	0.782	0.887	0.757	0.881	0.695	0.820
$SS_{2001}/SS_{F0.1}$	0.766	0.807	0.764	0.810	0.710	0.758
T_{min}	2004	2001	2004	2001	2004	2002
$C_{recover}$	3301 MT 7.277 mp	3217 MT 7.092 mp	3230 MT 7.121 mp	3212 MT 7.081 mp	3190 MT 7.033 mp	3229 MT 7.119 mp

note: 1 metric tonne = 2204.6 pounds

Table 6.1. ABC ranges to rebuild the red grouper stock in 10 years starting in 2002
Values are millions of pounds gutted weight (From Table Proj-2 in NMFS 2001)

	Constant Catch					
			Percent reduction from 1999-2001 average catch of 7.249 mp gutted weight (note 1)			
	steepness = 0.7 (note 2)	steepness = 0.8	steepness = 0.7		steepness = 0.8	
Annual	7.03	7.12	3.0%		1.8%	
	Constant F					
Year	steepness = 0.7	steepness = 0.8	Annual	3-year interval	Annual	3-year interval
2002	7.32	7.32	(note 3)			
2003	6.17	7.36	- 14.9%	6.56 mp - 9.6%	1.5% increase	7.59 mp 4.7% increase
2004	6.59	7.63	- 9.1%		5.3% increase	
2005	6.91	7.78	- 4.7%		7.3% increase	
2006	7.13	7.83	- 1.6%	7.23 mp - 0.3%	8.0% increase	7.75 mp 6.9% increase
2007	7.25	7.76	0%		7.0% increase	
2008	7.31	7.67	0.8% increase		5.8% increase	
2009	7.32	7.54	1.0% increase	7.33 mp 1.1% increase	4.0% increase	7.46 mp 2.9%% increase
2010	7.33	7.47	1.1% increase		3.0% increase	
2011	7.35	7.36	1.4% increase		1.5% increase	
MSY - 2012+	7.56	7.26	4.3% increase		0.2% increase	
OY - 2012+	7.39	7.12	1.9% increase		- 1.8%	

source: RFSAP (2002), Table 3 (for constant catch and for MSY/OY levels) and Table 4 (for constant F)

Note 1: From Table 6.3, total red grouper landings (commercial and recreational) for 1999-2001 is 17,586 + 4,162 = 21,748 pounds gutted weight, or an annual average of 21,748 ÷ 3 = 7,429 pounds.

Note 2: The RFSAP recommended a steepness = 0.7 as more realistic than 0.8.

Note 3: The 2002 pounds shown are the actual estimated landings for that year. The ABCs and percent reductions needed begin with 2003. The ABCs beyond 2005 reflect the currest best available scientific information, and will be re-evaluated in the next red grouper stock assessment.

Note 4: The MSY and OY rows are the estimated ongoing annual levels to harvest at either the MSY or OY level beginning in 2012, once the stock is recovered.

Table 6.2. Summary of SFA parameters at two steepness levels

	S-R steepness = 0.7	S-R steepness = 0.8	Comments
F_{1997}	0.302	0.302	
F_{1997}/F_{MSY}	1.354	1.119	Values >1 mean overfishing is occurring
SS_{1997}	244.3	246.3	
SS_{1997}/SS_{MSY}	0.564	0.702	Values <0.8 mean stock is overfished

The above F-ratio indicates that overfishing is occurring. The SS ratio indicates that the spawning stock is below 80% of MSST, and is overfished under the recommended default rule.

Table 6.3. Commercial and recreational harvest (pounds gutted weight) for red grouper and gag

	Red Grouper		Gag	
	Commercial Landings	Recreational Harvest	Commercial Landings	Recreational Harvest
1986	6,475	2,348	1,578	4,048
1987	6,900	1,261	1,439	2,479
1988	4,894	2,493	1,139	3,329
1989	7,595	2,493	1,620	2,781
1990	4,843	1,396	1,768	1,421
1991	5,134	1,742	1,507	2,104
1992	4,255	2,932	1,571	1,782
1993	6,400	2,191	1,769	2,136
1994	4,940	1,958	1,537	1,691
1995	4,771	2,180	1,538	2,151
1996	4,473	944	1,469	1,667
1997	4,888	639	1,499	2,544
1998	3,977	743	2,405	3,220
1999	5,955	1,146	1,975	3,041
2000	5,811	1,689	1,757	3,242
2001	5,820	1,327	2,797	3,750
86-89 Total	25,864	8,595	5,776	12,637
86-89 Percents	75%	25%	31%	69%
90-00 Total	55,447	17,560	18,795	24,999
90-00 Percents	76%	24%	43%	57%
99-01 Total	17,586	4,162	6,529	10,033
99-01 Percents	81%	19%	39%	61%

source: red grouper commercial and recreational landings for 1986-2001 are from Table 1 of the 2002 RFSAP report (metric tons converted to pounds using the formula: 1 MT = 2204.5855 lbs. Gag commercial landings for 1986-2000 are from Table 4 of the Supplemental Analyses and Updated Information in Support of Draft Amendment 18 to the Gulf Reef Fish Fishery Management Plan. Gag recreational harvest for 1986-2000 is personal communication from Gerry Scott to Steven Atran (e-mail dated 8/20/2001). Gag commercial and recreational landings for 2001 are from the NMFS/SEFSC online Fisheries Statistics and Economics website (http://www.st.nmfs.gov/st1/index.html) 2001 commercial landings were converted from whole weight to gutted weight using the ALS conversion factor 1.18. 2001 recreational harvest was converted from whole weight to gutted weight using the 1994 gag stock assessment conversion factor 1.028. 2001 recreational harvest is MRFSS data only, headboat survey data is not included.

Table 6.4. Schedule for changing from constant catch to constant F for red grouper (for Alternative 4, Section 6.3.1)

Number of years for initial constant catch	Constant catch ABC	Switch to Constant F in Year
2	2.94-4.11 mp	3
3	3.14-4.29 mp	4
4	3.34-4.47 mp	5
5	3.52-4.64 mp	6
6	3.69-4.79 mp	7
7	3.85-4.92 mp	8
8	3.00-5.88 mp	9
9	4.12-5.15 mp	10

Table 6.5. Commercial Red grouper and gag landings (thousand pounds gutted weight) by gear, 1986-1997 Sources: 1999 Red Grouper Stock Assessment (corrected tables), Tables 37-42; 1997 Red Grouper Stock Assessment, Tables 24-26

Red Grouper	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Average	90-97 Ave.
Fish Traps	727	467	555	580	306	642	808	717	1126	1252	652	880	726	798
Handlines	3103	2499	1954	3686	1289	1282	1544	1314	1171	1130	741	867	1715	1167
Longlines	2481	3723	2069	3198	3240	3205	1892	4353	2621	2373	2515	2763	2869	2870
Spearfishing	6	14	4	10	8	6	11	9	11	8	7	5	8	8
Unknown	6	0	1	1	0	0	0	6	12	7	1	1	3	3
Percent	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	Total	90-97 Total
Fish Traps	11%	7%	12%	8%	6%	13%	19%	11%	23%	26%	17%	19%	14%	16%
Handlines	49%	37%	43%	49%	27%	25%	36%	21%	24%	24%	19%	19%	32%	24%
Longlines	39%	56%	45%	43%	67%	62%	44%	68%	53%	50%	64%	61%	54%	59%
Spearfishing	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
unknown	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Gag	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996		Average	90-96 Ave.
Fish Traps	50	77	56	49	26	22	24	50	30	34	28		41	31
Handlines	1038	771	734	1233	1084	1015	1198	1303	1156	1189	1133		1078	1154
Longlines	504	628	380	421	700	476	310	388	296	290	282		425	392
Percent	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996		Total	90-96 Total
Fish Traps	3%	5%	5%	3%	1%	1%	2%	3%	2%	2%	2%		3%	2%
Handlines	65%	52%	63%	72%	60%	67%	78%	75%	78%	79%	79%		70%	73%
Longlines	32%	43%	32%	25%	39%	31%	20%	22%	20%	19%	20%		28%	25%

Table 6.6. Expected reductions from phasing out longline gear

	Fraction of effort transferred from longline to bandit gear					
	0.0	0.2	0.4	0.6	0.8	1.0
Red grouper*	59%	53%	48%	43%	38%	33%
SW aggregate	48%	43%	39%	35%	31%	27%

* Fractional reductions for the shallow-water grouper aggregate are from Table Longline in the NMFS August 27, 2001 analyses. Fractional reductions for red grouper were calculated using the same proportional reductions as for the shallow-water grouper aggregate.

Table 6.7. Average vessel trips, pounds landed, and dockside revenues for trips landing red grouper, gag, or black grouper (1993-2000).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
All Reef Fish Vessels												
Trips	709	916	986	924	1,016	903	850	789	764	783	783	769
Lbs.	514	520	567	537	697	742	677	619	539	573	620	660
$	1,094	1,052	1,235	1,164	1,327	1,241	1,185	1,161	1,044	1,175	1,270	1,239
Longline Vessels												
Trip	109	106	125	116	127	119	140	120	112	109	109	118
Lbs.	286	306	317	286	319	348	295	278	252	309	349	397
$	588	594	668	603	588	565	511	517	480	615	693	717
Vertical Line Vessels												
Trips	536	747	791	734	765	638	561	518	535	595	597	579
Lbs	195	183	218	209	275	240	226	203	189	216	227	217
$	438	397	500	473	556	428	412	393	381	464	487	436
Fish Trap Vessels												
Trips	40	39	40	46	78	109	112	104	85	49	47	42
Lbs.	28	25	24	33	88	140	152	125	88	40	37	37
$	58	50	53	71	164	233	249	237	171	84	77	71

Source of basic data: Waters (2001).

Table 6.8. Average recreational catch and trips in the Gulf of Mexico for selected species, by wave, 1990-1999.

Wave ⇒	January-February	March-April	May-June	July-August	September-October	November-December
SWG Complex						
Fish Landed	75,081	77,379	127,774	136,580	116,193	115,527
Catch Trips	106,091	114,882	165,834	189,785	151,885	144,917
Target Trips	42,954	31,170	55,441	63,349	49,170	49,835
Red Grouper						
Fish Landed	22,441	17,186	50,994	72,396	54,313	27,097
Catch Trips	51,499	43,565	79,945	109,640	68,999	60,256
Target Trips	17,258	11,690	22,097	38,299	19,138	16,261
Gag						
Fish Landed	46,074	52,998	68,463	54,342	53,993	83,705
Catch Trips	62,662	81,006	104,889	94,399	97,031	108,283
Target Trips	32,558	22,886	47,060	40,411	36,292	42,902
Black Grouper						
Fish Landed	4,854	4,831	3,429	6,399	3,236	3,585
Catch Trips	10,294	7,716	4,603	9,274	4,676	6,861
Target Trips	6,414	3,494	3,644	5,362	1,788	2,239

Source of basic data: Holiman (2001).

Table 6.9. Number and fate of red grouper caught on longline gear from April 1994 - February 1995 (Observer Study)

Fathoms	18-19	20-29	30-39	40-49	50-59	60-64	unknown	Total
Total red grouper	80	1589	911	339	19	14	95	3047
Kept	52	573	534	187	9	10	57	1422
Released alive	18	867	324	83	0	1	25	1318
Released dead	5	78	43	48	8	3	10	195
Used for bait	0	17	3	2	0	0	0	22
Unknown	5	52	7	19	2	0	3	88
% Kept (Kept/Total	65%	36%	59%	55%	47%	71%	60%	47%
Release Mortality*	36%	14%	14%	45%	100%	75%	34%	19%

*Release mortality = (Released dead+Used for bait+unknown)/(Released alive+Released dead+Used for bait+unknown)

Table 6.10. Other Shallow-water Grouper Commercial Catches 1990-1998 in 1,000s pounds gutted weight.

Species	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	1999-2001 Ave.
black grouper	168	148	156	161	134	103	113	76	81	74	55	414	181
yellowfin grouper	34	6	3	2	3	5	10	3	1	4	10	1	6
yellowmouth grouper	0	0	0	0	0	0	0	0	0	0	0	0	0
red hind	0	47	15	11	6	3	10	3	4	6	10	4	7
rock hind	1	1	23	2	2	3	4	1	3	1	0	0	0
scamp	247	304	278	311	214	232	233	294	222	230	171	261	221
marbled grouper	3	8	34	37	21	12	2	15	11	1	0	0	0
grouper uncl. (adj)	14	12	13	10	3	3	3	3	4	3	1	63	22
Total gutted wt.	467	526	522	534	383	361	375	395	326	319	247	743	436

Table 6.11. Average monthly imports of groupers and snappers into the Southeastern U.S. (Thousand pounds, product weight), 1993-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
	Groupers											
Fresh / Chilled	815	868	994	958	843	746	842	773	650	563	576	654
Frozen	90	97	83	46	67	44	63	23	15	75	29	76
Sub-total	905	965	1,077	1,004	910	790	905	796	665	638	605	730
	Snappers											
Fresh / Chilled	1,107	1,063	1,444	1,317	1,482	1,546	1,530	1,375	1,285	1,283	1,311	1,283
Frozen	112	64	80	48	69	156	135	126	92	77	77	89
Sub-total	1,219	1,127	1,524	1,365	1,551	1,702	1,665	1,501	1,377	1,360	1,388	1,372
Total	2,124	2,092	2,601	2,369	2,461	2,492	2,570	2,297	2,042	1,998	1,993	2,102

Source of basic data: Waters (2001).

Table 6.12a. Red grouper trip limit analyses from 1999-2001 reef fish logbook data expected percent harvest reduction from a single trip limit applied to all gear. Interpolated trip limit for 9.5% harvest reduction is in bold.

Trip Limit Whole wt.	Trip Limit Gutted wt.	Shallow-water Grouper Trip Limit		
		Red Grouper Reduction	Gag/Black Grouper Reduction	All Shallow-water Grouper Reduction
8900	8476	2%	2%	1%
8455	8052	2%	2%	2%
8010	4629	2%	2%	2%
7565	7205	3%	3%	3%
7120	6781	4%	3%	4%
6675	6357	5%	4%	5%
6230	5933	6%	4%	6%
5785	5510	8%	5%	7%
5450	**5190**	**9.5%**	**6%**	**8.5%**
5340	5086	10%	6%	9%
4895	4662	12%	7%	11%
4450	4238	15%	8%	13%
4005	3814	18%	9%	15%
3560	3390	22%	11%	18%
3115	2967	26%	13%	22%
2670	2543	31%	16%	26%
2225	2119	37%	20%	31%
1780	1695	44%	25%	38%
1335	1271	53%	32%	46%
890	848	64%	42%	57%
445	424	79%	59%	72%

Source: Poffenberger 2003.

Note: Analyses was done in whole weight, but trip limits will be designated in gutted weight, using a conversion factor of GW = WW ÷ 1.05. Whole weight values were rounded up.

Table 6.12b. Red grouper trip limit analyses from 1999-2001 reef fish logbook data expected percent harvest reduction from a single trip limit applied to handline gear. Interpolated trip limit for 9.5% harvest reduction is in bold.

Trip Limit Whole wt.	Trip Limit Gutted wt.	Shallow-water Grouper Trip Limit		
		Red Grouper Reduction	Gag/Black Grouper Reduction	All Shallow-water Grouper Reduction
10000	9524	0%	0%	0%
9500	9048	0%	0%	0%
9000	8571	0%	0%	0%
8500	8095	0%	0%	0%
8000	7619	0%	1%	0%
7500	7143	0%	1%	0%
7000	6667	0%	1%	0%
6500	6190	0%	1%	3%
6000	5714	0%	1%	3%
5500	5238	4%	1%	3%
5000	4762	4%	1%	3%
4500	4286	4%	3%	3%
4000	3810	4%	3%	3%
3500	3333	4%	4%	5%
3000	2857	8%	5%	5%
2500	2381	8%	7%	8%
2313	**2203**	**9.5%**	**8.5%**	**10%**
2000	1905	12%	11%	13%
1500	1429	21%	18%	18%
1000	952	37%	27%	31%
500	476	62%	46%	51%

Source: Poffenberger 2003.

Note: Analyses by Poffenberger (2003) was done in whole weight, but trip limits will be designated in gutted weight, using a conversion factor of GW = WW ÷ 1.05. Initial analyses by Poffenberger (2003) produced percent reductions for each gear relative to total commercial harvest rather than harvest by that gear. In this table, the percentages have been weighted by the proportion of commercial catch taken by the gear type to determine percent reductions by gear relative to the gear's catch. Proportional catches by gear for red grouper and for gag/black grouper were calculated from Table 6.5. Proportional catches by gear for all shallow-water grouper were calculated from Poffenberger (2003) table 7.

Table 6.12c. Red grouper trip limit analyses from 1999-2001 reef fish logbook data expected percent harvest reduction from a single trip limit applied to longline gear. Interpolated trip limit for 9.5% harvest reduction is in bold.

Trip Limit Whole wt.	Trip Limit Gutted wt.	Shallow-water Grouper Trip Limit		
		Red Grouper Reduction	Gag/Black Grouper Reduction	All Shallow-water Grouper Reduction
10000	9524	3%	8%	4%
9500	9048	3%	8%	4%
9000	8571	5%	8%	4%
8500	8095	5%	2%	6%
8000	7619	7%	12%	8%
7500	7143	8%	16%	8%
7125	**6786**	**9.5%**	**16%**	**9.5%**
7000	6667	10%	16%	10%
6500	6190	14%	20%	14%
6000	5714	15%	20%	16%
5500	5238	19%	24%	20%
5000	4762	24%	28%	24%
4500	4286	27%	32%	28%
4000	3810	32%	40%	32%
3500	3333	39%	44%	38%
3000	2857	46%	52%	44%
2500	2381	52%	60%	51%
2000	1905	61%	68%	59%
1500	1429	69%	76%	67%
1000	952	79%	89%	77%
500	476	89%	100%	89%

Source: Poffenberger 2003.

Note: Analyses by Poffenberger (2003) was done in whole weight, but trip limits will be designated in gutted weight, using a conversion factor of GW = WW ÷ 1.05. Initial analyses by Poffenberger (2003) produced percent reductions for each gear relative to total commercial harvest rather than harvest by that gear. In this table, the percentages have been weighted by the proportion of commercial catch taken by the gear type to determine percent reductions by gear relative to the gear's catch. Proportional catches by gear for red grouper and for gag/black grouper were calculated from Table 6.5. Proportional catches by gear for all shallow-water grouper were calculated from Poffenberger (2003) table 7.

Table 6.12d. Red grouper trip limit analyses from 1999-2001 reef fish logbook data expected percent harvest reduction from a single trip limit applied to trap gear. Interpolated trip limit for 9.5% harvest reduction is in bold.

Trip Limit Whole wt.	Trip Limit Gutted wt.	Shallow-water Grouper Trip Limit		
		Red Grouper Reduction	Gag/Black Grouper Reduction	All Shallow-water Grouper Reduction
10000	9524	0%	0%	0%
9500	9048	0%	0%	0%
9000	8571	0%	0%	0%
8500	8095	0%	0%	0%
8000	7619	0%	0%	0%
7500	7143	0%	0%	0%
7000	6667	6%	0%	0%
6500	6190	6%	0%	0%
6000	5714	6%	0%	9%
5500	5238	6%	0%	9%
5000	4762	6%	0%	9%
4708	**4484**	**9.5%**	**0%**	**9%**
4500	4286	12%	0%	9%
4000	3810	12%	0%	9%
3500	3333	12%	0%	19%
3000	2857	18%	0%	19%
2500	2381	24%	0%	28%
2000	1905	36%	0%	38%
1500	1429	43%	0%	47%
1000	952	61%	0%	66%
500	476	73%	51%	76%

Source: Poffenberger 2003.

Note: Analyses by Poffenberger (2003) was done in whole weight, but trip limits will be designated in gutted weight, using a conversion factor of GW = WW ÷ 1.05. Initial analyses by Poffenberger (2003) produced percent reductions for each gear relative to total commercial harvest rather than harvest by that gear. In this table, the percentages have been weighted by the proportion of commercial catch taken by the gear type to determine percent reductions by gear relative to the gear's catch. Proportional catches by gear for red grouper and for gag/black grouper were calculated from Table 6.5. Proportional catches by gear for all shallow-water grouper were calculated from Poffenberger (2003) table 7.

Table 6.13. Gulf of Mexico red snapper target effort, individual angler trips.					
Year	For-hire	%	Private	%	Total
1996	105,095	48.90	109,821	51.10	214,916
1997	141,579	56.01	111,208	43.99	252,787
1998	144,108	54.06	122,446	45.94	266,554
1999	95,240	30.20	220,119	69.80	315,359
2000	94,217	29.93	220,606	70.07	314,823

Source: Holiman (2002).

Table 6.14. Number of affected recreational angler catch trips under alternative bag limit proposals. The totals across the species categories are not additive since a given trip may catch multiple grouper species.

Bag Limit	# of Affected Trips
Red Grouper	
1	20,500
2	6,100
3	3,100
4	1,600
Gag	
1	78,200
2	35,100
3	18,900
4	11,300
All Shallow Water Grouper	
1	149,800
2	71,300
3	38,600
4	19,800

Source: Holiman (2002).

Table 6.15. Potential percentage savings in red grouper harvest weight (gutted pounds) at indicated discard mortality rate for minimum sizes indicated.

	Recreational Sector			Handline/Powerline Sector			Longline Sector		
	Discard Mortality			Discard Mortality			Discard Mortality		
Minimum Size (TL inches)	10%	20%	30%	30%	60%	90%	30%	60%	90%
21	20.7%	18.4%	16.1%	4.8%	2.8%	0.7%	3.9%	2.2%	0.6%
22	32.0%	28.4%	24.9%	10.8%	6.2%	1.5%	9.5%	5.4%	1.4%
23	41.6%	37.0%	32.3%	16.4%	9.4%	2.3%	14.9%	8.5%	2.1%
24	51.0%	45.3%	39.6%	22.2%	12.7%	3.2%	20.8%	11.9%	3.0%

Source: Recreational sector - Memo from Joseph Powers to Wayne Swingle dated June 20, 2002, titled "Red Grouper Recreational Size Limit Analyses". Commercial sectors - Handout provided by NMFS at the July 8-12, 2002 Council meeting in Sarasota, Florida.

Table 6.16. Release mortalities of red grouper caught by longline, bandit gear, and fish traps.

	Longlines	Bandit Gear	Fish Traps
No. of Fish	3080	1077	5901
% kept	46.9%	40.2%	22.2%
% retained for bait	0.7%	0%	0%
% released alive	42.9%	55.1%	74.9%
% released dead	6.6%	4.1%	2.4%
% fate unknown	2.9%	0.6%	0.6%
Calculated release mortality	18.0%	7.9%	3.8%

Source: NMFS 1995. Characterization of the reef fish fishery of the eastern U.S. Gulf of Mexico. MARFIN Grant 95MFIH07. NMFS/SEFSC, Galveston.

Note: Calculated release mortality is (% rel. dead + % unknown) ÷ (% rel. alive + % rel. dead + % unknown).

Table 6.17. Expected reductions from phasing out longline gear

	Fraction of effort transferred from longline to bandit gear					
	0.0	0.2	0.4	0.6	0.8	1.0
Red grouper*	59%	53%	48%	43%	38%	33%
SW aggregate	48%	43%	39%	35%	31%	27%

* Fractional reductions for the shallow-water grouper aggregate are from Table Longline in the NMFS August 27, 2001 analyses. Fractional reductions for red grouper were calculated using the same proportional reductions as for the shallow-water grouper aggregate.

Table 6.18. Percent of Commercial Grouper Harvest Attributed to Longline – 1998 to June 2001

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Red	4.5%	4.5%	6.2%	4.7%	5.1%	5.2%	3.9%	4.3%	2.5%	5.0%	6.1%	6.8%
SW aggregate	3.7%	3.7%	5.0%	3.9%	4.3%	4.3%	3.3%	3.5%	2.1%	4.3%	5.0%	5.6%
	Potential reduction in harvest by moving longline gear to 50 fathoms in given month (assuming 82-99% of longline harvest is inside 50 fathoms and no gear effort shifting)											
Red	3.7-4.5%	3.7-4.5%	5.1-6.1%	3.9-4.7%	6.7-5.0%	4.1-5.1%	3.2-3.9%	3.5-4.3%	2.1-2.5%	4.1-5.0%	5.0-6.0%	5.6-6.7%
SW aggregate	3.0-3.7%	3.0-3.7%	4.1-5.0%	3.2-3.9%	3.5-4.3%	3.5-4.3%	2.7-3.3%	2.9-3.5%	1.7-2.1%	3.5-4.3%	4.1-5.0%	4.6-5.5%

Table 6.19. Longline vessel harvest and revenues of red grouper, gag, and black grouper

Year	Thousand Pounds (Gutted Weight)	Dockside Revenues (Thousand Dollars)	Net Revenues (Thousand Dollars)
1993	3,932	7,919	5,939
1994	3,125	5,874	4,406
1995	2,788	5,037	3,778
1996	3,345	6,599	4,949
1997	3,609	7,151	5,363
1998	3,724	7,561	5,671
1999	4,632	9,447	7,085
2000	3,363	7,581	5,686
Average	3,565	7,146	5,360

Source of basic data: Waters (2001;1996).

Table 6.20. Average vessel trips, pounds landed, and dockside revenues for longline vessel trips landing red grouper, gag, or black grouper, 1993-2000 (Pounds [gutted weight] and dollars are in thousands).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Number												
Trip	109	106	125	116	127	119	140	120	112	109	109	118
Lbs.	271	291	302	272	304	331	282	265	241	295	333	379
$	588	594	668	603	588	565	511	517	480	615	693	717
Percent												
Trips	7.8	7.5	8.9	8.2	9.0	8.4	9.9	8.5	7.9	7.8	7.8	8.4
Lbs	7.6	8.2	8.5	7.6	8.5	9.3	7.9	7.4	6.7	8.3	9.3	10.6
$	8.2	8.3	9.4	8.4	8.2	7.9	7.2	7.2	6.7	8.6	9.7	10.1

Source of basic data: Waters (2001).

Table 6.21. Total Deep-Water Grouper Landed Weight Commercial Landings by Month 1996-2000
Landed weight is pounds reported in NMFS ALS on 4/8/2002 divided by 1.18.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	35,806	29,786	61,964	83292	94,808	72,987	73,589	48,869	62,711	51,206	30,841	20,102	665,962
1997	11,991	34,519	66,677	72,430	161,591	114,793	80,617	151,003	111,895	55,967	61,826	37,148	960,456
1998	19,898	20,951	53,740	65,614	84,161	145,004	68,352	70,918	54,190	63,083	70,623	90,895	807,428
1999	62,165	73,353	77,277	122,180	171,854	112,083	114,951	128,426	61,908	81,206	118,767	122,903	1,247,073
2000	79,856	83,499	116,431	89647	127,853	182,844	143,854	223,012	154,637	80,308	82,475	46,139	1,410,557
Mean	**41493**	**48422**	**75,218**	**86,632**	**128,054**	**125,542**	**96,627**	**124,446**	**89,068**	**66,354**	**72,906**	**63,437**	**1,018,295**
Percent	**Landings**												
1996	0.05	0.04	0.09	0.13	0.14	0.11	0.11	0.07	0.09	0.08	0.05	0.03	1
1997	0.01	0.04	0.07	0.08	0.17	0.12	0.08	0.16	0.12	0.06	0.06	0.04	1
1998	0.02	0.03	0.07	0.08	0.10	0.18	0.08	0.09	0.07	0.08	0.09	0.11	1
1999	0.05	0.06	0.06	0.10	0.14	0.09	0.09	0.10	0.05	0.07	0.10	0.10	1
2000	0.06	0.06	0.08	0.06	0.09	0.13	0.10	0.16	0.11	0.06	0.06	0.03	1
Mean	**0.04**	**0.04**	**0.07**	**0.09**	**0.13**	**0.13**	**0.09**	**0.12**	**0.09**	**0.07**	**0.07**	**0.06**	1

Table 6.22. Total Tilefish (all species) Landed Weight Commercial Landings by Month 1996-2000
Landed weight is pounds reported in NMFS ALS on 4/8/2002 (no conversion).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1996	9,521	13,868	29,173	17,613	40,652	31,168	22,571	21,531	22,502	21,719	29,645	19,746	279,709
1997	5,536	22,478	32,662	22,387	89,198	60,462	50,407	68,692	25,231	44,518	75,719	56,485	553,775
1998	18,957	14,595	40,200	47,472	45,810	56,253	40,387	34,864	20,933	30,388	40,703	11,640	402,202
1999	19,784	13,039	8,079	22,471	58,299	30,916	54,629	29,859	20,885	53,273	81,277	59,926	452,437
2000	40,805	47,055	47,931	40,224	45,596	45,690	41,602	63,495	38,606	31,832	34,061	15,919	492,816
Mean	**18,921**	**22,207**	**31,609**	**30,033**	**55,911**	**44,898**	**41,919**	**43,688**	**25,631**	**36,346**	**52,281**	**32,743**	436,188
Percent													
1996	0.03	0.05	0.10	0.06	0.15	0.11	0.08	0.08	0.08	0.08	0.11	0.07	1
1997	0.01	0.04	0.06	0.04	0.16	0.11	0.09	0.12	0.05	0.08	0.14	0.10	1
1998	0.05	0.04	0.10	0.12	0.11	0.14	0.10	0.09	0.05	0.08	0.10	0.03	1
1999	0.04	0.03	0.02	0.05	0.13	0.07	0.12	0.07	0.05	0.12	0.18	0.13	1
1999	0.08	0.10	0.10	0.08	0.09	0.09	0.08	0.13	0.08	0.06	0.07	0.03	1
Mean	**0.04**	**0.05**	**0.08**	**0.07**	**0.13**	**0.10**	**0.09**	**0.10**	**0.06**	**0.08**	**0.12**	**0.07**	1

Table 7.1. Potential TACs (million pounds, gutted weight) during the rebuilding period, 2002-2011, including status quo.

Year	Constant Catch		Constant F		Status Quo (Projected Landings)
	Steepness=0.7	Steepness=0.8	Steepness=0.7	Steepness=0.8	
	Path 1	Path 2	Path 3	Path 4	
2002	7.03	7.12	7.32	7.32	8.39
2003	7.03	7.12	6.17	7.36	8.42
2004	7.03	7.12	6.59	7.63	8.47
2005	7.03	7.12	6.91	7.78	8.49
2006	7.03	7.12	7.13	7.83	8.42
2007	7.03	7.12	7.25	7.76	8.28
2008	7.03	7.12	7.31	7.67	8.09
2009	7.03	7.12	7.32	7.54	7.90
2010	7.03	7.12	7.33	7.47	7.73
2011	7.03	7.12	7.35	7.36	7.61
Total	70.30	71.20	70.68	80.52	81.80

Source of basic data: SEFSC (2001).

Table 7.2. TACs (million pounds, gutted weight) for various rebuilding paths for red grouper, 2002-2011, including status quo.

	TAC 1 Constant Catch Steepness: 0.7	TAC 2 Constant F Steepness: 0.7	TAC 3 Stepwise	Status Quo
2002	7.03	7.32	7.32	8.39
2003	7.03	6.17	6.55	8.42
2004	7.03	6.59	6.55	8.47
2005	7.03	6.91	6.55	8.49
2006	7.03	7.13	7.23	8.42
2007	7.03	7.25	7.23	8.28
2008	7.03	7.31	7.23	8.09
2009	7.03	7.32	7.33	7.90
2010	7.03	7.33	7.33	7.73
2011	7.03	7.35	7.33	7.61
2012+	7.56	7.56	7.56	7.52
Total	70.30	70.68	70.65	81.80

Source of basic data: SEFSC (2002).

Table 7.3. Baseline model runs for the 3 TAC paths.

	Status Quo	TAC 1 Constant Catch TACs	TAC 2 Constant F TACs	TAC 3 Stepwise TACs
Achieves SSB Target	NO	YES	YES	YES
Commercial Net Present Values (Million $)				
Longline vessels	64.1	74.5	75.1	74.9
Vertical line vessels	36.7	44.4	44.9	44.7
Total	100.8	118.9	120	119.6
Season Length: Rebuilding Period (Days)				
Commercial	365	194-302	210-217	208-217
Recreational	365	92-116	96-99	98-99
Season Length: Post-Rebuilding Period (Days)				
Commercial	365	208-211	209-213	209-213
Recreational	365	100-101	100-101	101-102

Table 7.4. Effects of a price or fleet size change on net present values of longline and vertical line vessels, using stepwise TAC strategy.

	NPV Change from Status Quo	NPV Change from Constant Price or Fleet Size
33% Price Decrease		
Longline	-34%	-43%
Vertical line	-39%	-45%
Total	-36%	-44%
1% Annual Increase in Fleet Size		
Longline	5%	-10%
Vertical line	0%	-10%
Total	3%	-10%

Table 7.5. TACs and required reductions from status quo under 5 rebuilding alternatives in section 6.3.1.

Year	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Status Quo
	TACs (Million Pounds)					
2002	7.03	7.32	7.32	7.03	5.86	8.39
2003	7.03	6.17	6.55	7.03	5.86	8.42
2004	7.03	6.59	6.55	7.03	5.86	8.47
2005	7.03	6.91	6.55	7.03	5.86	8.49
2006	7.03	7.13	7.23	7.03	5.86	8.42
2007	7.03	7.25	7.23	7.23	5.86	8.28
2008	7.03	7.31	7.23	7.23	5.86	8.09
2009	7.03	7.32	7.33	7.23	5.86	7.90
2010	7.03	7.33	7.33	7.23	5.86	7.73
2011	7.03	7.35	7.33	7.23	7.56	7.61
Total	70.3	70.68	70.65	71.3	60.3	81.8
	Percent Reduction from Status Quo					
2002	16.2	12.8	12.8	16.2	30.2	0
2003	16.5	26.7	22.2	16.5	30.4	0
2004	17.0	22.2	22.7	17.0	30.8	0
2005	17.2	18.6	22.9	17.2	30.9	0
2006	16.5	15.3	14.1	16.5	30.4	0
2007	15.1	12.4	12.7	12.7	29.2	0
2008	13.1	9.6	10.6	10.6	27.6	0
2009	11.0	7.3	7.2	8.5	25.8	0
2010	9.1	5.2	5.2	6.5	24.2	0
2011	7.6	3.4	3.7	5.0	0.7	0
	10-year Percent Reduction					
2002-2011	14.1	13.6	13.6	12.8	26.3	0

Table 7.6. Economic impacts of a 5-month closure in the commercial sector (Scenario 1).

Management Measure	Achieves SSB Target	% Change in Net Present Values from Status Quo		
		Longline Vessels	Vertical Line Vessels	Total
Scenario 1-A	Yes	19	24	21
Scenario 1-B	Yes	-38.8	-43.1	-40.7
Scenario 1-C	Yes	11.6	7.7	9.8
Scenario 1-D	No	-3.6	-6.3	-4.8
Scenario 1-E	No	-48.6	-52.3	-50.3

Scenarios are defined as follow:

Scenario 1-A Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 5-month closure, no price change, no fleet size change

Scenario 1-B Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 5-month closure, 33% price reduction, no fleet size change

Scenario 1-C Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 5-month closure, no price change, 1% fleet size change

Scenario 1-D Recreational sector: harvests not controlled to match recreational allocation of TAC
Commercial sector: 5-month closure, no price change, no fleet size change

Scenario 1-E Recreational sector: harvests not controlled to match recreational allocation of TAC
Commercial sector: 5-month closure, 33% price reduction, no fleet size change

Table 7.7. Economic impacts of a 50-fathom longline ban (Scenario 2).

Management Measure	Achieves SSB Target	% Change in Net Present Values from Status Quo		
		Converted Longline Vessels	Vertical Line Vessels	Total
Scenario 2-A	Yes	-59	98	-2
Scenario 2-B	Yes	-64	57	-8
Scenario 2-C	Yes	-73	30	-25
Scenario 2-D	Yes	-75	25	-28

Scenarios are defined as follow:

Scenario 2-A Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, no fleet size change

Scenario 2-B Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, 1% annual fleet size change

Scenario 2-C Recreational sector: harvests not controlled to match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, no fleet size change

Scenario 2-D Recreational sector: harvests not controlled to match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, 1% annual fleet size change

Note: The "converted longline vessels" column refers to longline vessels that converted to bandit gear under the other management alternatives.

Table 7.8. Economic impacts of a 50-fathom longline ban: additional scenarios (Scenario 2).

Management Measure	Achieves SSB Target	% Change in Net Present Values from Status Quo		
		Converted Longline Vessels	Vertical Line Vessels	Total
Scenario 2-AA	Yes	-59	98	-2
Scenario 2-AB	Yes	-48	61	3
Scenario 2-AC	Yes	-43	65	7
Scenario 2-AD	Yes	-29	61	13

Scenarios are defined as follow:

Scenario 2-AA Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, no fleet size change

Scenario 2-AB Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, no fleet size change, 25% higher productivity for a converted longline vessel

Scenario 2-AC Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, no fleet size change, $650 trip cost for a converted longline vessel

Scenario 2-AD Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 50-fathom longline ban, no fleet size change, 25% higher productivity and $650 trip cost for a converted longline vessel

Note: The "converted longline vessels" column refers to longline vessels that converted to bandit gear under the other management alternatives.

Table 7.9. Average pounds per trip, by boat category, 2000.

	Longline	Vertical Line	Fish Trap
Top 20 boats	4,583	1,716	2,665
21-50 boats	2,885	899	1,300
51-100 boats	1,905	816	83
101-200 boats	705	413	n/a

Source of basic data: Waters (2001).

Table 7.10. Economic impacts of a 3-month closure and a 1,800-pound or 2,000-pound trip limits (Scenario 3).

Management Measure	Achieves SSB Target	% Change in Net Present Values from Status Quo		
		Longline Vessels	Vertical Line Vessels	Total
Scenario 3-A	Yes	-52	40	-9
Scenario 3-B	Yes	-42	37	-5

Scenarios are defined as follow:

Scenario 3-A Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 3-month closure, 1,800-pound trip limit, increase in number of trips, no price change, no fleet size change

Scenario 3-B Recreational sector: harvests match recreational allocation of TAC
Commercial sector: 3-month closure, 2,000-pound trip limit, increase in number of trips, no price change, no fleet size change

Table 7.11. Selected characteristics of the red snapper and red grouper recreational fisheries. Data are based solely on MRFSS. Numbers inside parentheses are percent of red grouper to red snapper.

	1990-1999 Average (thousands, except percents)	
	Red Snapper	Red Grouper
Number of fish landed	961	244 (25%)
Pounds of fish landed	3,173	1,561 (49%)
Target trips	195	126 (65%)
Catch trips	364	414 (114%)
Percent of target trips to total recreational trips	1.15	0.73
Percent of catch trips to total recreational trips	2.14	2.43

Source of basic data: Holiman (2000).

Table 7.12. Economic impacts of trip limit on longline and vertical line vessels (Scenario 11).

Management Measure	Achieves SSB Target	Net Present Values (Million Dollars)		
		Longline Vessels	Vertical Line Vessels	Total
Status Quo	No	64.1	36.7	100.8
Scenario 11-A	Yes	64.4	35.5	99.9
Scenario 11-B	No	71.4	39.4	110.8
Scenario 11-C	No	69.7	38.5	108.2
Scenario 11-D	Yes	59.1	32.5	91.6
Scenario 11-E	Yes	67.2	37.0	104.2
Scenario 11-F	No	65.9	36.3	102.2

Scenarios are defined as follow:

Scenario 11-A Recreational sector: harvests match recreational allocation of TAC
Commercial sector: trip limit, no closure, no change in number of trips

Scenario 11-B Recreational sector: harvests match recreational allocation of TAC
Commercial sector: trip limit, no closure, increase in number of trips

Scenario 11-C Recreational sector: harvests exceed recreational allocation of TAC
Commercial sector: trip limit, no closure, change in number of trips

Scenario 11-D Recreational sector: harvests match recreational allocation of TAC
Commercial sector: trip limit, 1-month closure, no change in number of trips

Scenario 11-E Recreational sector: harvests match recreational allocation of TAC
Commercial sector: trip limit, 1-month closure, change in number of trips

Scenario 11-F Recreational sector: harvests exceed recreational allocation of TAC
Commercial sector: trip limit, 1-month closure, change in number of trips

Table 8.0. Species in the Reef Fish Fishery Management Plan.

Species in the Management Unit

Snappers - Lutjanidae Family	
queen snapper	*Etelis oculatus*
mutton snapper	*Lutjanus analis*
schoolmaster	*Lutjanus apodus*
blackfin snapper	*Lutjanus buccanella*
red snapper	*Lutjanus campechanus*
cubera snapper	*Lutjanus cyanopterus*
gray (mangrove) snapper	*Lutjanus griseus*
dog snapper	*Lutjanus jocu*
mahogany snapper	*Lutjanus mahogoni*
lane snapper	*Lutjanus synagris*
silk snapper	*Lutjanus vivanus*
yellowtail snapper	*Ocyurus chrysurus*
wenchman	*Pristipomoides aquilonaris*
vermilion snapper	*Rhomboplites aurorubens*
Groupers - Serranidae Family	
rock hind	*Epinephelus adscensionis*
speckled hind	*Epinephelus drummondhayi*
yellowedge grouper	*Epinephelus flavolimbatus*
red hind	*Epinephelus guttatus*
jewfish	*Epinephelus itajara*
red grouper	*Epinephelus morio*
misty grouper	*Epinephelus mystacinus*
warsaw grouper	*Epinephelus nigritus*
snowy grouper	*Epinephelus niveatus*
black grouper	*Mycteroperca bonaci*
yellowmouth grouper	*Mycteroperca interstitialis*
gag	*Mycteroperca microlepis*
scamp	*Mycteroperca phenax*
yellowfin grouper	*Mycteroperca venenosa*
marbled grouper	*Epinephelus inermis*
Tilefishes - Malacanthidae (Branchiostegidae) Family	
goldface tilefish	*Caulolatilus crysops*
blackline tilefish	*Caulolatilus cyanops*
anchor tilefish	*Caulolatilus intermedius*
blueline tilefish	*Caulolatilus microps*
tilefish	*Lopholatilus chamaeleonticeps*
Jacks - Carangidae Family	
greater amberjack	*Seriola dumerili*
lesser amberjack	*Seriola fasciata*
almaco jack	*Seriola rivoliana*
banded rudderfish	*Seriola zonata*
Triggerfishes - Balistidae Family	
gray triggerfish	*Balistes capriscus*
Wrasses - Labridae Family	
hogfish	*Lachnolaimus maximus*

Table 10. Monthly distribution of shallow water grouper landings for all gears and all areas in the Gulf of Mexico.
Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
1999-2001 AVERAGE LANDINGS													
RED GROUPER	440	386	402	445	569	657	592	589	414	521	510	523	6,045
GAG	198	162	170	183	199	139	102	86	78	134	132	174	1,757
OTHER SWG	128	116	103	120	133	96	83	72	60	88	94	104	1,198
ALL SWG	766	665	675	747	901	892	777	747	552	743	736	800	9,000
1999-2001 CUMULATIVE LANDINGS													
RED GROUPER	440	826	1,228	1,673	2,241	2,898	3,490	4,079	4,492	5,013	5,523	6,045	
GAG	198	360	529	712	911	1,050	1,152	1,238	1,316	1,451	1,583	1,757	
OTHER SWG	128	244	348	467	601	697	779	852	912	1,000	1,094	1,198	
ALL SWG	766	1,430	2,105	2,853	3,754	4,646	5,423	6,170	6,722	7,464	8,201	9,000	
CUMULATIVE LANDINGS AS PERCENTAGE OF RED GROUPER QUOTA													
RED GROUPER	8.3%	15.6%	23.1%	31.5%	42.2%	54.6%	65.7%	76.8%	84.6%	94.4%	104.0%	113.8%	
CUMULATIVE LANDINGS AS PERCENTAGE OF SHALLOW WATER GROUPER QUOTA													
ALL SWG	8.7%	16.3%	23.9%	32.4%	42.7%	52.8%	61.6%	70.1%	76.4%	84.8%	93.2%	102.3%	

Table 11. Estimated changes in fishing effort, landings, revenues and net incomes, by primary gear type, due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

WITHOUT QUOTAS						WITH QUOTAS						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,307	3,032	3,840	8,250	2,364	7,937	1,015
% changes compared to harvesting without quotas =						-9.8%	-14.6%	-14.4%	-13.3%	-1.7%	-11.3%	
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,706	1,418	3,088	7,097	10,402	13,345	617
% changes compared to harvesting without quotas =						-7.7%	-9.9%	-11.1%	-10.7%	-0.7%	-4.4%	
FISH TRAPS												
531	891	937	1,845	393	1,741	501	838	879	1,733	385	1,648	93
% changes compared to harvesting without quotas =						-5.7%	-5.9%	-6.2%	-6.0%	-2.0%	-5.3%	
OTHER GEARS												
508	30	102	238	252	291	460	28	92	216	246	277	13
% changes compared to harvesting without quotas =						-9.5%	-7.3%	-9.7%	-9.5%	-2.4%	-4.6%	
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	9,973	5,316	7,899	17,296	13,398	23,208	1,739
% changes compared to harvesting without quotas =						-8.0%	-12.1%	-12.2%	-11.5%	-0.9%	-7.0%	

Table 12. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

JANUARY TO MID-NOVEMBER SEASON OPEN WITHOUT AND WITH QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON OPEN WITHOUT QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON CLOSED WITH QUOTAS				
TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,283	8,250	2,223	7,849	165	1,267	181	1,103	24	0	141	88	1,015
VERTICAL LINES												
7,461	7,097	9,589	12,691	887	846	883	1,271	244	0	813	654	617

Table 13. Estimated changes in fishing effort, landings, revenues and net incomes, by area landed, due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

WITHOUT QUOTAS						WITH QUOTAS						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
WEST-CENTRAL FLORIDA (AREAS 3-6)												
4,761	5,034	6,653	14,181	2,143	12,059	4,288	4,441	5,848	12,566	2,085	10,804	1,255
% changes compared to harvesting without quotas =						-9.9%	-11.8%	-12.1%	-11.4%	-2.7%	-10.4%	
FLORIDA KEYS (AREAS 1-2)												

Table 14. Estimated losses in net incomes by area landed for boat owners, captains and crews due to a closure of the shallow water grouper fishery when a 5.31 MP quota for red grouper or an 8.80 MP quota for shallow water groupers is reached, based on NMFS logbook data averaged for 1999-2001.

	JANUARY TO MID-NOVEMBER SEASON OPEN WITHOUT AND WITH QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON OPEN WITHOUT QUOTAS				MID-NOVEMBER THROUGH DECEMBER SEASON CLOSED WITH QUOTAS				
	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES	4,250	12,566	1,958	10,725	511	1,614	185	1,334	38	0	127	79	1,255
VERTICAL LINES	775	646	1,047	1,230	101	87	149	184	32	0	135	109	75
FISH TRAPS	2,976	3,636	2,390	4,183	395	482	242	476	86	0	195	132	344
OTHER GEARS	1,685	447	6,970	6,263	143	65	582	550	131	0	576	486	64
ALL GEARS COMBINED	9,686	17,296	12,365	22,401	1,150	2,248	1,157	2,545	287	0	1,033	806	1,739

Table 15. Landings of shallow water groupers (SWG) in relation to a 7000 pound trip limit, all gears and areas in the Gulf of Mexico. Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
1999	997	46	4.6%	11,281	140	1.2%	8,649	8,356	293	3.4%
2000	1,019	63	6.2%	11,116	141	1.3%	8,914	8,573	341	3.8%
2001	968	58	6.0%	10,110	178	1.8%	9,439	9,042	397	4.2%
AVG	995	56	5.6%	10,836	153	1.4%	9,001	8,657	344	3.8%

Table 16. Landings of shallow water groupers (SWG) in relation to a 7000 pound trip limit, by primary gear for each trip.
Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

PRIMARY GEAR	FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
VERTICAL	1999	811	2	0.2%	8,807	2	0.0%	2,932	2,929	3	0.1%
LINES	2000	843	11	1.3%	8,528	13	0.2%	3,621	3,573	48	1.3%
	2001	797	6	0.8%	7,710	10	0.1%	3,874	3,845	29	0.7%
	AVG	817	6	0.8%	8,348	8	0.1%	3,476	3,449	27	0.8%
BOTTOM	1999	157	43	27.4%	1,461	135	9.2%	4,800	4,512	288	6.0%
LONGLINES	2000	167	48	28.7%	1,463	112	7.7%	4,036	3,784	251	6.2%
	2001	156	50	32.1%	1,422	160	11.3%	4,625	4,295	330	7.1%
	AVG	160	47	29.4%	1,449	136	9.4%	4,487	4,197	290	6.5%
FISH	1999	61	1	1.6%	564	3	0.5%	840	838	2	0.2%
TRAPS	2000	59	4	6.8%	544	16	2.9%	1,148	1,105	42	3.7%
	2001	53	3	5.7%	485	7	1.4%	822	817	5	0.6%
	AVG	58	3	4.6%	531	9	1.6%	937	920	16	1.7%
OTHER	1999	98	0	0.0%	449	0	0.0%	76	76	0	0.0%
GEARS	2000	130	0	0.0%	581	0	0.0%	110	110	0	0.0%
	2001	108	1	0.9%	493	1	0.2%	118	85	34	28.8%
	AVG	112	0	0.3%	508	0	0.1%	101	90	11	11.2%

Table 17. Landings of shallow water groupers (SWG) in relation to a 7000 pound trip limit, by region where landed.

Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

PRIMARY GEAR	FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
FLORIDA	1999	207	2	1.0%	898	9	1.0%	395	374	20	5.1%
KEYS	2000	195	2	1.0%	873	2	0.2%	288	286	2	0.7%
	2001	182	4	2.2%	856	9	1.1%	333	318	15	4.5%
	AVG	195	3	1.4%	876	7	0.8%	339	326	12	3.6%
WEST-	1999	474	44	9.3%	4,950	126	2.5%	6,675	6,416	259	3.9%
CENTRAL	2000	476	57	12.0%	5,022	126	2.5%	6,642	6,341	301	4.5%
FLORIDA	2001	442	55	12.4%	4,312	150	3.5%	6,641	6,300	341	5.1%
	AVG	464	52	11.2%	4,761	134	2.8%	6,653	6,352	300	4.5%
NORTHWEST	1999	322	4	1.2%	3,310	5	0.2%	1364	1350	13	1.0%
FLORIDA	2000	343	11	3.2%	3,415	13	0.4%	1,759	1,720	39	2.2%
	2001	334	8	2.4%	3,388	17	0.5%	2269	2246	23	1.0%
	AVG	333	8	2.3%	3,371	12	0.3%	1,797	1,772	25	1.4%
OTHER	1999	178	0	0.0%	2,123	0	0.0%	215	215	0	0.0%
AREAS	2000	195	0	0.0%	1,806	0	0.0%	225	225	0	0.0%
	2001	170	2	1.2%	1,554	2	0.1%	196	178	18	9.2%
	AVG	181	1	0.4%	1,828	1	0.0%	212	206	6	2.8%

Table 18. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 7000 pound trip limit for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips can be taken when the trip limit is constraining.

	NO TRIP LIMIT						7000 POUND TRIP LIMIT						
	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES													
	1,449	3,550	4,487	9,518	2,405	8,952	1,449	3,338	4,197	8,889	2,374	8,292	660
% changes compared to harvesting without a trip limit =							0.0%	-6.0%	-6.5%	-6.6%	-1.3%	-7.4%	
VERTICAL LINES													
	8,348	1,575	3,476	7,943	10,472	13,963	8,348	1,561	3,449	7,884	10,467	13,899	63
% changes compared to harvesting without a trip limit =							0.0%	-0.9%	-0.8%	-0.7%	0.0%	-0.5%	

Table 19. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 7000 pound trip limit for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001, and assuming that one extra trip can be taken, if profitable, when the trip limit is constraining.

	NO TRIP LIMIT						7000 POUND TRIP LIMIT						
	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES													
	1,449	3,550	4,487	9,518	2,405	8,952	1,532	3,509	4,429	9,388	2,400	8,633	319
% changes compared to harvesting without a trip limit =							5.8%	-1.2%	-1.3%	-1.4%	-0.2%	-3.6%	
VERTICAL LINES													
	8,348	1,575	3,476	7,943	10,472	13,963	8,356	1,572	3,470	7,929	10,470	13,942	21
% changes compared to harvesting without a trip limit =							0.1%	-0.2%	-0.2%	-0.2%	0.0%	-0.1%	

Table 20. Estimated losses in net incomes, by area landed, for boat owners, captains and crews due to a 7000 pound trip limit for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001. and assuming that no extra trips can be taken when the trip limit is constraining.

	NO TRIP LIMIT						7000 POUND TRIP LIMIT						
	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
WEST-CENTRAL FLORIDA (AREAS 3-6)													
	4,761	5,034	6,653	14,181	2,143	12,059	4,761	4,817	6,353	13,529	2,107	11,373	686
% changes compared to harvesting without a trip limit =							0.0%	-4.3%	-4.5%	-4.6%	-1.6%	-5.7%	
FLORIDA KEYS (AREAS 1-2)													
	876	229	339	733	1,196	1,414	876	219	326	707	1,192	1,383	31

Table 21. Landings and fishing effort for shallow water groupers (SWG) in relation to various trip limits during the 4th calendar quarter.

Landings are expressed in thousands of pounds, eviscerated weights, based on NMFS logbook data as of February 14, 2003.

TRIP LIMIT	FISHING YEAR	TOTAL BOATS	BOATS OVER LIMIT	BOATS OVER LIMIT PERCENT	TOTAL TRIPS	TRIPS OVER LIMIT	TRIPS OVER LIMIT PERCENT	TOTAL SWG POUNDS GUTTED (1000s)	SWG POUNDS WITHIN LIMIT (1000s)	SWG POUNDS OVER LIMIT (1000s)	SWG POUNDS OVER LIMIT PERCENT
7000 LBS	1999	655	17	2.6%	2,444	25	1.0%	1,823	1,736	87	4.8%
	2000	661	46	7.0%	2,601	81	3.1%	2,759	2,569	189	6.9%
	2001	638	33	5.2%	2,470	49	2.0%	2,255	2,129	126	5.6%
	AVG	651	32	4.9%	2,505	52	2.1%	2,279	2,145	134	5.9%
6000 LBS	1999	655	26	4.0%	2,444	43	1.8%	1,823	1,701	122	6.7%
	2000	661	59	8.9%	2,601	111	4.3%	2,759	2,474	284	10.3%
	2001	638	50	7.8%	2,470	74	3.0%	2,255	2,068	187	8.3%
	AVG	651	45	6.9%	2,505	76	3.0%	2,279	2,081	198	8.7%
5000 LBS	1999	655	40	6.1%	2,444	70	2.9%	1,823	1,647	176	9.7%
	2000	661	78	11.8%	2,601	162	6.2%	2,759	2,337	421	15.3%
	2001	638	62	9.7%	2,470	109	4.4%	2,255	1,977	279	12.4%
	AVG	651	60	9.2%	2,505	114	4.5%	2,279	1,987	292	12.8%
4000 LBS	1999	655	65	9.9%	2,444	121	5.0%	1,823	1,553	270	14.8%
	2000	661	97	14.7%	2,601	213	8.2%	2,759	2,150	609	22.1%
	2001	638	77	12.1%	2,470	147	6.0%	2,255	1,851	404	17.9%
	AVG	651	80	12.2%	2,505	160	6.4%	2,279	1,851	428	18.8%

Table 22. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 7000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

			WITH QUOTAS AND TRIP LIMIT					
SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)
4,487	9,518	2,405	8,952	1,321	3,016	3,820	8,196	2,357
	-8.8%	-15.0%	-14.9%	-13.9%	-2.0%			
3,476	7,943	10,472	13,963	7,772	1,426	3,113	7,152	10,412
	-6.9%	-9.5%	-10.4%	-10.0%	-0.6%			
937	1,845	393	1,741	504	841	883	1,741	386
	-5.0%	-5.5%	-5.7%	-5.6%	-1.7%			
102	238	252	291	464	28	92	217	247
	-8.5%	-7.0%	-9.0%	-8.9%	-2.1%			
9,001	19,544	13,522	24,946	10,061	5,312	7,908	17,306	13,402
				-7.1%	-12.1%	-12.1%	-11.4%	-0.9%

	WITHOUT QUOTAS AND TRIP LIMIT		
		NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
TRIPS	RED GROUPER POUNDS (1000s)		
BOTTOM LONGLINES			
1,449	3,550	7,847	1,105
% changes compared to harvesting with quotas and trip limits =		-12.3%	12.3%
VERTICAL LINES			
8,348	1,575	13,381	582
% changes compared to harvesting with quotas and trip limits =		-4.2%	4.2%
FISH TRAPS			
531	891	1,654	88
% changes compared to harvesting with quotas and trip limits =		-5.0%	5.0%
OTHER GEARS			
508	30	278	12

Table 23. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 6000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,326	3,011	3,813	8,174	2,355	7,812	1,139
% changes compared to harvesting with quotas and trip limits =						-8.4%	-15.2%	-15.0%	-14.1%	-2.1%	-12.7%	12.7%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,801	1,431	3,129	7,186	10,415	13,403	559
% changes compared to harvesting with quotas and trip limits =						-6.6%	-9.1%	-10.0%	-9.5%	-0.5%	-4.0%	4.0%
FISH TRAPS												
531	891	937	1,845	393	1,741	505	840	881	1,737	387	1,650	91
% changes compared to harvesting with quotas and trip limits =						-5.0%	-5.7%	-5.9%	-5.8%	-1.7%	-5.2%	5.2%
OTHER GEARS												
508	30	102	238	252	291	467	28	93	218	247	279	12
% changes compared to harvesting with quotas and trip limits =						-8.1%	-6.7%	-8.7%	-8.5%	-2.0%	-4.2%	4.2%
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,099	5,311	7,916	17,315	13,404	23,145	1,802
% changes compared to harvesting with quotas and trip limits =						-6.8%	-12.2%	-12.0%	-11.4%	-0.9%	-7.2%	7.2%

Table 24. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 5000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,335	2,999	3,798	8,133	2,353	7,750	1,201
% changes compared to harvesting with quotas and trip limits =						-7.8%	-15.5%	-15.4%	-14.5%	-2.2%	-13.4%	13.4%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,853	1,444	3,167	7,266	10,423	13,466	497
% changes compared to harvesting with quotas and trip limits =						-5.9%	-8.3%	-8.9%	-8.5%	-0.5%	-3.6%	3.6%
FISH TRAPS												
531	891	937	1,845	393	1,741	507	839	881	1,736	387	1,648	93
% changes compared to harvesting with quotas and trip limits =						-4.6%	-5.8%	-6.0%	-5.9%	-1.6%	-5.4%	5.4%
OTHER GEARS												
508	30	102	238	252	291	470	28	93	219	248	279	12
% changes compared to harvesting with quotas and trip limits =						-7.5%	-6.8%	-8.2%	-8.1%	-1.8%	-4.0%	4.0%
ALL GEARS COMBINED												
10,836	6,046	9,001	19,544	13,522	24,946	10,164	5,311	7,938	17,354	13,410	23,143	1,803
% changes compared to harvesting with quotas and trip limits =						-6.2%	-12.2%	-11.8%	-11.2%	-0.8%	-7.2%	7.2%

Table 25. Estimated losses in net incomes by primary gear type for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and a 4000 pound trip limit during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that no extra trips are possible when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
BOTTOM LONGLINES												
1,449	3,550	4,487	9,518	2,405	8,952	1,349	2,972	3,769	8,064	2,347	7,650	1,302
% changes compared to harvesting with quotas and trip limits =						-6.9%	-16.3%	-16.0%	-15.3%	-2.4%	-14.5%	14.5%
VERTICAL LINES												
8,348	1,575	3,476	7,943	10,472	13,963	7,960	1,464	3,227	7,399	10,438	13,561	402

Table 26. Estimated losses in net incomes, for all gears and areas combined, for boat owners, captains and crews due to a 5.31 MP quota for red grouper, an 8.80 MP quota for shallow water groupers, and various trip limits during the 4th quarter for the shallow water grouper fishery in the Gulf of Mexico, based on NMFS logbook data averaged for 1999-2001 and assuming that one extra trip can be made, if profitable, when the trip limit is constraining.

WITHOUT QUOTAS AND TRIP LIMIT						WITH QUOTAS AND TRIP LIMIT						
TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	TRIPS	RED GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER POUNDS (1000s)	SHALLOW WATER GROUPER REVENUE ($1000s)	OTHER SPECIES REVENUE ($1000s)	NET REVENUE TO BOAT CAPT & CREW ($1000s)	NET LOSS INCOME TO BOAT CAPT & CREW ($1000s)
7000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,015	5,312	7,900	17,300	13,401	23,156	1,790
% changes compared to harvesting with quotas and trip limits =						-7.6%	-12.1%	-12.2%	-11.5%	-0.9%	-7.2%	7.2%
6000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,031	5,311	7,901	17,304	13,401	23,140	1,806
% changes compared to harvesting with quotas and trip limits =						-7.4%	-12.2%	-12.2%	-11.5%	-0.9%	-7.2%	7.2%
5000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,069	5,311	7,904	17,308	13,403	23,106	1,840
% changes compared to harvesting with quotas and trip limits =						-7.1%	-12.2%	-12.2%	-11.4%	-0.9%	-7.4%	7.4%
4000 POUND TRIP LIMIT												
10,836	6,046	9,001	19,544	13,522	24,946	10,114	5,312	7,909	17,313	13,404	23,048	1,898
% changes compared to harvesting with quotas and trip limits =						-6.7%	-12.1%	-12.1%	-11.4%	-0.9%	-7.6%	7.6%

19.0 FIGURES

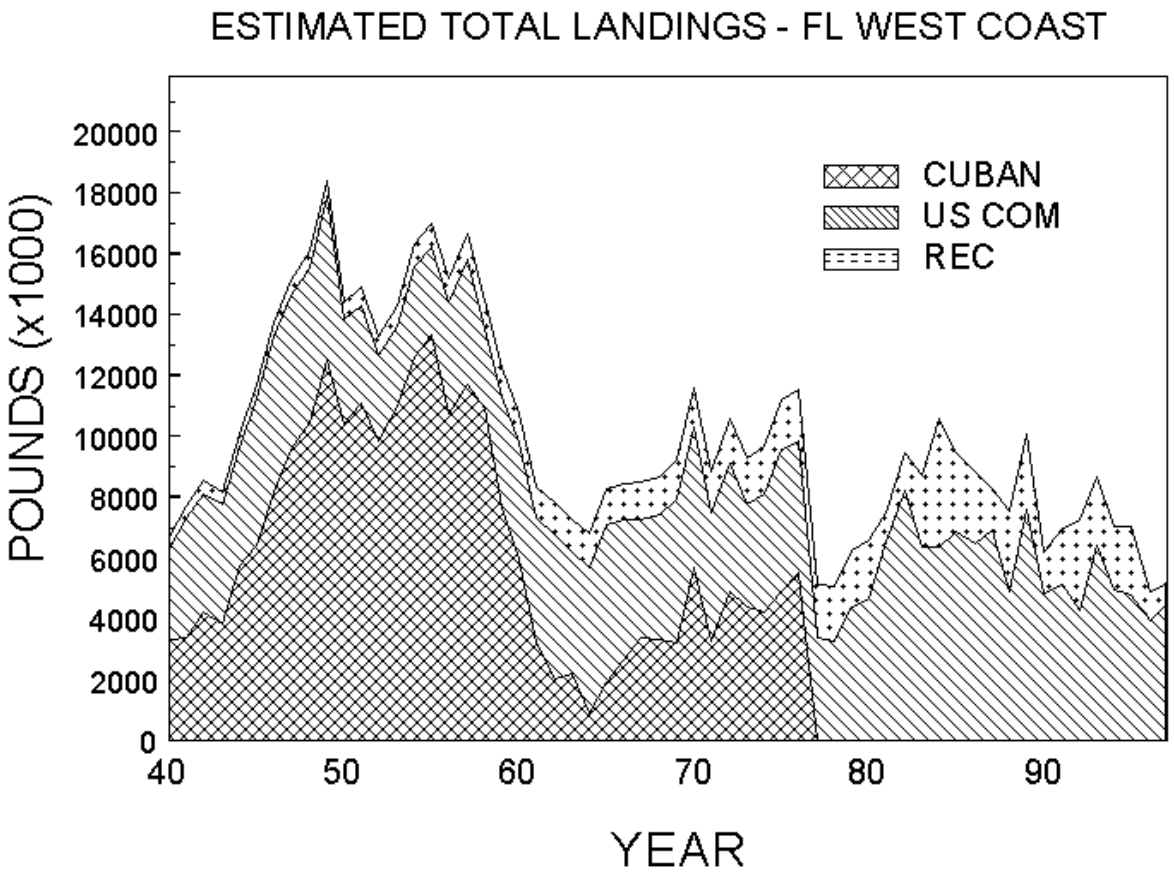


Figure 1. (Figure 33 in Schirripa et al. 1999). Estimated total landings of red grouper from Florida west coast, 1940-1997.

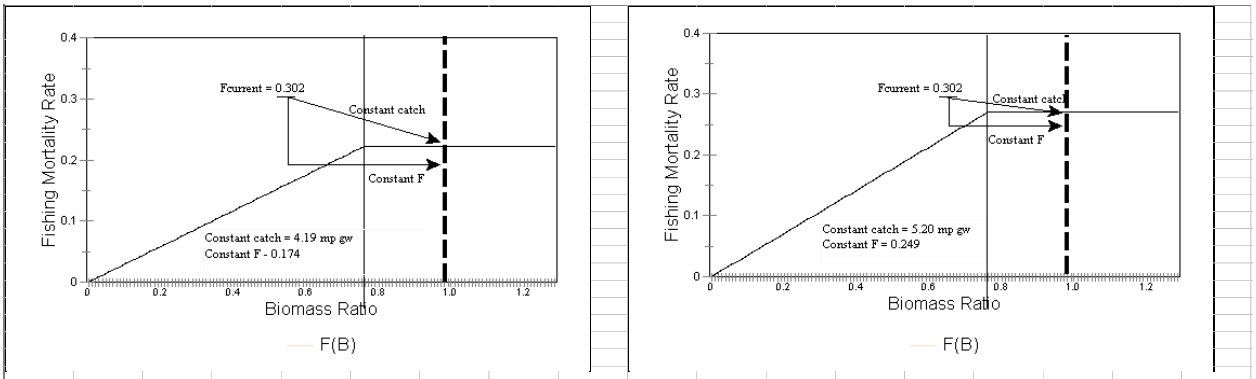


Figure Rebuild-1a. Reduction in F needed to rebuild to B(msy) in 10 years under the defaul MSY control rule with spawner-recruit curve steepness = 0.7

Figure Rebuild-1b. Reduction in F needed to rebuild to B(msy) in 10 years under the defaul MSY control rule with spawner-recruit curve steepness = 0.8

Figure 2. Control rules to illustrate the reduction in F needed under Alternatives 1 (constant catch) and 2 (constant F) of Section 6.3.1 (rebuild overfished stock). The left and right charts represent the results from using the lower and upper spawner-recruit steepness levels for each alternative. The solid vertical line is the 80% B_{MSY} minimum stock size threshold (MSST), below which the stock is in an overfished condition. The dashed vertical line is 100% B_{MSY}, which is the rebuilding target for an overfished stock. The inflection point for the MSY control rule is at the NMFS default recommendation of 80% B_{MSY}. Under constant catch, the catch would remain constant for 10 years, but as the stock biomass increases, the catch would be a decreasing proportion of the total stock biomass, and thus a decreasing F. Under constant F, the proportion of the stock taken would remain constant and would initially be lower than under constant catch, but would result in an increasing annual catch as the total stock biomass increases in size. After 10 years, both strategies would rebuild the stock to 100% B_{MSY}.

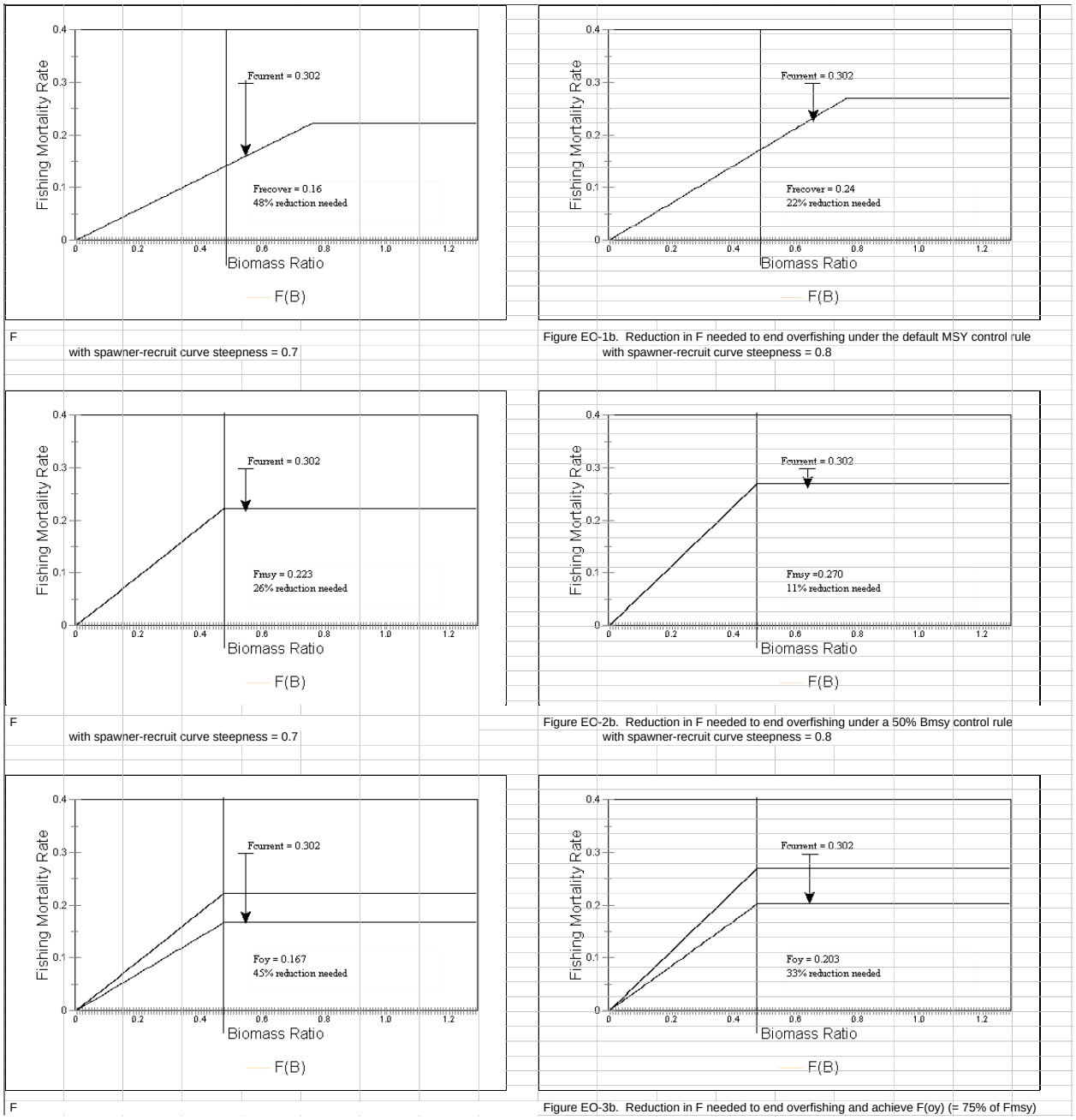


Figure EO-1b. Reduction in F needed to end overfishing under the default MSY control rule

Figure EO-2b. Reduction in F needed to end overfishing under a 50% Bmsy control rule

Figure EO-3b. Reduction in F needed to end overfishing and achieve F(oy) (= 75% of Fmsy)

Figure 3. Control rules to illustrate the reduction in F needed under Alternatives 1, 2, and 3 of Section 6.4.1 (overfishing is occurring but stock is not overfished). The left and right charts represent the results from using the lower and upper spawner-recruit steepness levels for each alternative. The vertical line is the 50% B_{MSY} minimum stock size threshold (MSST), below which the stock would be in an overfished condition. Under Alternative 1 (top two charts), the inflection point for the MSY control rule is at the NMFS default recommendation of 80% B_{MSY}. This requires that F be reduced from the current condition (top of arrow) by 22% to 48% to be back on the MSY control rule line. Under Alternative 2 (middle two charts), the inflection point for the MSY control rule is set at the MSST threshold of 50% B_{MSY}. This requires that F be reduced from the current condition (top of arrow) by 11% to 26% to be back on the MSY control rule line. Under Alternative 3 (bottom two charts), the optimum yield (OY) control rule is used instead of MSY. F_{OY} is set at the NMFS recommendation of 75% of F_{MSY}, and is the lower of the two control rule lines. This requires that F be reduced from the current condition (top of arrow) by 33% to 45% to be back on the OY control rule line.

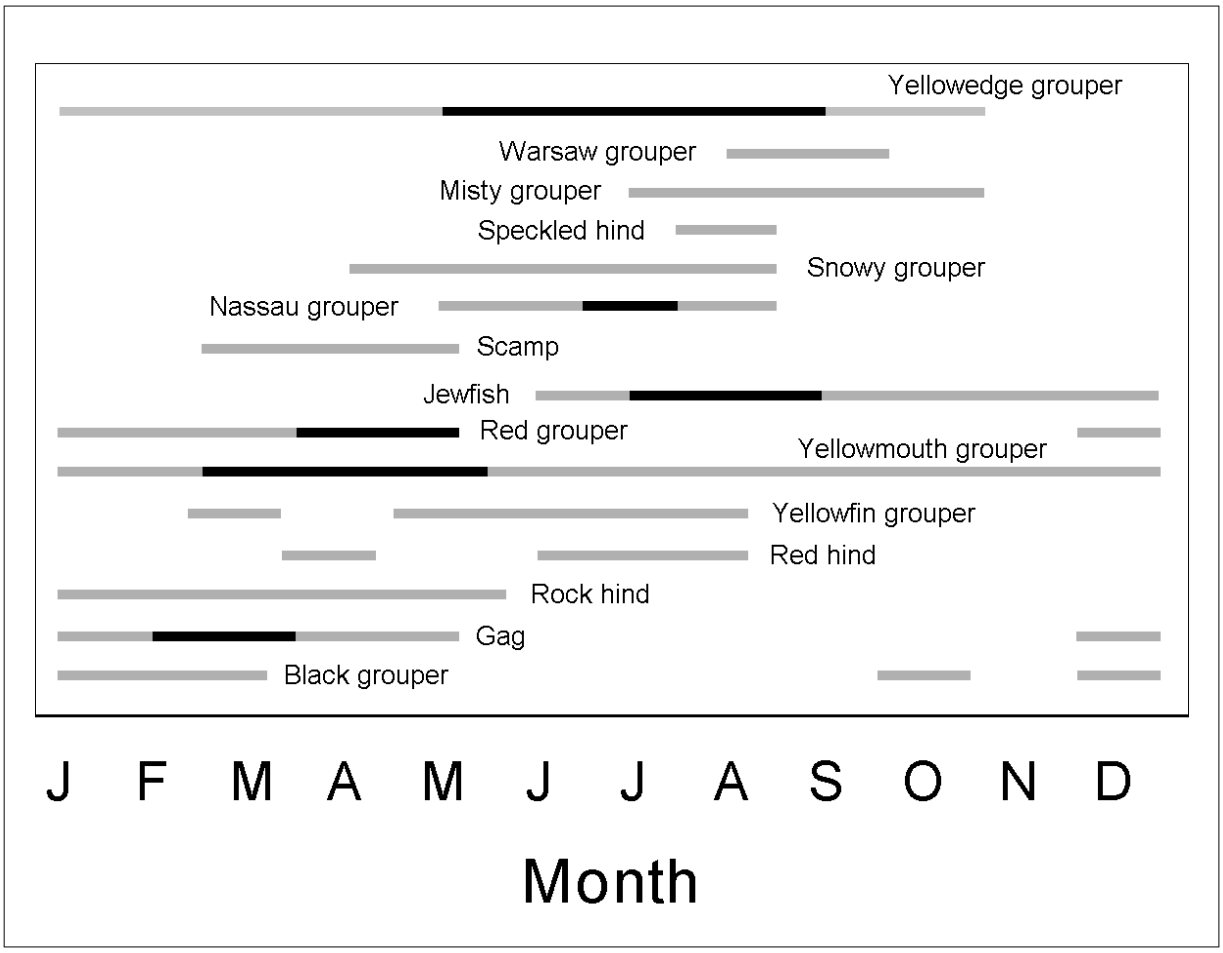


Figure 4. Spawning seasons of grouper species caught in the Gulf of Mexico. Gray lines represent when spawning is occurring and black lines represent peak spawning.

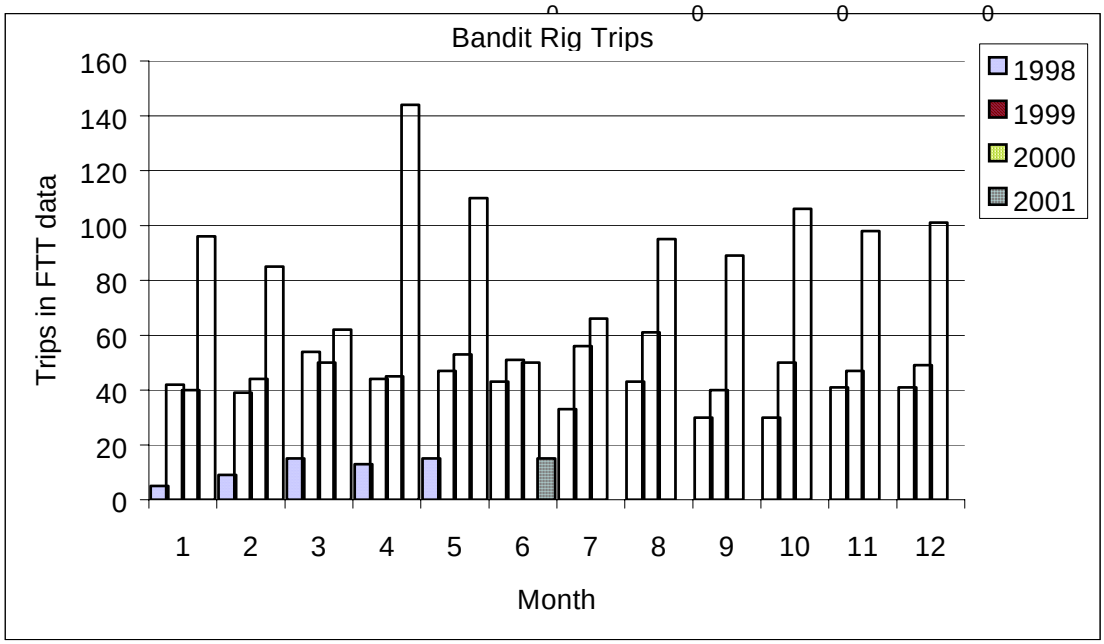


Figure 5. Number of bandit rig trips by month reporting red grouper landings recorded in FTT data from 1998-June 2001, including unedited data as of 8 Aug, 2001. Year 2001 is incomplete.

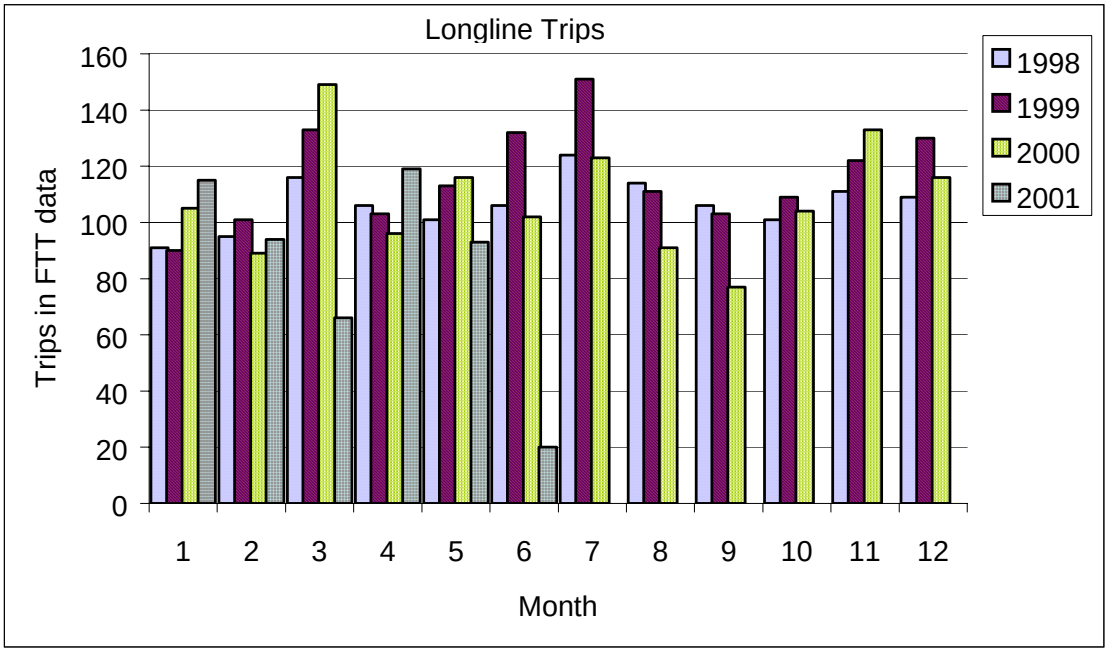


Figure 6. Number of longline trips by month reporting red grouper landings recorded in FTT data from 1998-June 2001, including unedited data as of 8 Aug, 2001. Year 2001 is incomplete.

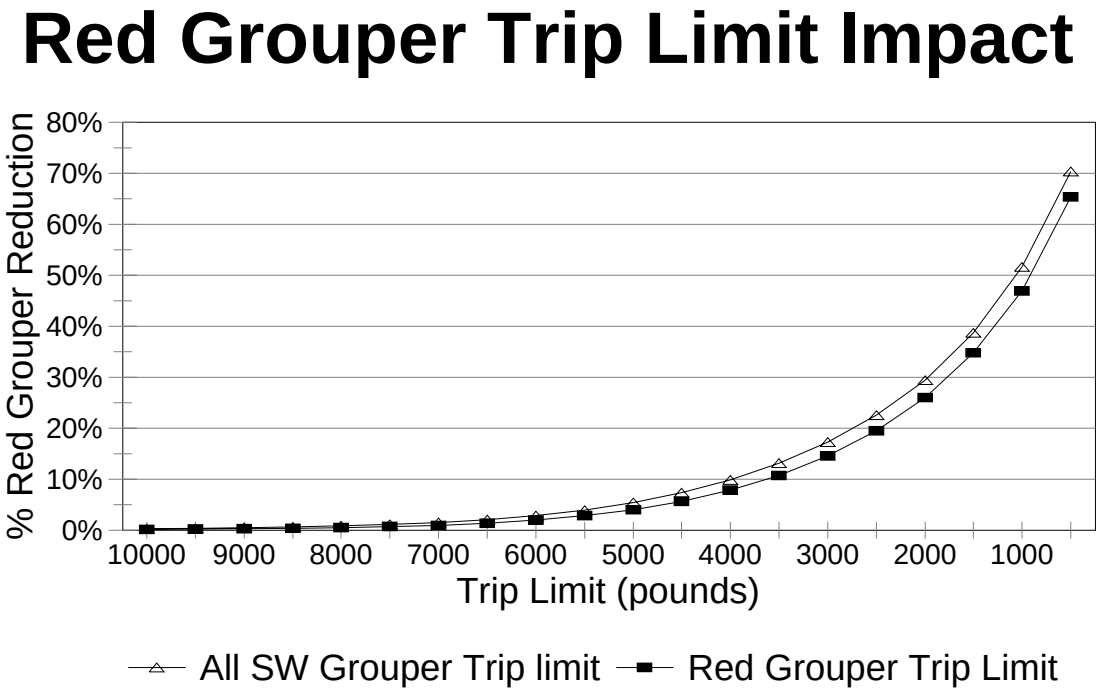


Figure 7. Red grouper trip limit analyses from 1991-1999 reef fish logbook data; expected percent harvest reduction from trip limits (see Table 6.8 for data listing).

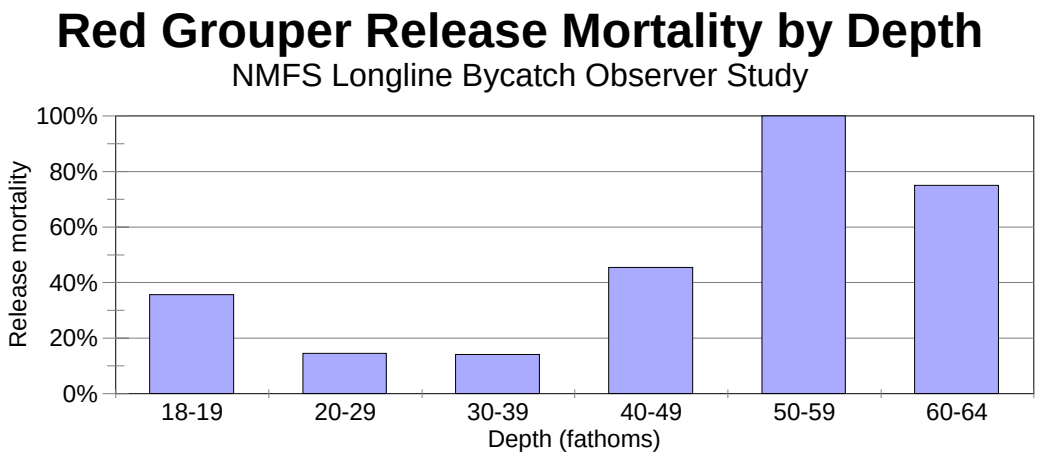


Figure 8. Red grouper release mortality by depth in the NMFS longline bycatch observer study

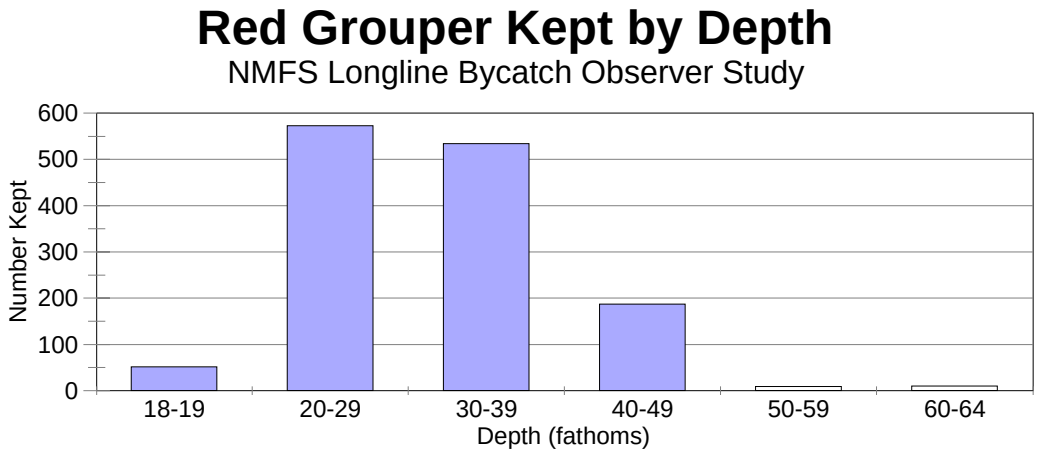


Figure 9. Red grouper numbers kept by depth in the NMFS longline bycatch observer study

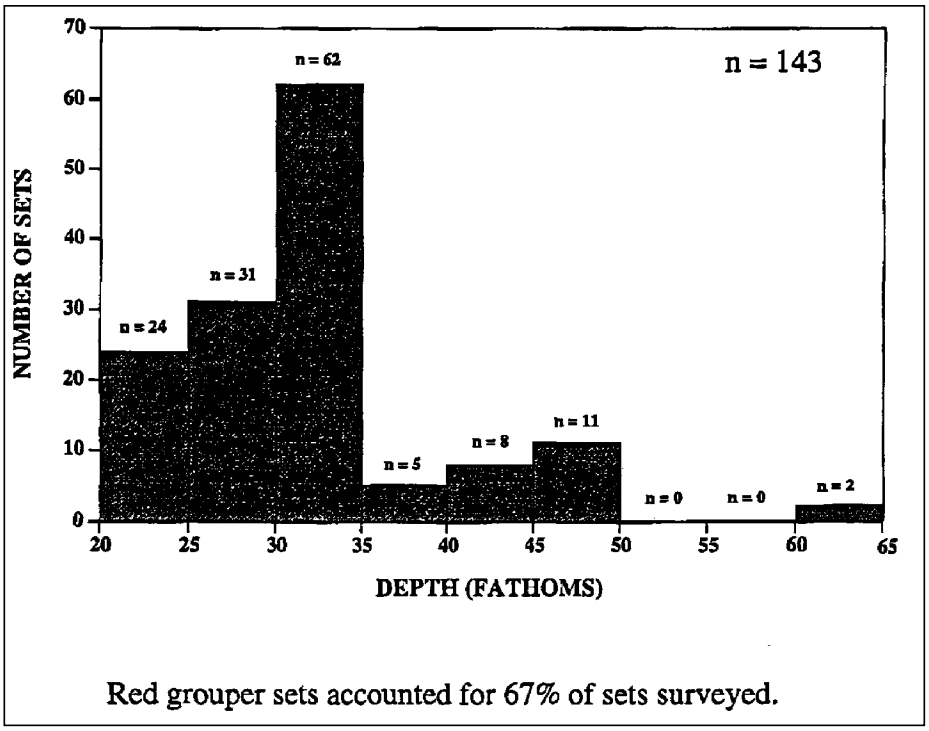


Figure 10. Number of longline sets where red grouper were caught by depth

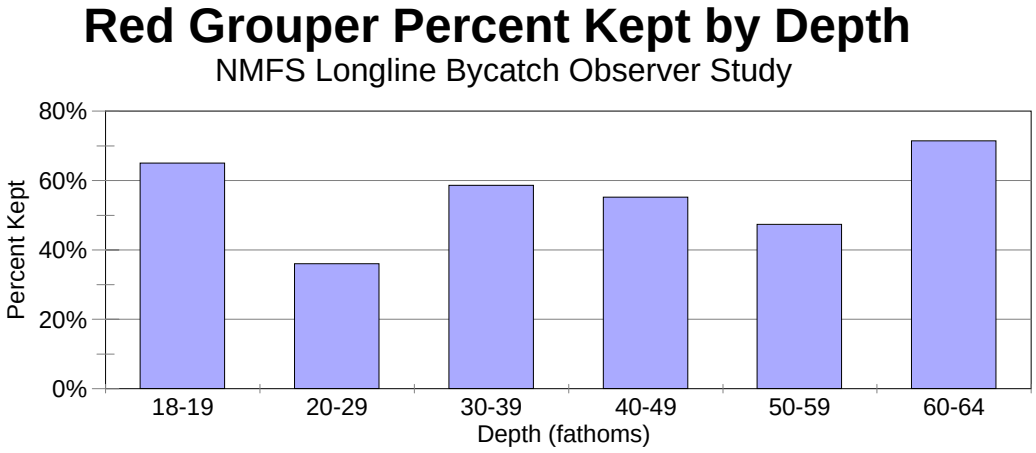


Figure 11. Red grouper percent kept by depth in the NMFS longline bycatch observer study

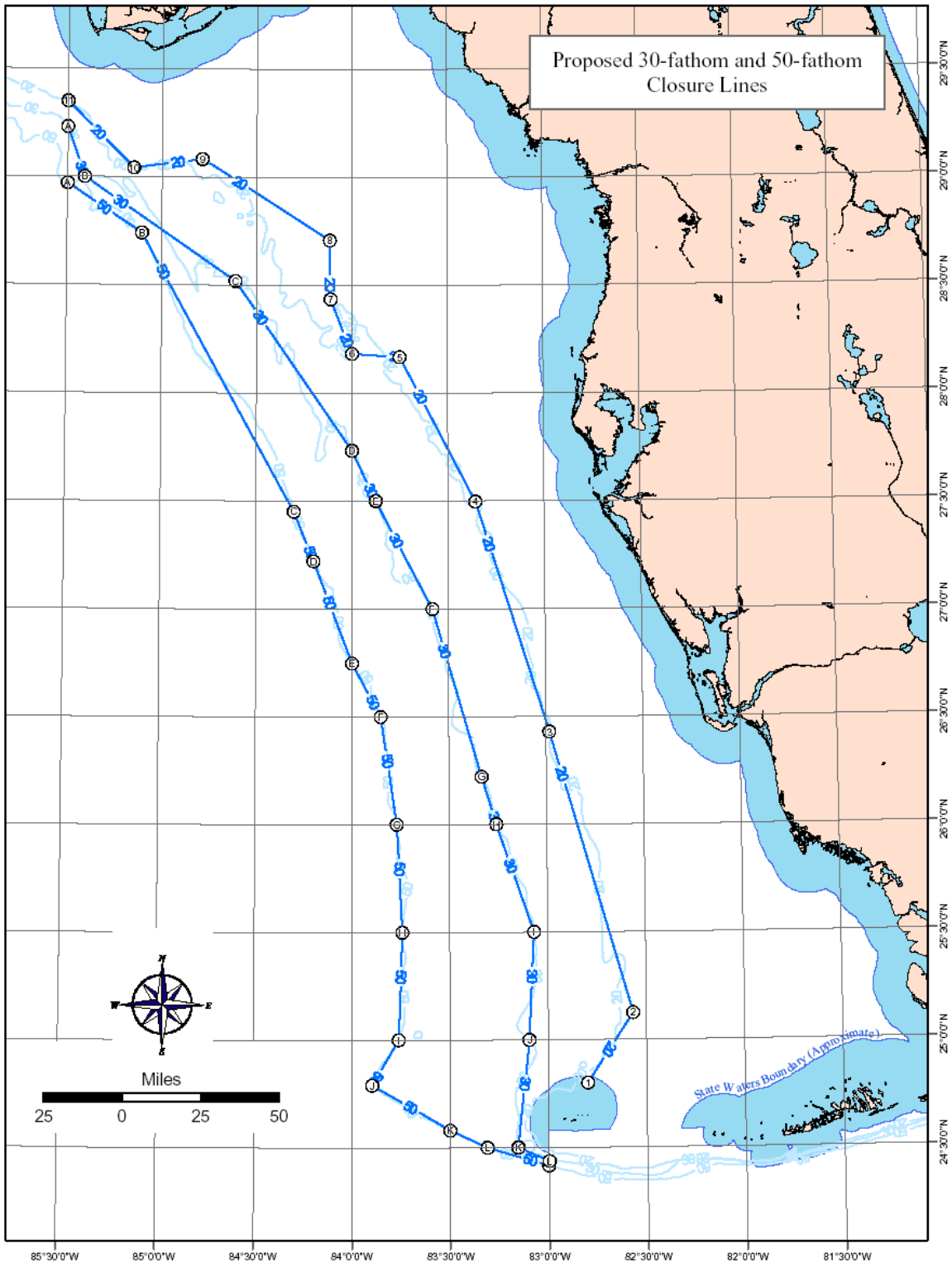


Figure 12. 20-fathom, 30-fathom and 50-fathom depth contour boundaries off Florida Gulf coast, Cape San Blas to Key West.

TAC 1

	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
	1	Hard Com TAC	Hard Rec TAC	No	No	na

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,084,666	$74,472,374	16%
NPV Fleet 1 steep .8	$ 63,633,535	$73,826,225	16%
NPV Fleet 2 steep .7	$ 36,658,617	$44,368,272	21%
NPV Fleet 2 steep .8	$ 36,320,357	$43,769,638	21%
Total .7	$ 100,743,283	$118,840,646	18%
Total .8	$ 99,953,891	$117,595,862	18%

.7 SSBmsy at 10 yrs
104%
.7 SSBoy at 10 yrs
86%

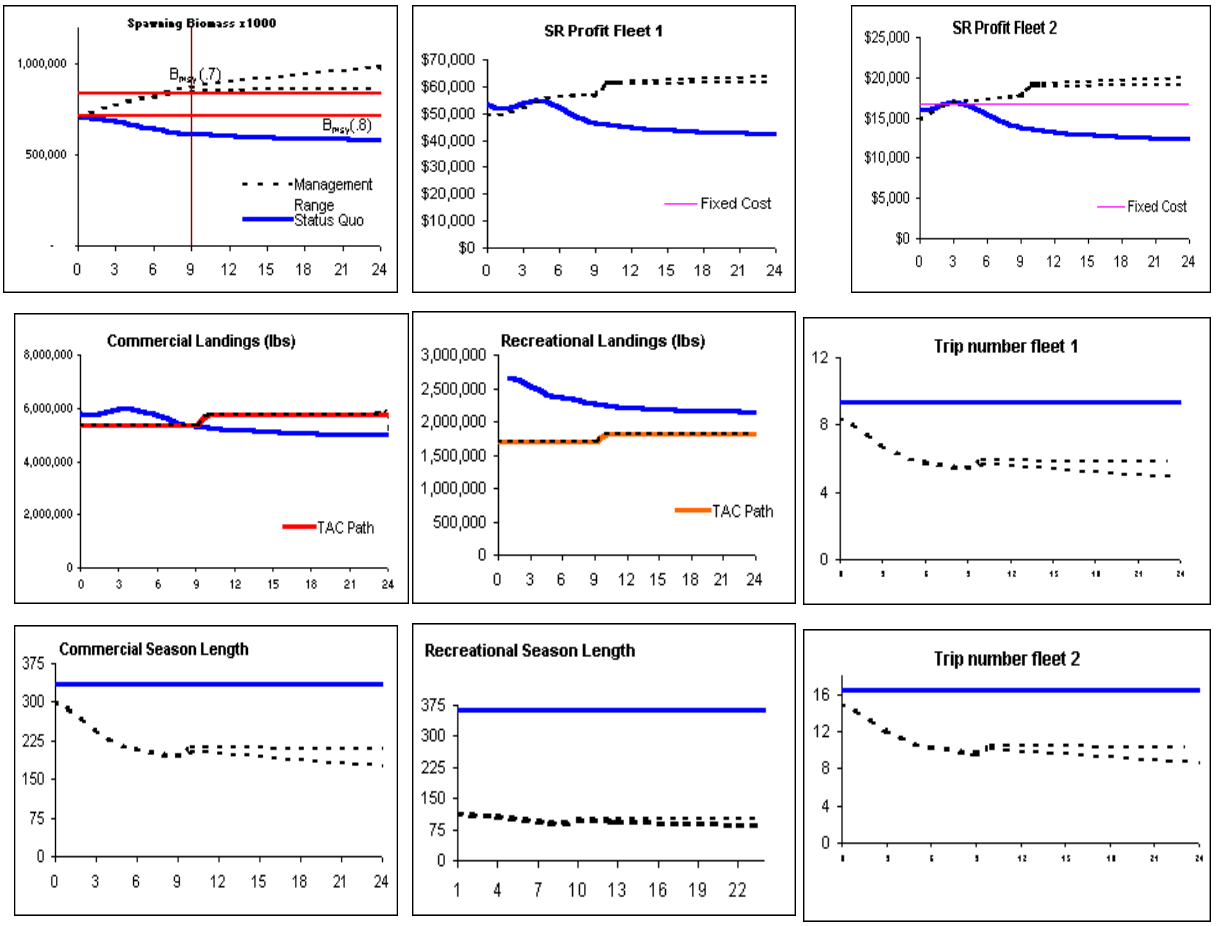


Figure 13. Baseline model run: economic impacts of constant catch TAC rebuilding plan. The commercial and recreational sectors are constrained to their respective allocations. Fleet 1 refers to longline vessels and Fleet 2 to vertical line vessels.

TAC 2

	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
	2	Hard Com TAC	Hard Rec TAC	No	No	na

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,084,666	$73,714,848	15%
NPV Fleet 1 steep .8	$ 63,633,535	$73,146,734	15%
NPV Fleet 2 steep .7	$ 36,658,617	$43,907,490	20%
NPV Fleet 2 steep .8	$ 36,320,357	$43,371,383	19%
Total .7	$ 100,743,283	$117,622,338	17%
Total .8	$ 99,953,891	$116,518,117	17%

.7 SSBmsy at 10 yrs
103%
.7 SSBoy at 10 yrs
85%

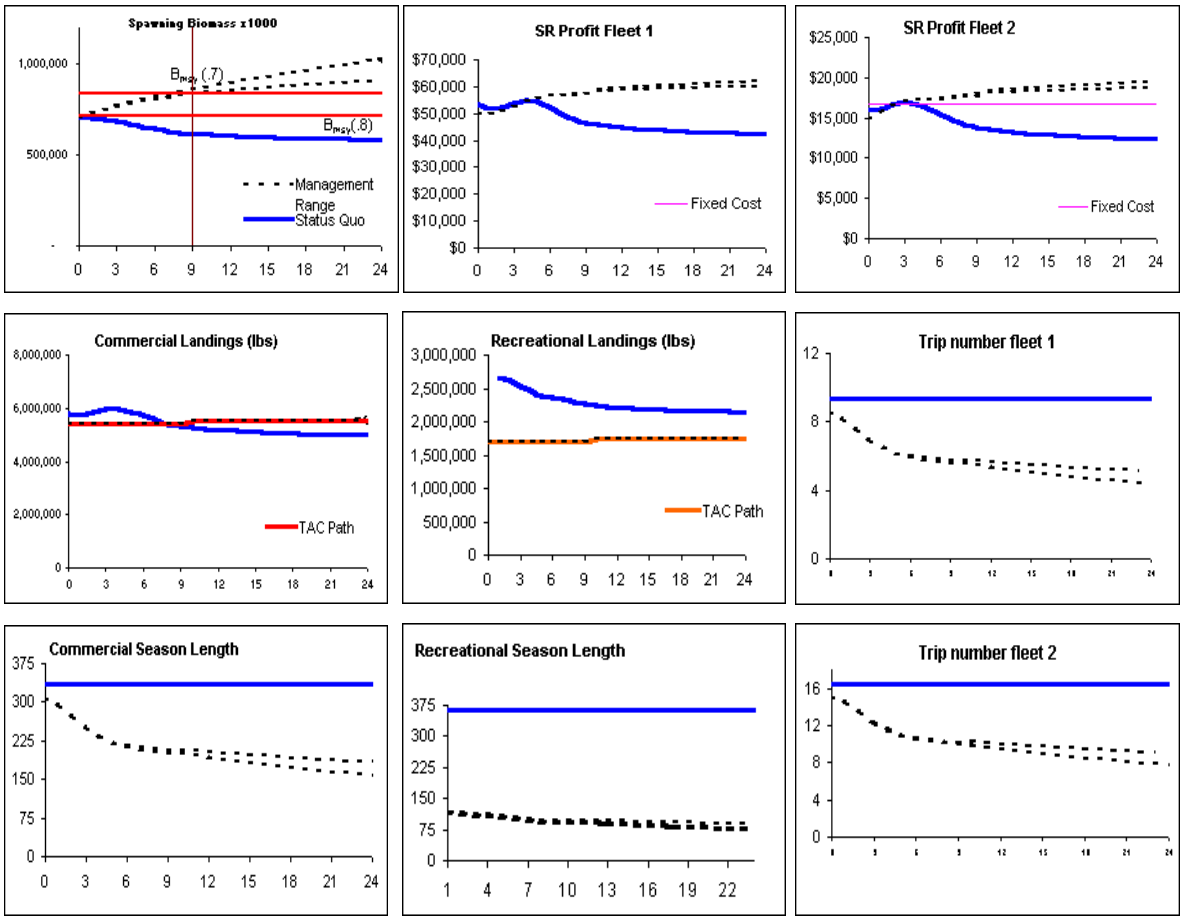


Figure 14. Baseline model run: economic impacts of constant F TACs rebuilding strategy. The commercial and recreational sectors are constrained to their respective allocations. Fleet 1 refers to longline vessels and Fleet 2 to vertical line vessels.

TAC 3

	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
	3	Hard Com TAC	Hard Rec TAC	No	No	na

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,084,666	$73,714,848	15%
NPV Fleet 1 steep .8	$ 63,633,535	$73,146,734	15%
NPV Fleet 2 steep .7	$ 36,658,617	$43,907,490	20%
NPV Fleet 2 steep .8	$ 36,320,357	$43,371,383	19%
Total .7	$ 100,743,283	$117,622,338	17%
Total .8	$ 99,953,891	$116,518,117	17%

.7 SSBmsy at 10 yrs
103%
.7 SSBoy at 10 yrs
85%

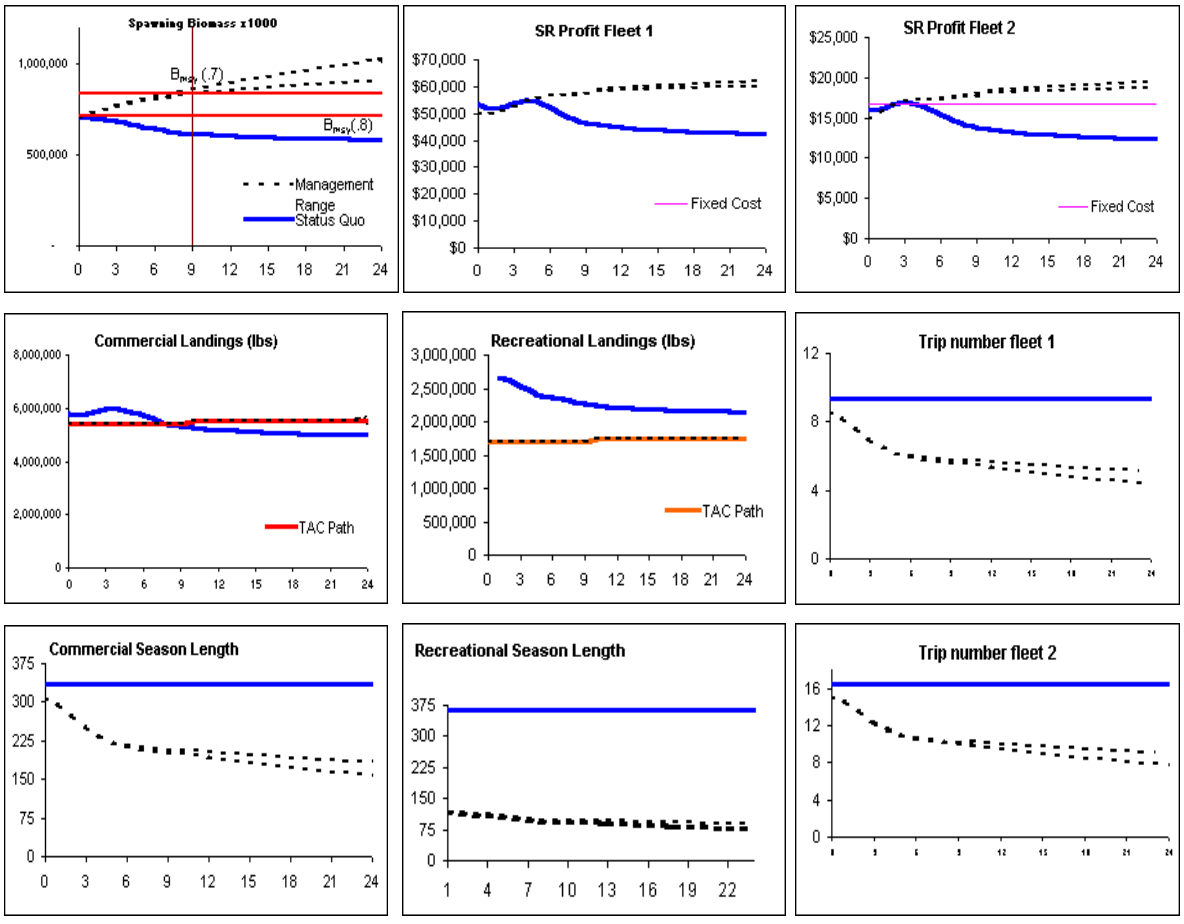
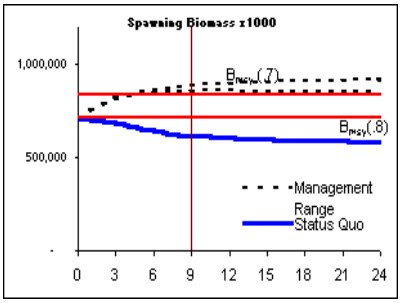
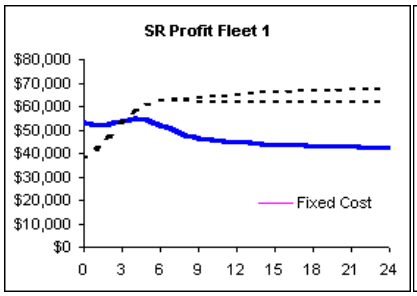


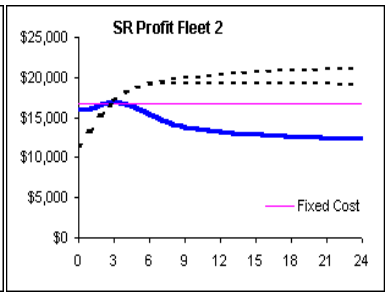
Figure 15. Baseline model run: economic impacts of stepwise TACs rebuilding strategy. The commercial and recreational sectors are constrained to their respective allocations. Fleet 1 refers to longline vessels and Fleet 2 to vertical line vessels.

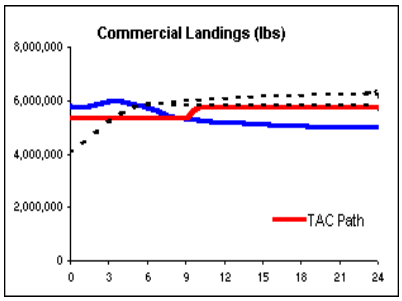
Five month commercial season closure

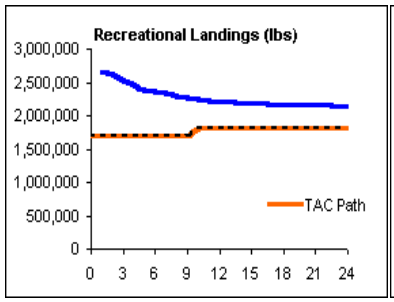
	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
		5-month	TAC	No	No	na
					.7 SSBmsy at 10 yrs	
		Status Quo	Result (.7)	Difference	106%	
	NPV Fleet 1 steep .7	$ 64,084,666	$76,301,669	19%	.7 SSBoy at 10 yrs	
	NPV Fleet 1 steep .8	$ 63,633,535	$74,052,924	16%	87%	
	NPV Fleet 2 steep .7	$ 36,658,617	$45,509,985	24%		
	NPV Fleet 2 steep .8	$ 36,320,357	$43,948,341	21%		
	Total .7	$ 100,743,283	$121,811,655	21%		
	Total .8	$ 99,953,891	$118,001,265	18%		

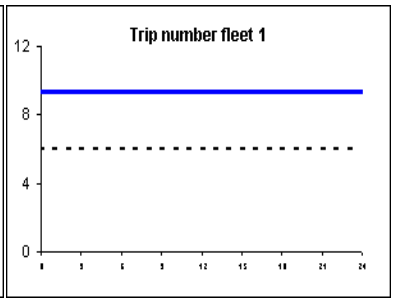


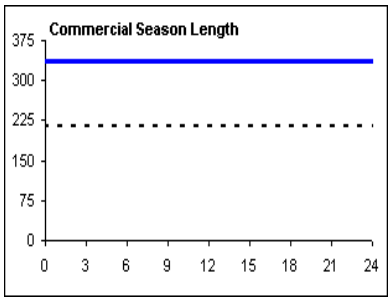


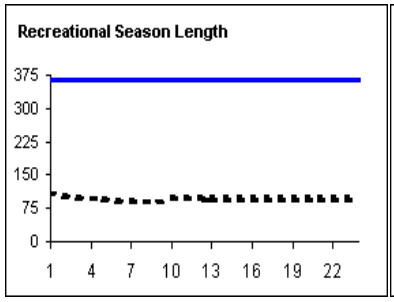












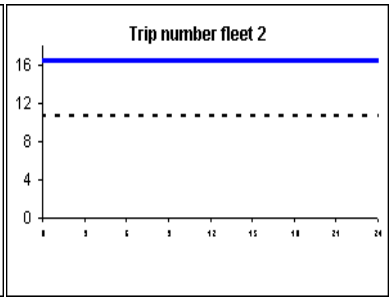


Figure 16. Economic impacts of a 5-month closure in the commercial sector, with no price or fleet size change. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels and Fleet 2 refers to vertical line vessels.

Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
8	1	5 month closure	Hard Rec TAC	Yes	No	na

SSB at 10 years
94%

	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$28,122,236	-41%	$29,094,634	-39%
NPV Fleet 2	$ 41,540,271	$22,866,890	-45%	$23,633,862	-43%
Total	$ 89,020,014	$ 50,989,126	-43%	$52,728,496	-41%

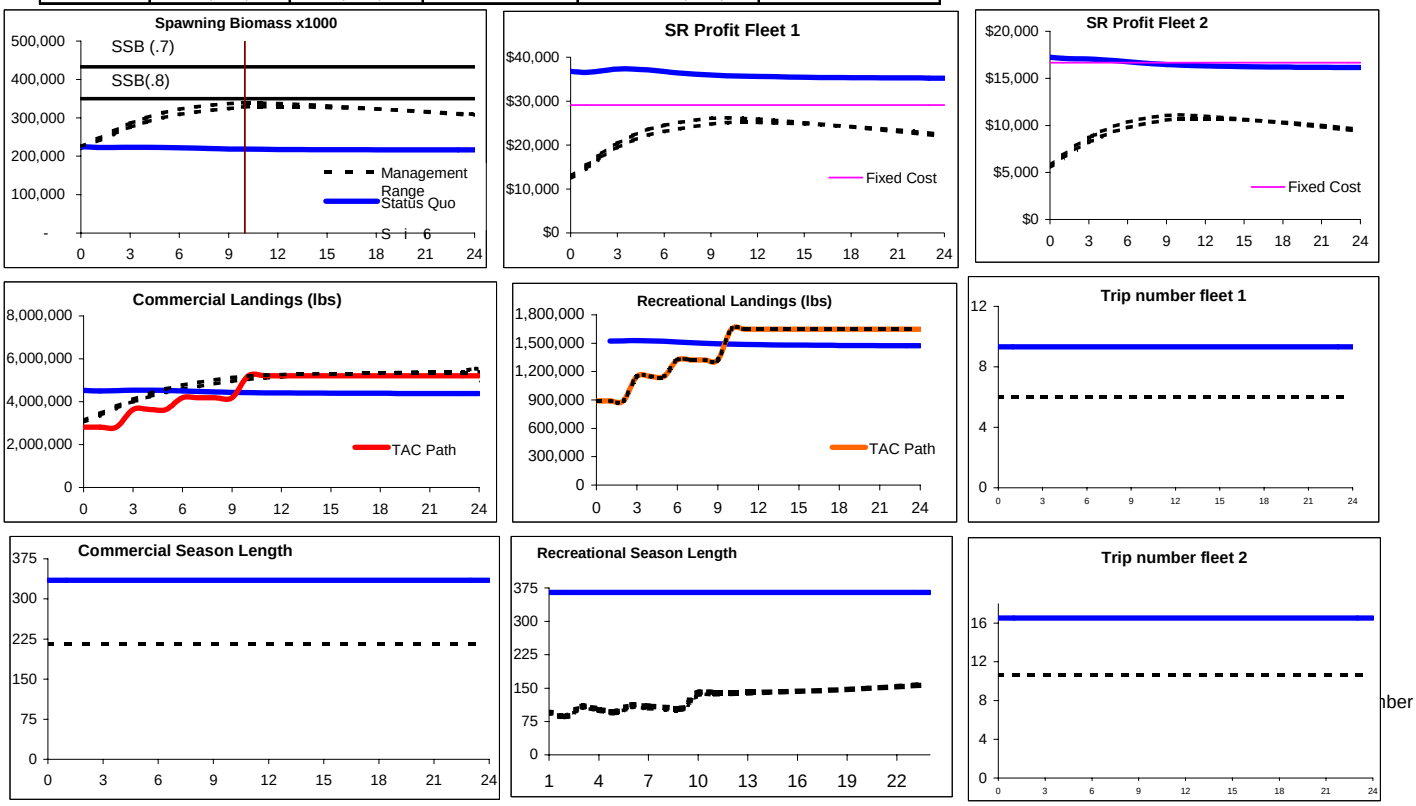


Figure 17. Economic impacts of a 5-month closure in the commercial sector, with a 33% price reduction and no fleet size change. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels and Fleet 2 refers to vertical line vessels.

Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
7a	1	5 month closure	Hard Rec TAC	No	Yes	na

SSB at 10 years
94%

	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$51,482,947	8%	$52,956,278	12%
NPV Fleet 2	$ 41,540,271	$43,500,806	5%	$44,662,885	8%
Total	$ 89,020,014	$ 94,983,753	7%	$97,619,163	10%

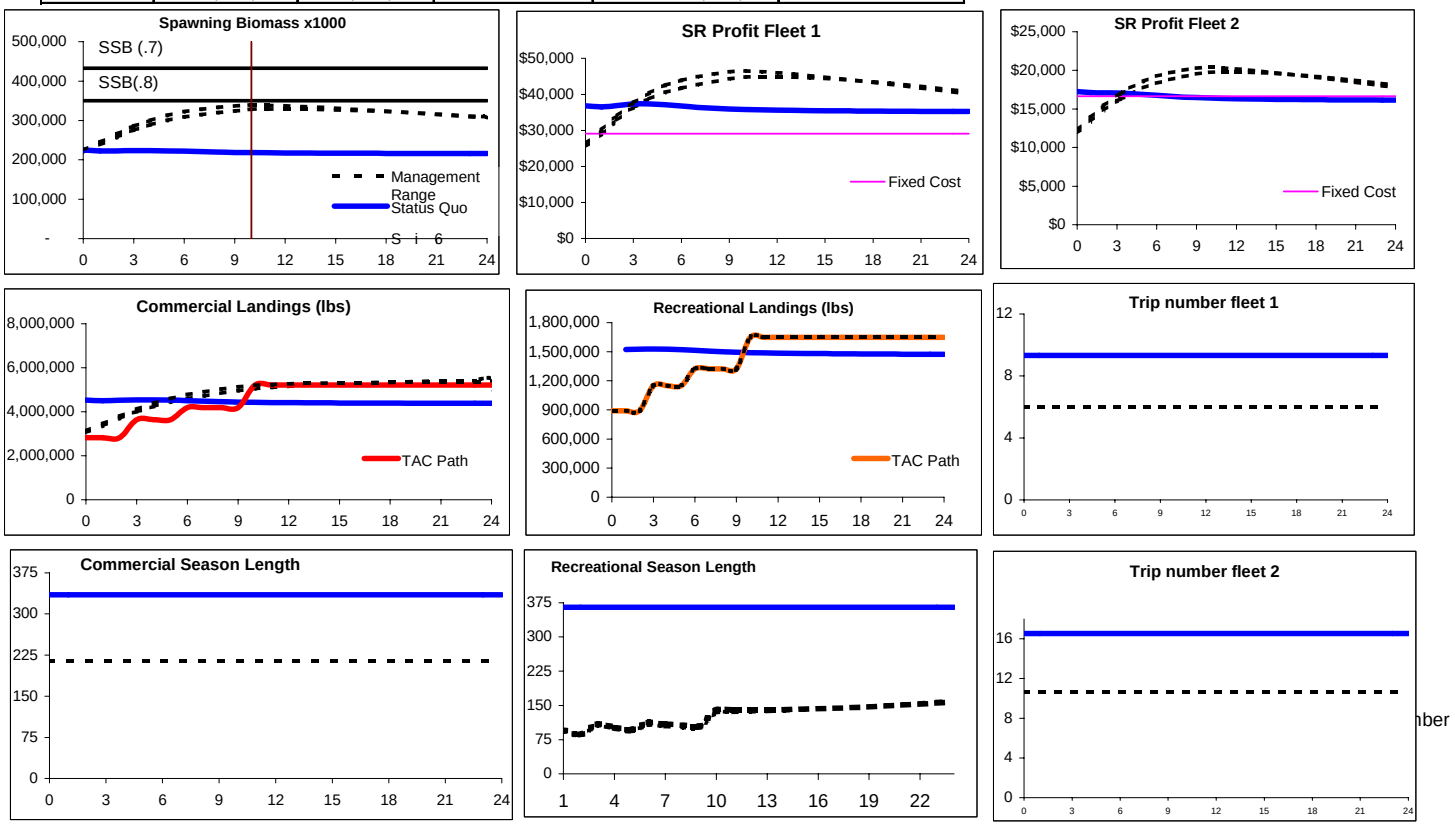


Figure 18. Economic impacts of a 5-month closure in the commercial sector, with no price change and a 1% annual increase in fleet size. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels and Fleet 2 refers to vertical line vessels.

Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
5	1	5 month closure	Current	No	No	na

SSB at 10 years
78%

	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$44,100,745	-7%	$45,821,201	-3%
NPV Fleet 2	$ 41,540,271	$37,409,983	-10%	$38,879,669	-6%
Total	$ 89,020,014	$ 81,510,729	-8%	$84,700,870	-5%

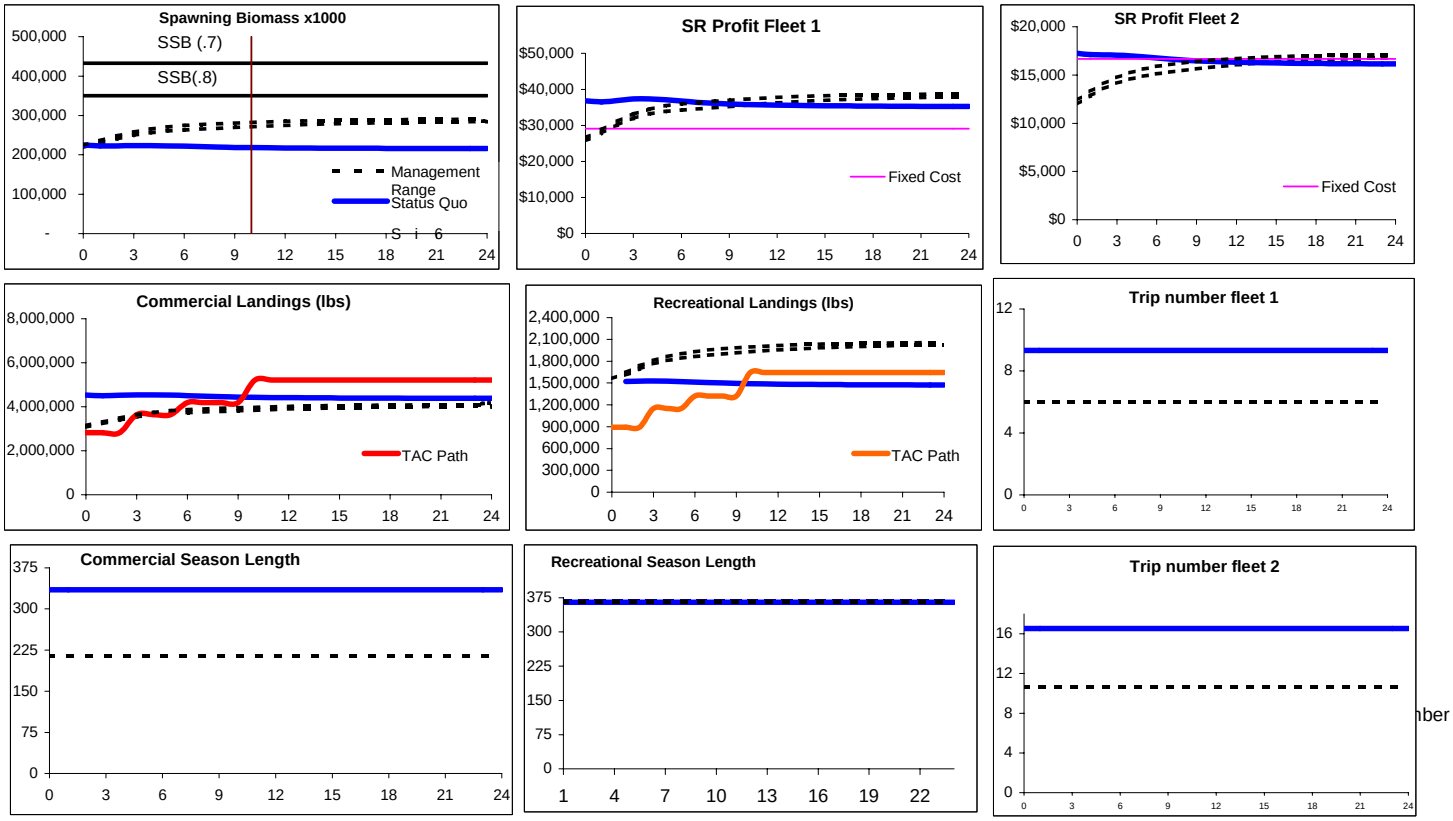


Figure 19. Economic impacts of a 5-month closure in the commercial sector, with no price or fleet size change. The recreational sector is allowed to exceed its allocation. Fleet 1 refers to longline vessels and Fleet 2 refers to vertical line vessels.

Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
6	1	5 month closure	Current	Yes	No	na

SSB at 10 years
78%

	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$23,249,983	-51%	$24,385,484	-49%
NPV Fleet 2	$ 41,540,271	$18,846,947	-55%	$19,816,939	-52%
Total	$ 89,020,014	$ 42,096,930	-53%	$44,202,423	-50%

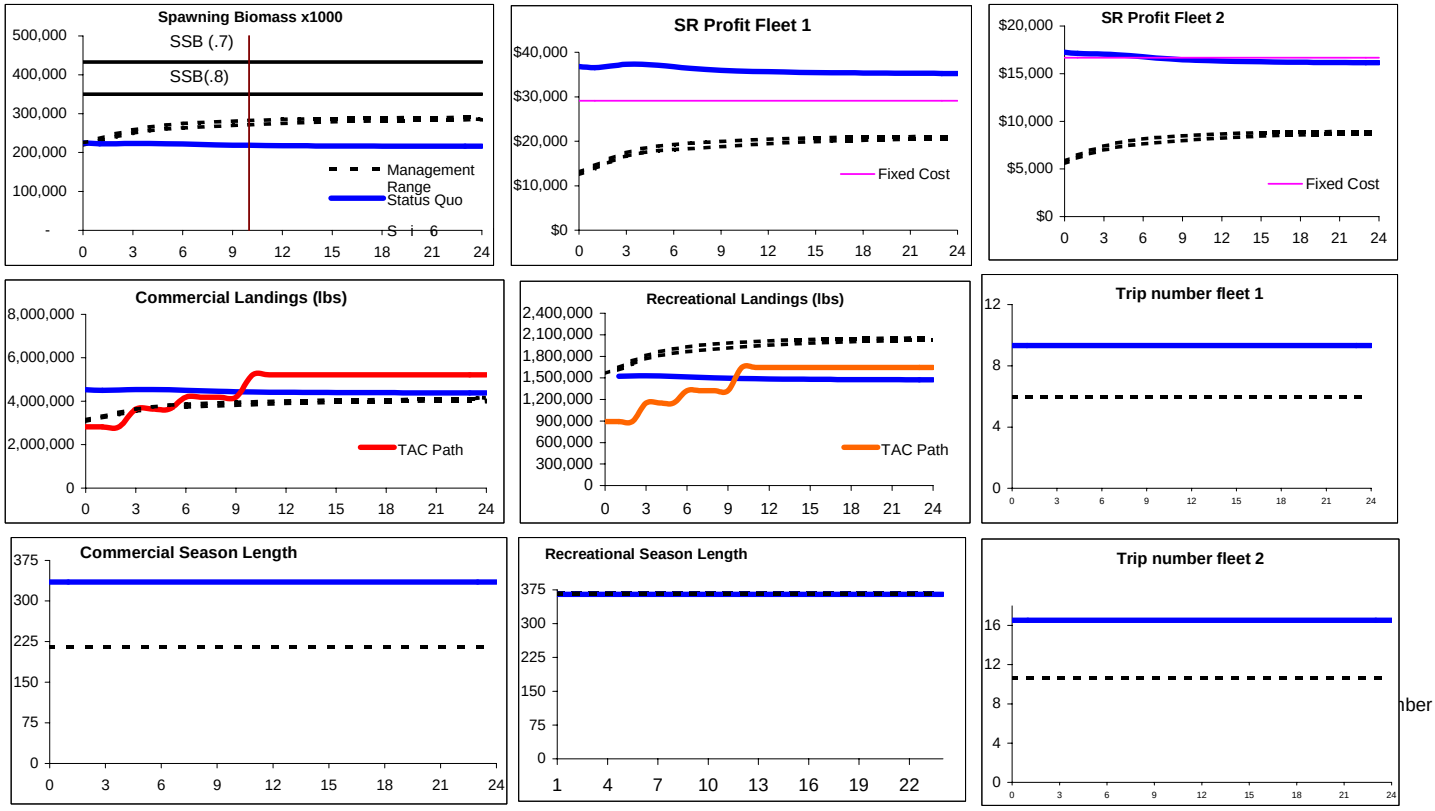


Figure 20. Economic impacts of a 5-month closure in the commercial sector, with a 33% price reduction and no fleet size change. The recreational sector is allowed to exceed its allocation. Fleet 1 refers to longline vessels and Fleet 2 refers to vertical line vessels.

50 fathom line

	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
		50-fathom	TAC	No	No	na

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,084,666	$26,525,685	-59%
NPV Fleet 1 steep .8	$ 63,633,535	$25,456,358	-60%
NPV Fleet 2 steep .7	$ 36,658,617	$72,426,403	98%
NPV Fleet 2 steep .8	$ 36,320,357	$69,880,387	92%
Total .7	$ 100,743,283	$ 98,952,088	-2%
Total .8	$ 99,953,891	$ 95,336,745	-5%

.7 SSBmsy at 10 yrs 109%

.7 SSBoy at 10 yrs 90%

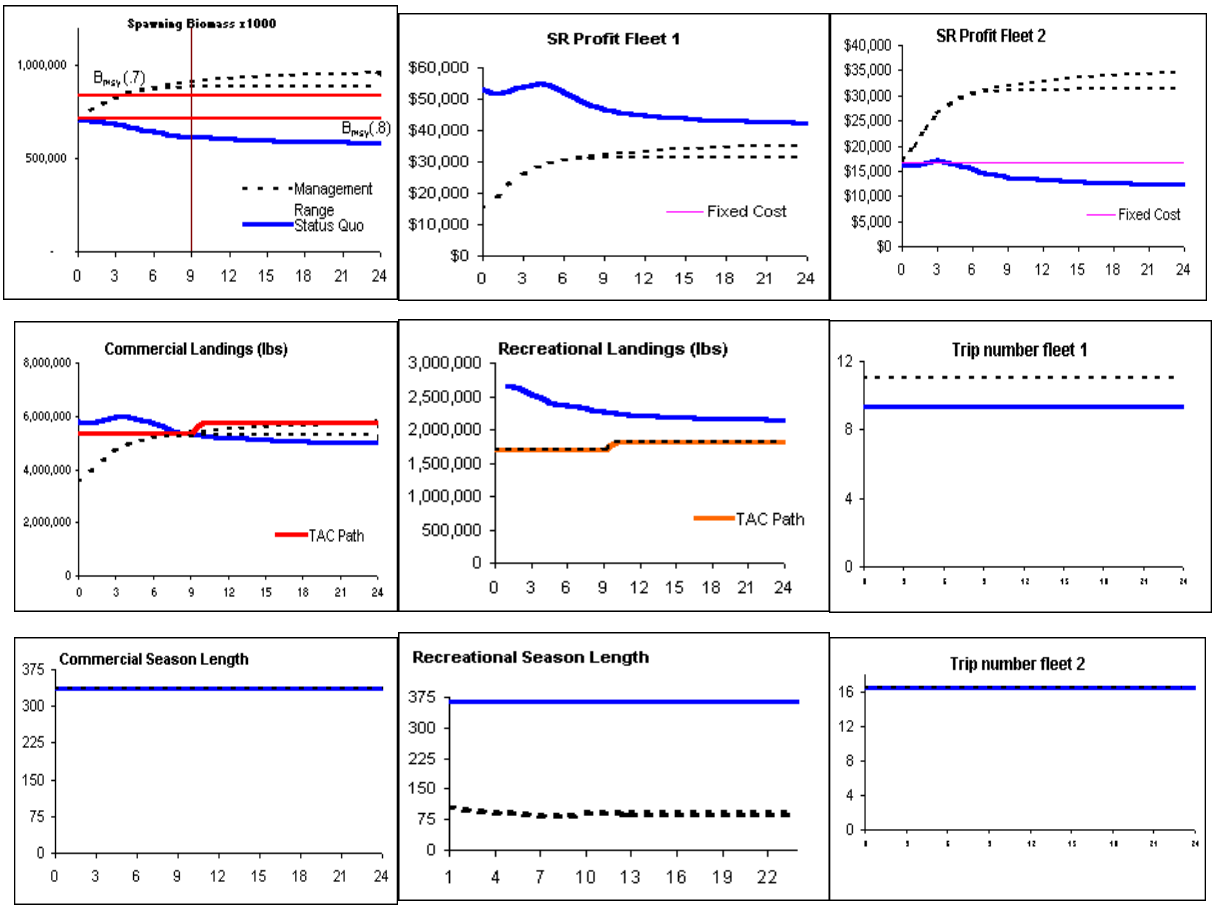
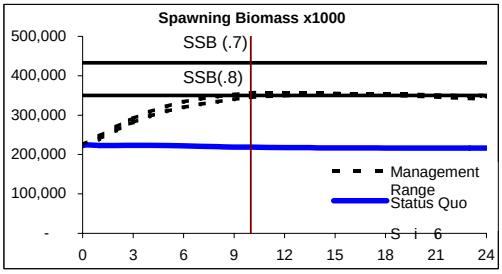


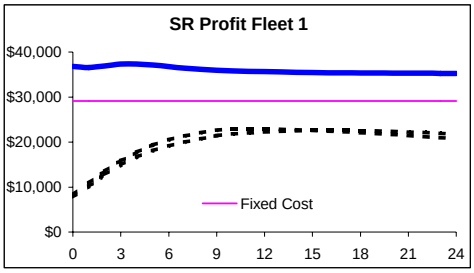
Figure 21. Economic impacts of a 50-fathom longline ban, with no fleet size change.
The recreational sector is constrained to its allocation.
Fleet 1 refers to longline vessels and Fleet 2 to vertical line vessels.

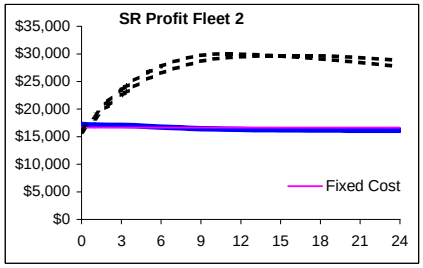
Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
12	1	50 fathom line	Hard Rec TAC	No	Yes	na

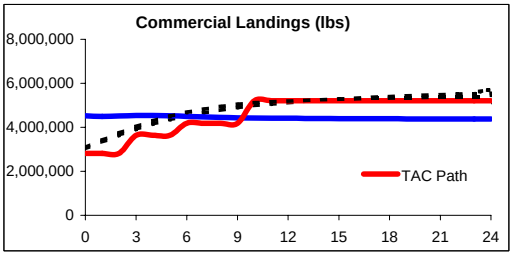
SSB at 10 years
99%

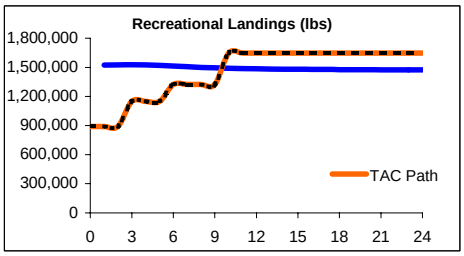
	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$16,568,464	-65%	$17,132,384	-64%
NPV Fleet 2	$ 41,540,271	$63,640,696	53%	$65,051,039	57%
Total	$ 89,020,014	$ 80,209,160	-10%	$82,183,423	-8%

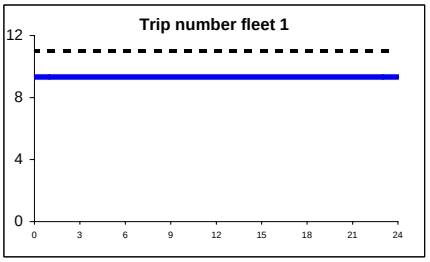


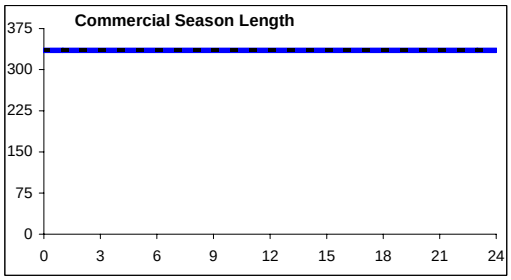


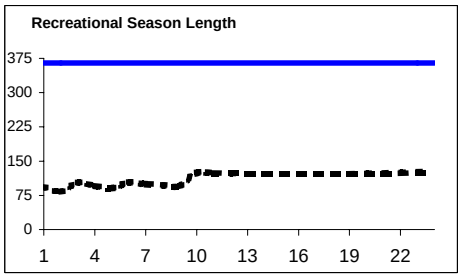












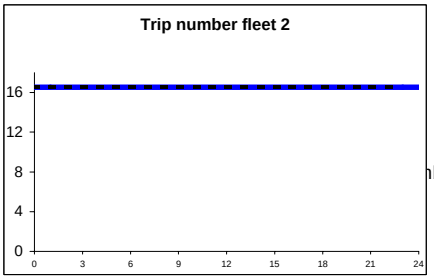


Figure 22. Economic impacts of a 50-fathom longline ban, with a 1% annual increase in fleet size. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels that convert to vertical line gear and Fleet 2 refers to vertical line vessels.

Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
9	1	50 fathom line	Current	No	No	na

SSB at 10 years
80%

	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$12,014,919	-75%	$12,734,792	-73%
NPV Fleet 2	$ 41,540,271	$51,862,902	25%	$53,853,671	30%
Total	$ 89,020,014	$ 63,877,822	-28%	$66,588,463	-25%

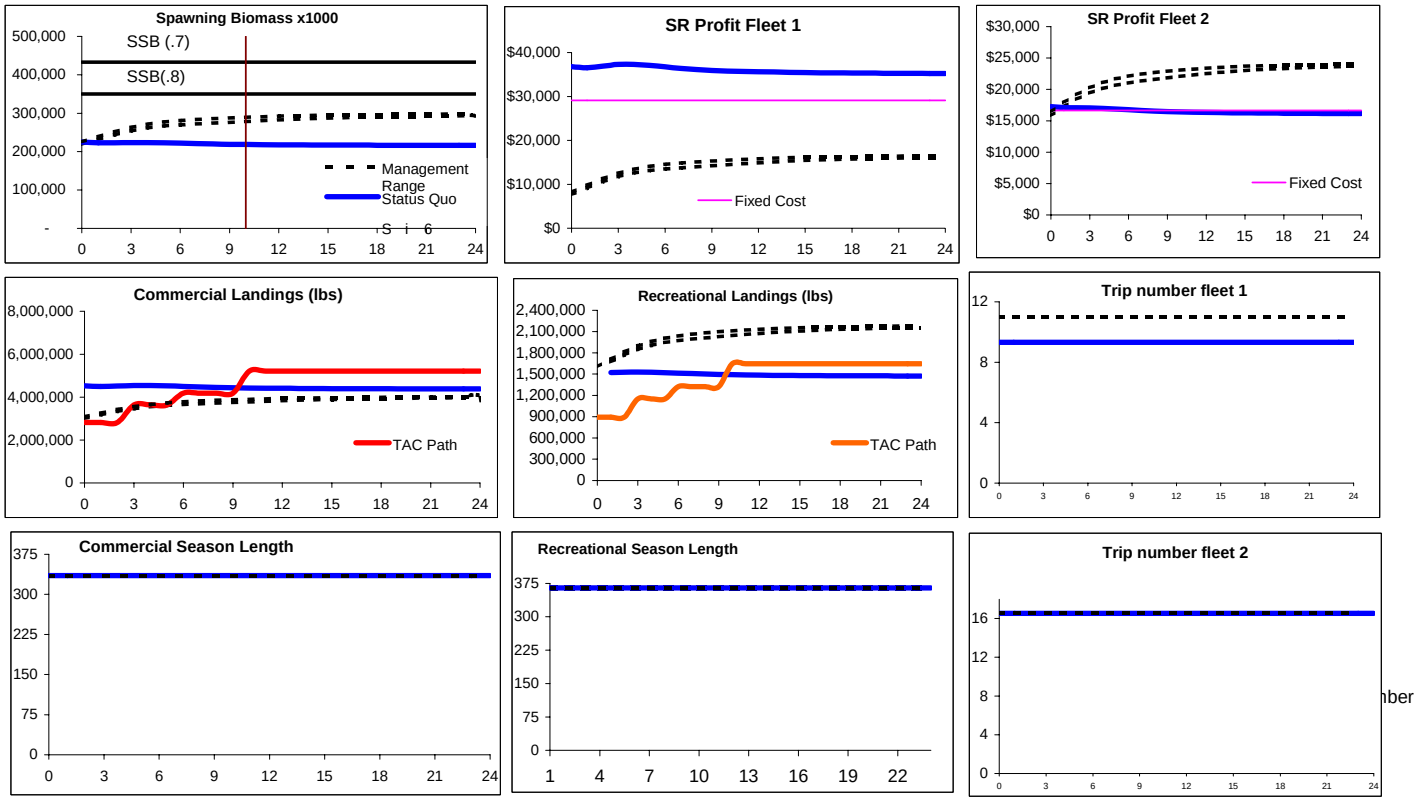


Figure 23. Economic impacts of a 50-fathom longline ban, with no fleet size change. The recreational sector is allowed to exceed its allocation. Fleet 1 refers to longline vessels that convert to vertical line gear and Fleet 2 refers to vertical line vessels.

Run	TAC	Measure	Rec	Price Reduction	Fleet Growth	TL Reaction
10	1	50 fathom line	Current	No	Yes	na

SSB at 10 years
78%

	Status Quo	Result (.7)	Difference	Result (.8)	Difference
NPV Fleet 1	$ 47,479,743	$11,278,773	-76%	$12,016,070	-75%
NPV Fleet 2	$ 41,540,271	$49,616,799	19%	$51,671,287	24%
Total	$ 89,020,014	$ 60,895,572	-32%	$63,687,358	-28%

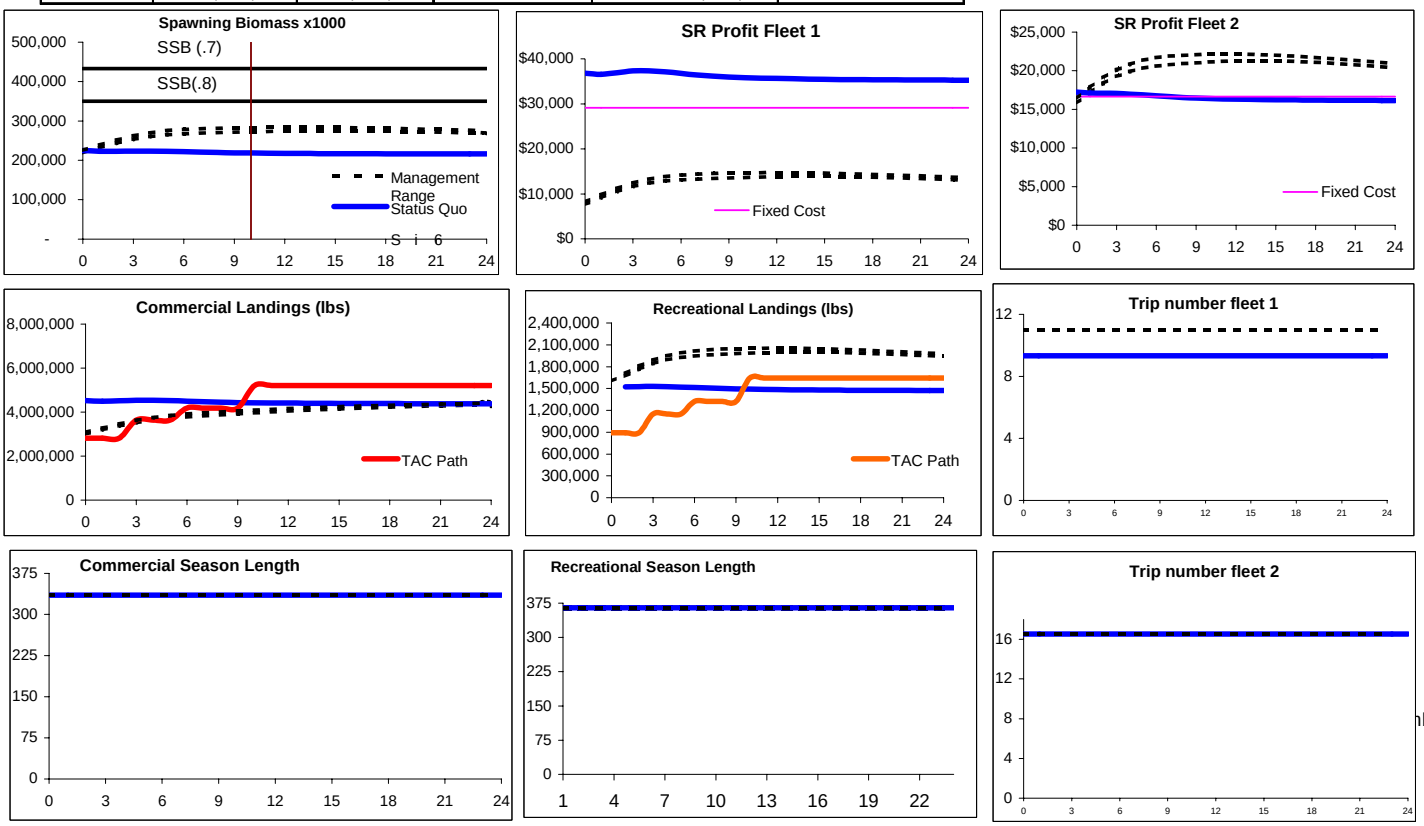


Figure 24. Economic impacts of a 50-fathom longline ban, with a 1% annual fleet size change. The recreational sector is allowed to exceed its allocation. Fleet 1 refers to longline vessels that convert to vertical line gear and Fleet 2 refers to vertical line vessels.

Run 4

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,100,612	$64,383,795	0%
NPV Fleet 1 steep .8	$ 63,647,671	$64,366,658	1%
NPV Fleet 2 steep .7	$ 36,667,200	$35,465,476	-3%
NPV Fleet 2 steep .8	$ 36,327,607	$35,462,767	-2%
Total .7	$ 100,767,812	$ 99,849,271	-1%
Total .8	$ 99,975,278	$ 99,829,425	0%

.7 SSBmsy at 10 yrs
105%
.7 SSBoy at 10 yrs
87%

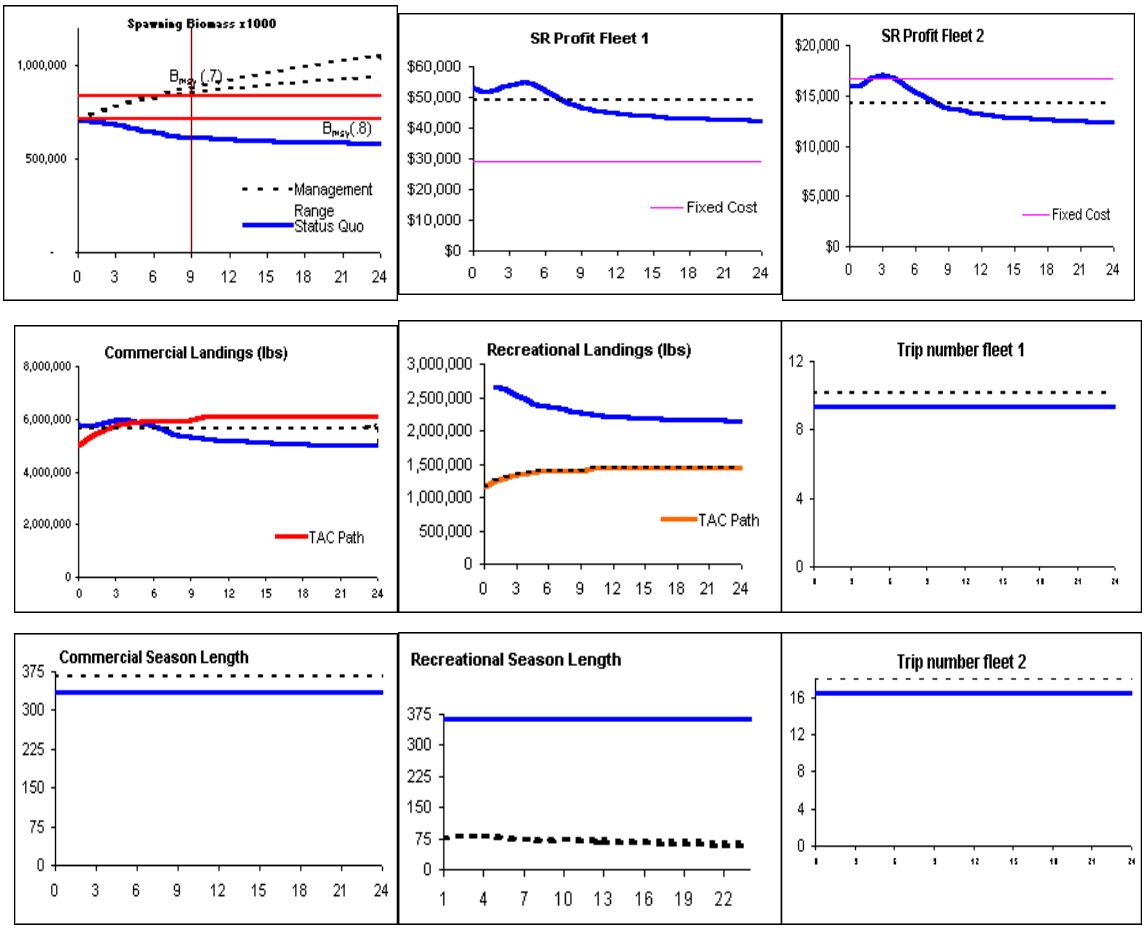


Figure 25. Economic impacts of a 5,200-pound shallow-water grouper trip limit, with no change in the number of trips and elimination of the 1-month closure. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels and Fleet 2, to vertical line vessels.

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,100,612	$71,420,251	11%
NPV Fleet 1 steep .8	$ 63,647,671	$70,858,015	11%
NPV Fleet 2 steep .7	$ 36,667,200	$39,393,387	7%
NPV Fleet 2 steep .8	$ 36,327,607	$39,070,113	8%
Total .7	$ 100,767,812	$110,813,638	10%
Total .8	$ 99,975,278	$109,928,127	10%

.7 SSBmsy at 10 yrs
97%

.7 SSBoy at 10 yrs
81%

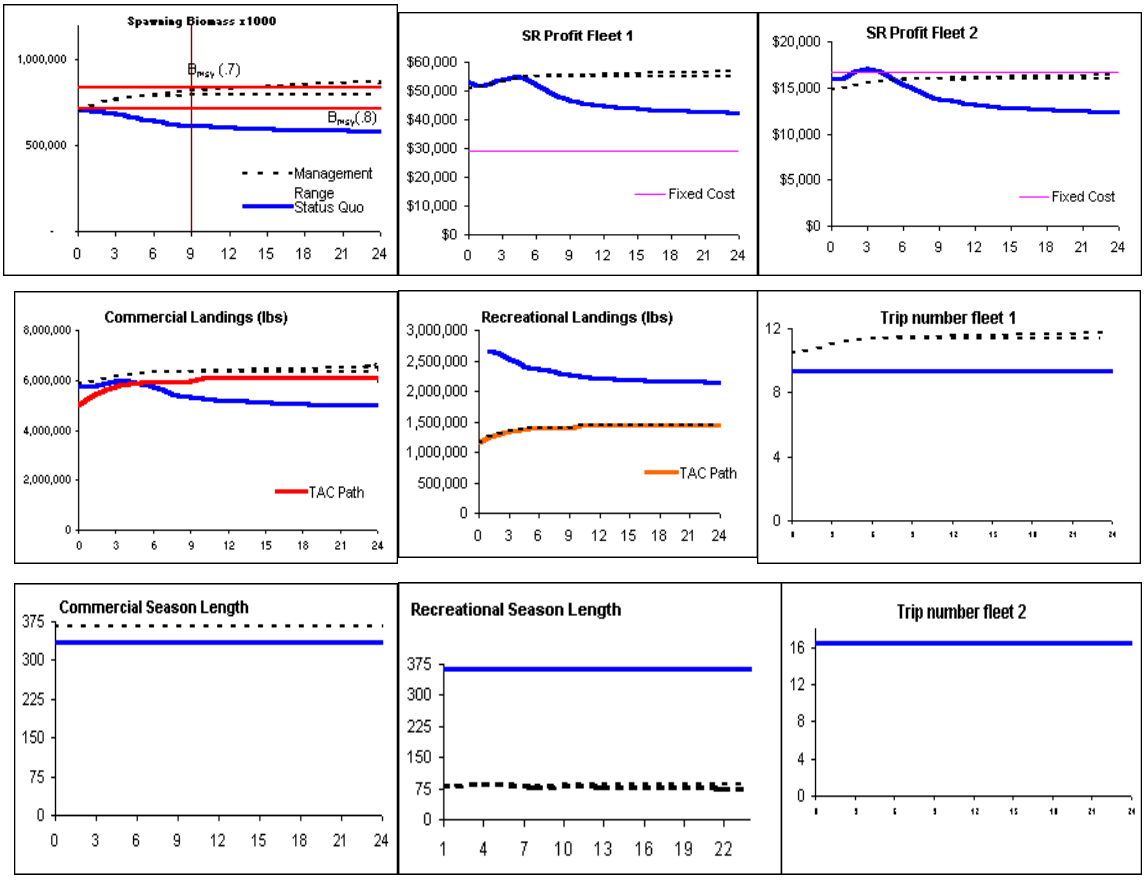


Figure 26. Economic impacts of a 5,200-pound shallow-water grouper trip limit, with an Increase in the number of trips and elimination of the 1-month closure. The recreational sector is constrained to its allocation.

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,100,612	$66,870,933	4%
NPV Fleet 1 steep .8	$ 63,647,671	$66,319,920	4%
NPV Fleet 2 steep .7	$ 36,667,200	$36,971,070	1%
NPV Fleet 2 steep .8	$ 36,327,607	$36,670,425	1%
Total .7	$ 100,767,812	$103,842,004	3%
Total .8	$ 99,975,278	$102,990,345	3%

.7 SSBmsy at 10 yrs
83%
.7 SSBoy at 10 yrs
68%

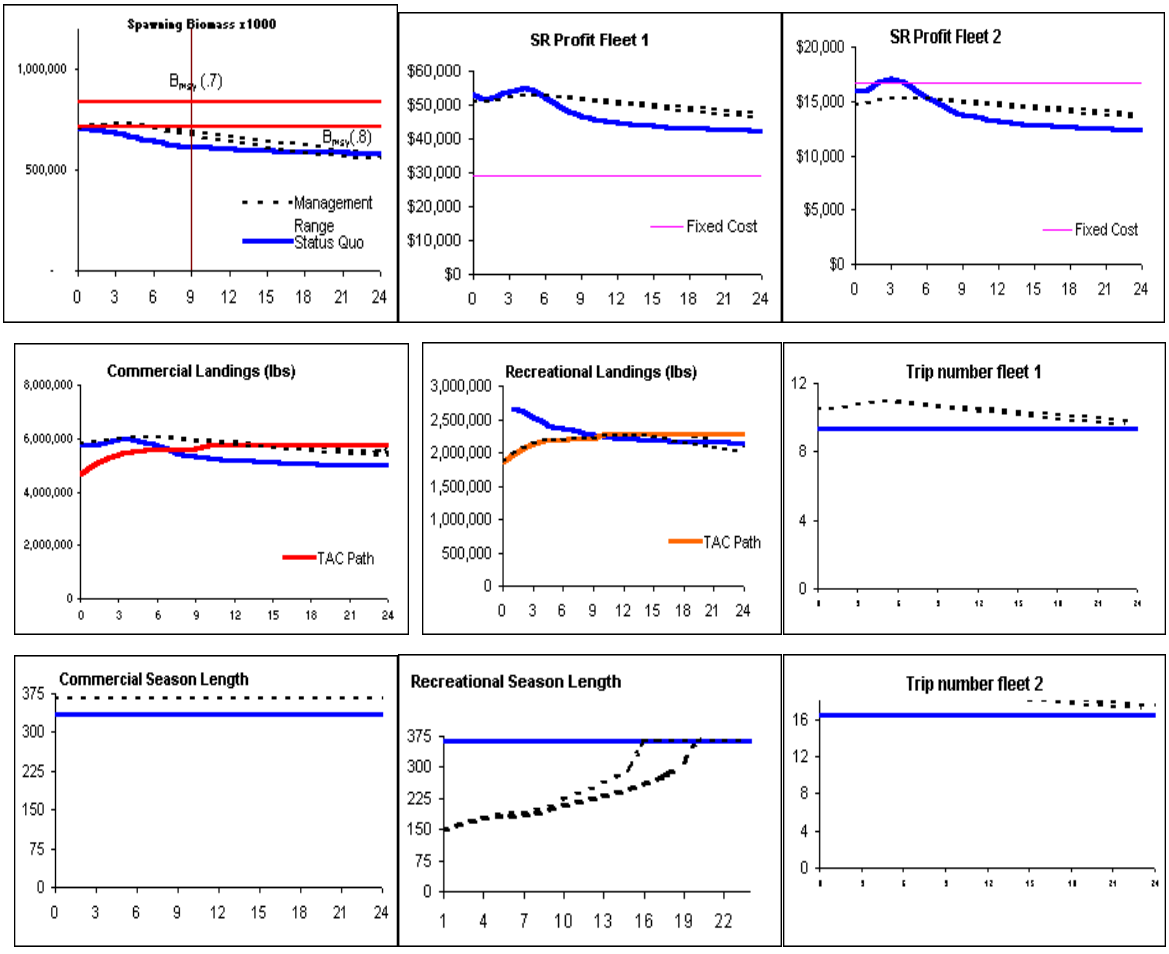


Figure 27. Economic impacts of a 5,200-pound shallow-water grouper trip limit, with an increase in the number of trips and elimination of the 1-month closure. The recreational sector exceeds its allocation. Fleet 1 refers to longline vessels and Fleet 2, to vertical line vessels.

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,100,612	$59,076,480	-8%
NPV Fleet 1 steep .8	$ 63,647,671	$59,076,271	-7%
NPV Fleet 2 steep .7	$ 36,667,200	$32,548,076	-11%
NPV Fleet 2 steep .8	$ 36,327,607	$32,548,013	-10%
Total .7	$ 100,767,812	$ 91,624,556	-9%
Total .8	$ 99,975,278	$ 91,624,284	-8%

.7 SSBmsy at 10 yrs
112%

.7 SSBoy at 10 yrs
93%

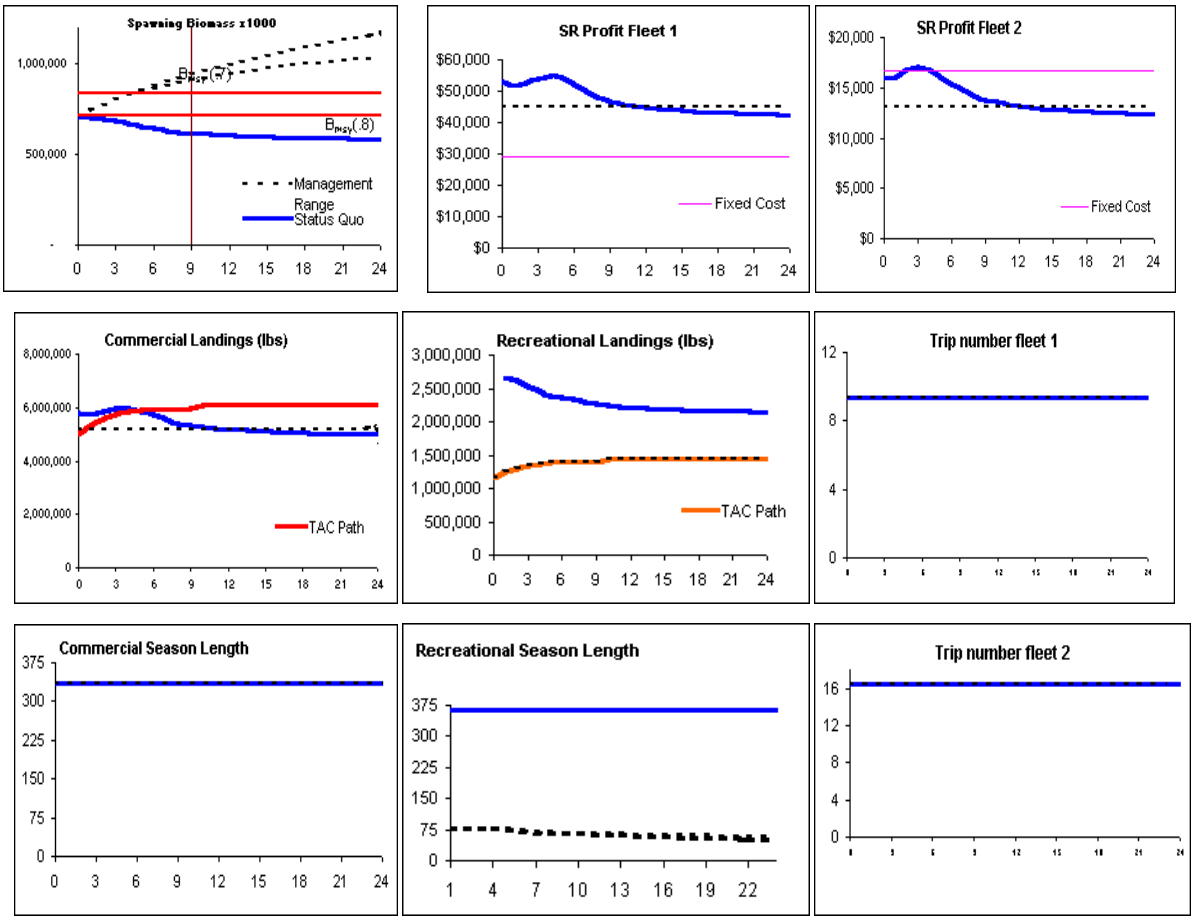


Figure 28. Economic impacts of a 5,200-pound shallow-water grouper trip limit, with no change in the number of trips and maintaining the 1-month closure. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels and Fleet 2, to vertical line vessels.

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,100,612	$67,232,262	5%
NPV Fleet 1 steep .8	$ 63,647,671	$66,746,708	5%
NPV Fleet 2 steep .7	$ 36,667,200	$37,038,483	1%
NPV Fleet 2 steep .8	$ 36,327,607	$36,752,248	1%
Total .7	$ 100,767,812	$104,270,745	3%
Total .8	$ 99,975,278	$103,498,956	4%

.7 SSBmsy at 10 yrs
104%
.7 SSBoy at 10 yrs
86%

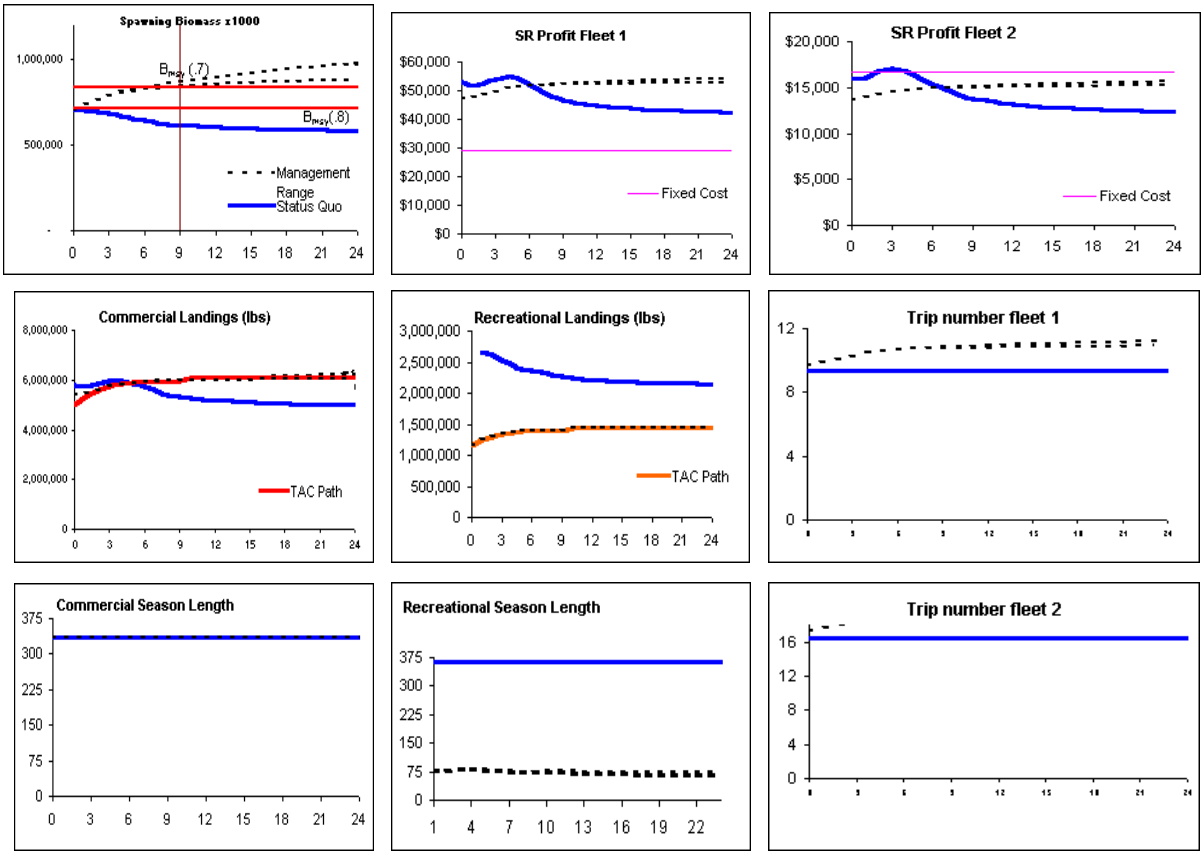


Figure 29. Economic impacts of a 5,200-pound shallow-water grouper trip limit, with a change in the number of trips and maintaining the 1-month closure. The recreational sector is constrained to its allocation. Fleet 1 refers to longline vessels and Fleet 2, to vertical line vessels.

	Status Quo	Result (.7)	Difference
NPV Fleet 1 steep .7	$ 64,100,612	$63,840,494	0%
NPV Fleet 1 steep .8	$ 63,647,671	$63,286,847	-1%
NPV Fleet 2 steep .7	$ 36,667,200	$35,202,179	-4%
NPV Fleet 2 steep .8	$ 36,327,607	$34,889,740	-4%
Total .7	$ 100,767,812	$ 99,042,673	-2%
Total .8	$ 99,975,278	$ 98,176,587	-2%

.7 SSBmsy at 10 yrs
89%

.7 SSBoy at 10 yrs
74%

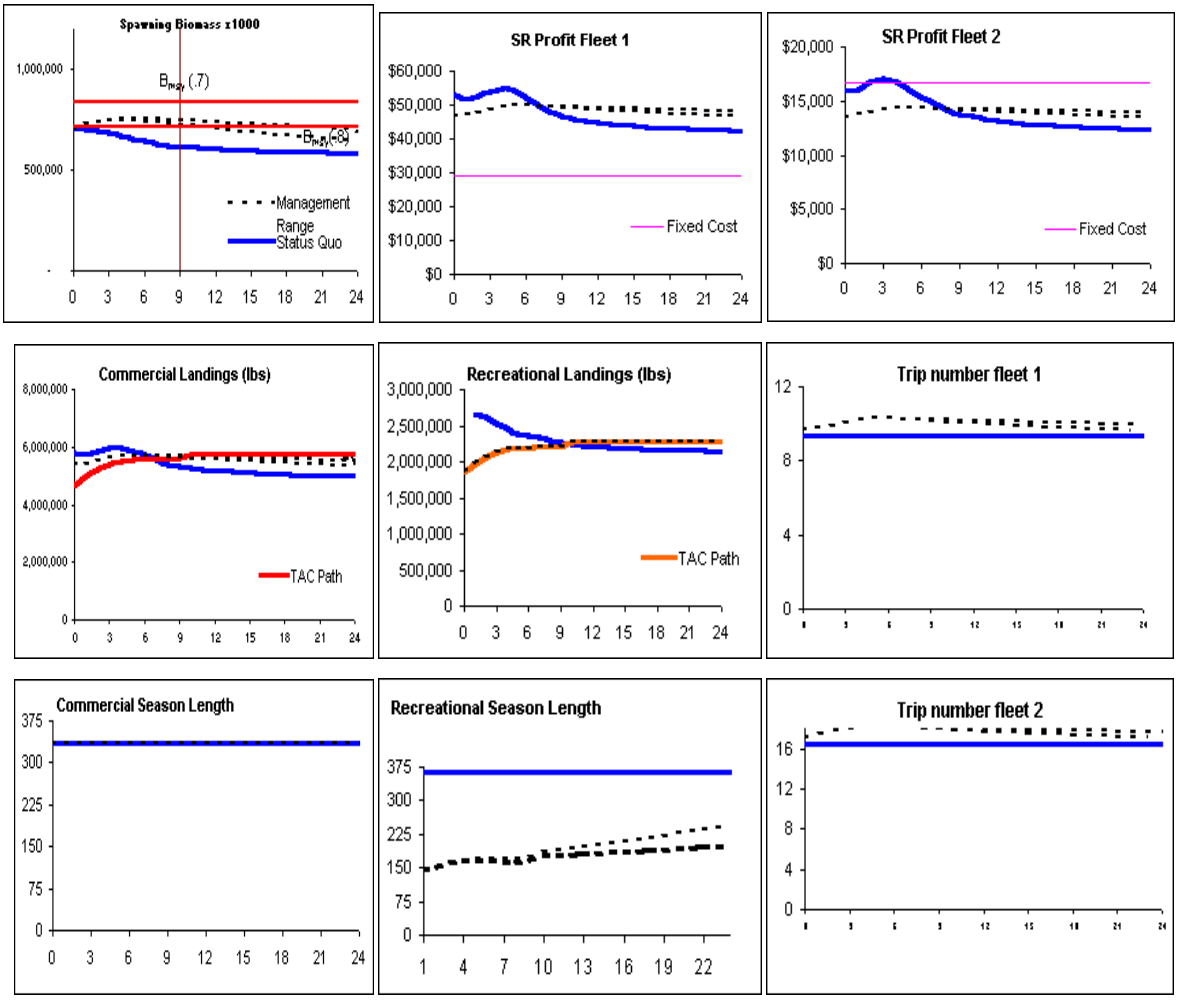


Figure 30. Economic impacts of a 5,200-pound shallow-water grouper trip limit, with a change in the number of trips and maintaining the 1-month closure. The recreational sector exceeds its allocation. Fleet 1 refers to longline vessels and Fleet 2, to vertical line vessels.

Appendix A - Ending Overfishing Strategy and Scenarios, Not Under Consideration

The issues and alternatives in Section 6.4 are for use in a plan to end overfishing, but not for rebuilding an overfished stock within 10 years. They are provided for consideration if the Council proposes a Minimum Stock Size Threshold (MSST) in Section 6.2.2 that results in the red grouper stock being classified as not overfished but still undergoing overfishing. Since the Council's MSST Proposed Alternative, and the current NMFS status determination, results in an overfished designation, these sections are not applicable, and will not be considered unless the Council changes its Proposed Alternative for MSST or NMFS changes its status determination for the red grouper stock.

6.4 Ending Overfishing (for Status = Not Overfished but Undergoing Overfishing)

The Alternatives in this section apply only if an MSST is adopted in Section 6.2.2 that results in the status of the red grouper stock being not overfished but undergoing overfishing. If an MSST is adopted that results in an "overfished" status, the alternatives in Section 6.3 (Rebuilding Overfished Stock) should be used, and this section should be skipped.

6.4.1 Strategy to End Overfishing

Alternative 1: Use the default MSY control rule recommended in the NMFS Technical Guidance document (Restrepo et al. 1998), which places the MFMT inflection point at 80% of B_{MSY} for red grouper. A 22% - 48% reduction in F (mid-point =35%) is needed.

Alternative 2: Use a control rule which places the MFMT inflection point at 50% of B_{MSY} for red grouper. An 11% - 26% reduction in F (mid-point =19%) is needed.

Alternative 3: Use an Optimum Yield target control rule based on the Council's Proposed Alternative of $F_{OY}=75\%F_{MSY}$ (OY=94% of MSY). A 33% - 45% reduction in F (mid-point =39%) is needed.

Alternative 4: Select one of the above strategies, but reduce F to MFMT over three 3-year intervals. The initial reduction would be one third of that indicated above, with the ABC for subsequent intervals to be determined in future stock assessments. The initial reduction needed is:

(1) 7% - 16% (mid-point=12%) for Alternative 1
(2) 4% - 9% (mid-point=6%) for Alternative 2
(3) 11%-15% (mid-point=13%) for Alternative 3

Alternative 5: Status quo. Do not adopt a strategy to end overfishing.

Discussion: Detailed discussion of these alternatives are not provided since these alternatives are not under active consideration. Section 6.3.1 provides discussions of the more restrictive management strategies provided to rebuild an overfished stock. All of the alternatives above would take longer than 10 years to rebuild the red grouper stock to the B_{MSY} level. Alternatives 1 and 2 will end overfishing immediately, and difffer only in whether to use a more conservative control rule (Alternative 1) that reduces the MFMT below F_{MSY} when the stock biomass is below 805 B_{MSY}, or a less conservative control rule (Alternative 2), which leaves MFMT at F_{MSY} until the stock biomass drops to 50% B_{MSY}. Atlerative 1 will rebuild the stock faster than Alternative 2. Alternative 3 also ends overfishing immediately, but it uses F_{OY} as its target insted of F_{MSY}. Initally, Alternative 3's imact is intermediate between Alternatives 1 and 2, but in the long run, it is the most conservative, and it, along with Alternative 4(c), are the only alternatives that comply with the National Standard 1 requirement to achieve optimum yield on a continuing basis. Alternative 4 spreads out the fishing mortality rate reduction over three 3-year time periods. One third of the reduction is achieved in the first period, two thirds in the second period, and all of the needed reduction in the third period. As

Strategy 4a: 7% - 16% (mid-point = 12%) harvest reduction needed.

Commercial Scenarios	Recreational Scenarios
a. Close February 15 - March 31: 12% reduction commercial reduction: **12%**	d. Close January - March: 11% reduction recreational reduction: **11%**
b. No closed season 3,500 lb. SWG trip limit: 13% reduction commercial reduction: **13%**	e. Close July - August: 34% reduction 2 of 5-fish bag limit: 6% reduction (adjusted) recreational reduction: **40%**
c. Close Feb. 15 - March 15: 8% reduction 5,000 lb. SWG trip limit: 5% reduction (adjusted) commercial reduction: **13%**	f. Close Feb. 15 - March 15: 3.5% reduction 2 of 5-fish bag limit: 9% reduction (adjusted) recreational reduction: **12.5%**

Commercial Scenarios	Recreational Scenarios
a. Close Feb. 15 - March 15: 8% reduction commercial reduction: **8%**	d. Close Feb. 15 - March 15: 3.5% reduction 3 of 5-fish bag limit: 3% reduction (adjusted) recreational reduction: **6.5%**
b. Close October: 6% reduction commercial reduction: **6%**	e. Close March - April: 6% reduction recreational reduction: **6%**
c. No closed season 4,500 lb. SWG trip limit: 7% reduction commercial reduction: **7%**	f. Close Jan.1 - Feb 15: 6% reduction recreational reduction: **6%**

Strategy 4c: 11% - 15% (mid-point = 13%) harvest reduction needed.

Commercial Scenarios	Recreational Scenarios
a. Close Feb. 15 - March 15: 8% reduction 5,000 lb. SWG trip limit: 5% reduction (adjusted) commercial reduction: **13%**	d. Close Feb. 15 - March 15: 3.5% reduction 2 of 5-fish bag limit: 9% reduction (adjusted) recreational reduction: **12.5%**
b. Close September - October: 13% reduction commercial reduction: **13%**	e. Close April - May: 14% reduction recreational reduction: **14%**
c. No closed season 3,500 lb. SWG trip limit: 13% reduction commercial reduction: **13%**	f. Close May: 11% reduction 3 of 5-fish bag limit: 3% reduction (adjusted) recreational reduction: **14%**

Option: in the above commercial and recreational scenarios, the closed seasons may be specified in effect only east and south of Cape San Blas, Florida.

Discussion: Detailed discussions of these scenarios are not provided since these alternatives are not under active consideration. Section 6.3.2 provides discussions of the more restrictive management scenarios provided to rebuild an overfished stock. Since the regulations in the scenarios above are less restrictive, the impacts of the above scenarios will be smaller.

6.5 Shallow-water Grouper Quota Alternatives Removed From Consideration

6.5.1 Shallow-water grouper quota adjustments 6.5

6.5.1 Shallow-water grouper quota adjustments

The following alternatives for revising the shallow-water grouper quota have been removed from consideration in the main section of this amendment because they reduce the quota from the previous quota level rather than the previous harvest level. Since the average harvest level is less than the old quota, these alternatives overestimated the amount of reduction needed. In addition, these alternatives use an average harvest baseline of 1990-2000 for determining percent reductions. In January 2003, the Council determined that a baseline of 1999-2001 was more appropriate since the more recent baseline incorporates the effect of the strong 1996 year-class, which will continue to be a factor in the landings for the next few years.

6.7 Longline/Buoy Gear Boundary

Alternative 1: Longline and buoy gear must fish outside of the 50-fathom contour throughout the Gulf of Mexico.

Alternative 2: Longline and buoy gear must fish outside of the 30-fathom contour east of 85º30' west longitude (near Cape San Blas, Florida).

Alternative 3: Longline and buoy gear must fish outside of the 15-fathom contour east of 85º30' west longitude (near Cape San Blas, Florida).

Alternative 4: Longline and buoy gear must fish outside of the 50-fathom contour east of 85º30' west longitude (near Cape San Blas, Florida) for a portion of the year (to be selected).

Proposed => **Alternative 5: Status Quo - longline and buoy gear must fish outside of the 20-fathom contour east of 85º30' west longitude (near Cape San Blas, Florida), and outside of the 50-fathom contour west of 85º30' west longitude (near Cape San Blas).**

Discussion: In an earlier version of this Secretarial Amendment, based on the results of the 1999 red grouper stock assessment and supplemental analyses through 2001, a red grouper harvest reduction of 36% to 53% (relative to the 1990-2000 average) was sought. In order to achieve this level of harvest reduction without implementing extensive closed seasons, the Council considered moving the longline/buoy gear boundary, which is currently at the 20-fathom depth contour east of 85º30' west longitude (near Cape San Blas, Florida), and at the 50-fathom depth contour west of 85º30' west longitude, to the 50-fathom depth contour throughout the Gulf. This move would achieve between a 33% and 59% reduction in red grouper harvest. However, due to the improved condition of the stock indicated by the results of the 2002 red grouper stock assessment, only a 9.5% red grouper harvest reduction (from the 1999-2001 average) is now needed to implement the first three years of a ten-year rebuilding plan to B_{MSY}. Moving the longline boundary as part of the red grouper rebuilding plan would result in a harvest reduction far in excess of that needed to rebuild the stock. The Council in January 2003 voted to retain the status quo longline/buoy gear boundary with respect to the red grouper rebuilding plan, but moving the boundary will be reconsidered in Reef Fish Amendment 18 (currently under development) as part of an overall review of grouper management in the Gulf of Mexico.

The longline and buoy gear 20-fathom boundary (Figure 12) currently extends offshore from 39 nautical miles to 87 nautical miles off the southwest Florida coast, except at the very southern tip, which intercepts the state boundary at 9 nautical miles from the Dry Tortugas (slightly over 60 miles from Key West). In the Carrabelle to Cape San Blas (Florida Big Bend) region, the longline and buoy gear boundary runs from 23 nautical miles to 78 nautical miles off the coast. A 50-fathom boundary would be approximately 80 nautical miles to 124 nautical miles off the southwest Florida coast, and about 24 nautical miles to 124 nautical miles in the Carrabelle to Cape San Blas region. Off of Pinellas County, where much of the longline fleet is based, the 20- fathom and 50-fathom boundaries are approximately 35 and 80 nautical miles offshore respectively. Longlines

are a dominant gear in the commercial red grouper fishery, but are secondary to handlines and bandit gear in the commercial gag fishery.

Recent analyses by NMFS of Florida trip ticket data and NMFS TIP data indicate that in recent years (1998 to 2000 for Florida trip ticket data, 1999-June 2001 for TIP data), approximately 82-99 percent of the red grouper longline catch occurred in water depths less than 50 fathoms, and approximately 46-70 percent occurred in depths less than 30 fathoms. Longlines accounted for approximately 59 percent of the commercial red grouper harvest and 49 percent of the commercial shallow-water grouper aggregate harvest from 1998-June 2001.

The results of the recent analyses are consistent with the results of a NMFS observer bycatch characterization study conducted in 1994-1995 (NMFS 1995). In that study, observers went on 11 longline vessel trips and observed 311 sets, in depths of 18 to 129 fathoms. Red grouper were caught in depths of 18 to 64 fathoms, as shown in Table 6.9. There was a clear increase in release mortality with increasing depth, particularly below 40 fathoms (Figure 8). However, 99 percent of the observed red grouper catches where depth of capture was known (1346/1365) were caught in less than 50 fathoms (Figure 9). There were 625 (46 %) red grouper kept that were caught inside of 30 fathoms, and 740 red grouper (54 %) that were caught in 30 fathoms or deeper (Figure 9). In the observer study, out of 143 observed longline sets where red grouper were caught, only two sets occurred in depths greater than 50 fathoms (Figure 10). Figure 11 shows that the percent of red grouper kept does not vary much with increasing depth, which suggests that moving the longline fishery into deeper water would have little impact on discard rate, although the release mortality of discarded fish may increase due to the increased depths.

Biological Impacts: Alternative 1, move the boundary out to 50 fathoms, would reduce commercial harvest of red grouper by up to 48 to 58 percent, in the absence of effort shifting. If the depth distribution of the shallow-water grouper aggregate is similar to that of red grouper, commercial harvest of the shallow-water grouper aggregate will be reduced by up to 40 to 48 percent, in the absence of effort shifting. Table 6.17 shows the estimated reductions calculated by NMFS in harvest of red grouper, and the shallow-water grouper aggregate, if various levels of effort shifting to bandit gear occurs. Even if 100% of the longline vessels convert to bandit gear, this alternative is still expected to result in a 33% red grouper commercial harvest reduction due to the lower catch rates of bandit gear vessels. While this alternative will reduce the overall harvest rate on red grouper and the shallow-water grouper aggregate, it could increase the harvest rate on deep-water grouper and tilefish as a result of longline vessels redirecting their effort to deep-water species. Yellowedge grouper is currently the number three grouper species in terms of pounds landed, after red grouper and gag, accounting for 9.5 percent of the grouper harvest, and would likely see increases if longline vessels fished at deeper depths as a result of this alternative. A positive benefit from moving the longline boundary to 50 fathoms is a reduction in bycatch and release mortality. Reef fish species with size limits are not known to occur in these deeper waters, except for possibly scamp.

Anecdotal information from fishermen suggests that virtually all of the scamp caught in federal waters are above the 16-inch minimum size limit, so regulatory discards should not be a factor. Deep-water grouper and tilefish have no minimum size limit, so there would be little or no discard mortality from longline vessels operating in deeper waters unless there are economic discards due to a lack of a market. This was previously a Preferred Alternative when a 36% to 53% red grouper harvest reduction was sought based on the 1999 stock assessment. However, with only 9.5% reduction now needed based on the 2002 red grouper assessment, this action is no longer necessary to rebuild the red grouper stock and would result in a greater harvest reduction than needed.

Alternative 2, move the boundary out to 30 fathoms, would reduce commercial harvest of red grouper by up to 27 to 41 percent, in the absence of effort shifting. If the depth distribution of the shallow-water grouper aggregate is similar to that of red grouper, commercial harvest of the shallow-water grouper aggregate will be reduced by up to 22 to 34 percent in the absence of effort shifting. Two forms of effort shifting could occur with this alternative. A percentage of longline vessels could shift their gear to bandit gear, or longline vessels could concentrate their fishing effort in water depths of 30 to 50 fathoms. Approximately 46-70 percent of longline red grouper catches currently occur in depths less than 30 fathoms, and some of this catch could be replaced by red grouper caught in deeper waters. The impact of this type of effort shifting cannot be estimated, since the amount of fishing effort that will shift to deeper waters is not known in advance. The shift to deeper water could result in some increase in release mortality of undersized red grouper. Wilson and Burns (1996) reported that red grouper caught in depths as great as 44 meters (24 fathoms) had a potential survival rate of 91%, but there was no survival of red grouper caught in 54 meters (30 fathoms) or deeper. For all grouper species, the survival rates were 92.5% at 44 meters (24 fathoms), 50% at 54 meters (30 fathoms), and 25% at 75 meters (41 fathoms). The red grouper TAC and management measures are to be evaluated every three years under the proposed rebuilding strategy. This means that subsequent assessments will be able to evaluate the actual impact of moving the longline/buoy gear boundary and adjust the TAC for the next three years accordingly. Therefore, over the course of the entire rebuilding plan, any effort shifting will be accommodated in the management actions.

Alternative 3, move the longline gear boundary into the 15-fathom depth contour east of 85º30' west longitude (near Cape San Blas, Florida), would increase the fishing pressure on reef fish in an area that has already been defined in the original Reef Fish FMP as a stressed area. This would move the boundary inshore by about 11 to 16 miles off the southwest Florida coast and by 6 to 48 miles off the Carrabelle to Cape San Blas region. If quota reductions are implemented due to the recent classification of red grouper as undergoing overfishing, then this alternative could increase the likelihood of the shallow-water grouper quota being reached. Under this scenario, there is potential for derby fisheries to develop in the grouper fishery, similar to those seen in the red snapper fishery. In the years preceding implementation of the current longline boundary and quota (1981-1989), annual commercial grouper landings ranged from 8.5 to 12.5 MP, and

reached or exceeded 9.8 MP in every year but one (Schirripa et al. 1999). In 1993, a regulatory amendment was prepared that proposed an experimental one-year move of the longline/buoy boundary from 20 fathoms to 15 fathoms. That regulatory amendment was never submitted to NMFS due to concerns that quota closures might trigger derby fisheries, similar to those seen in the red snapper fishery. This alternative would likely increase user conflicts between bandit gear/handline vessels, recreational fishing vessels, and longline vessels. However, release mortality of undersized fish would likely be lower due to the shallower water being fished.

Alternative 4 is similar to Alternative 1, but would move the longline gear boundary to 50 fathoms for only a portion of the year. For the remainder of the year, the boundary would remain at 20 fathoms east of 85º30' west longitude (near Cape San Blas, Florida). The impact of this alternative is intermediate between Alternative 1 and status quo, depending upon the time period selected to move the longline gear to the outer boundary. The percent of annual commercial red grouper catch and annual shallow-water grouper aggregate catch that came from longline fishing in each month (based on 1998-June 2001), and potential commercial harvest reductions from closing each month, is given in Table 6.18.

Alternative 5 (Preferred Alternative) leaves the longline gear boundary at its current position, where it has been since 1990. Longlines are the dominant gear for commercial red grouper harvest, and have accounted for about 2.9 MP per year (54 percent) of commercial red grouper landings, from 1986-1997. Adoption of the 20-inch minimum size limit in 1990 had no impact on longline red grouper landings, but the percent of commercial landings increased to 59 percent as handline landings have gradually decreased (Table 6.5). For gag, handlines are the dominant gear, with longlines accounting for an average of 392,000 pounds (25 percent) of commercial landings, since the 20-inch minimum size limit was implemented in 1990.

Socioeconomic Impacts: The information on catch of reef fish, particularly grouper, by water depth is probably not as robust as other information on commercial reef fish vessel operations. The reef fish logbook system does not collect information by depth of catch. The Florida Trip Ticket System (FTTS) does collect this information on a more routine basis but the information on catch by depth has been considered relatively unreliable for a variety of reasons. One reason is that the trip ticket allows fishermen/dealer to identify only one depth when in fact vessels fish at multiple depths, especially those that fish for several days before returning to the dock, such as longline vessels. From the FTTS information, most of grouper catches are indicated to be at depths greater than 50 fathoms. Other sources, notably the previously mentioned NMFS observer study and the NMFS TIP data (at least for red grouper), indicate that most of shallow-water grouper catches, particularly red grouper and gag, are caught in water depths of 50 fathoms or less. It would appear, then, that FTTS data record the maximum water depths where vessels fished, although it could happen that most of their fishing activities were in shallower water. This situation makes it very difficult to determine the potential impacts

of moving the longline boundary line. Cognizant of these data problems, an attempt is made to estimate the impacts of the various measures considered in this section.

A report by NMFS (2001) estimated that about 20 percent and 54 percent of longline catch of red grouper were caught beyond the 50-fathom and 30-fathom contours, respectively. If the same percentages also hold true for the other shallow-water grouper species, then the longline fishery would be virtually eliminated from the shallow-water grouper fishery under Alternative 1. The impacts of Alternative 2 would not be as large, but still it would severely restrict the performance of the longline fishery.

Table 6.19 presents some information on the economic significance of Alternatives 1 and 2 at the vessel level. Net revenues are assumed to equal 75 percent of dockside revenues. Based on averages for the 1993-2000 period, Alternative 1 would reduce longline vessel harvest by 2.9 MP of red grouper, gag, and black grouper. The corresponding reduction in dollar terms would be $5.7 million in dockside revenues or $4.3 million in net revenues. Reductions under Alternative 2 would be 1.9 MP in landings, $3.9 million in dockside revenues, or $2.9 million in net revenues. Considering that longline vessels also harvest other shallow-water species in the 20- to 50-fathom depths, losses could be greater than the above estimates.

Longline vessels could continue to fish for deep-water grouper, or, with the appropriate permits, for sharks or pelagic longline species such a swordfish. However, limited entry systems and quotas on these other longline fisheries would make it difficult for a vessel that is not already permitted to enter these fisheries. Additionally, quotas and trip limits would limit the ability of a currently permitted vessel to offset reductions in shallow-water grouper harvest with increased harvest of other longline species. Vessels capable of converting to other fishing gear (e.g., bandit gear or handlines) could continue to fish inside of the longline boundary by converting to other gear, but unless already outfitted with the other gear, would incur conversion costs that can range from $7,000 to $10,000 (Spaeth, pers. comm. 2001). Other estimates reported by individuals in public testimony before the Council placed these costs at $3,000 to $5,000.

Since very few alternatives for longline fishing exist, vessels would lose a good part of their value. Waters (1996) estimated that in 1993 the resale value of longline vessels was about $65,308 for high-volume vessels and $62,813 for low-volume vessels[1]. It should be emphasized that these are resale values of the existing vessels and not the cost of replacement. In addition, these resale values do not account for the existence of commercial reef fish permits. The amount of reduction in resale value would partly depend on whether affected vessels would be employed in other fisheries or in the same grouper fishery using different gear types.

[1]Waters (1996) stratified vessels into low-volume and high-volume with the 75th percentile of total reef fish landings used as the cut-off level.

The impacts of moving the longline boundary inside to 15 fathoms (Alternative 3) would depend on the reactions of longliners if this alternative were adopted. In Amendment 1, it was noted that less than 10 percent of longline catch of red grouper were from less than 20 fathoms. If longline vessels do move to fish in these areas, these vessels as a group would experience an increase in catch but most likely at the expense of other gear types, such as vertical lines and fish traps.

Alternative 4 would result in negative impacts on longliners that would be less than those of Alternative 1. These negative impacts could be more or could be less than those of Alternative 2 depending on how many months the boundary line is moved out beyond 50 fathoms. Several examples of impacts may be explored using information summarized in Table 6.20.

It can be gleaned from Table 6.20 that the longline boundary line would have to be moved beyond 50 fathoms for about four to six months to generate about the same reductions in longline vessel landings as Alternative 3. Below this time period, Alternative 4 would result in lower reductions than Alternative 3; the reverse occurs when a longer time period is chosen.

To the extent that few alternatives exist for longline vessels to continue using the longline gear when restrictions are imposed on this segment of the commercial grouper fishery, a good possibility exists that adversely affected vessels may switch to handlining and continue targeting groupers. In this eventuality, the estimated reductions in grouper landings under the alternatives that would move the longline boundary to deeper waters may be considered as maximum reductions. How much of such reductions would be recouped when longline vessels switch gear partly depends on how many longline vessels can successfully make the switch.

Among the longline vessels that can possibly make the switch, the low-volume vessels are probably in a better position than their high-volume counterparts. Waters (1996) estimated that there are about 47 low-volume longline vessels in the eastern Gulf (Franklin County, FL to Collier County, FL). On average, a low-volume longline vessel generates $94,668 in annual revenues with annual routine trip costs of $26,046 while its high-volume counterparts generates $115,094 in annual revenues with $28,108 in annual routine trip costs. Annual average fixed costs per boat are $29,639 and $40,974 for a low-volume and high-volume longline vessel, respectively.

If low-volume longline vessels can successfully convert to vertical line vessels, it is still likely that not all landings and revenue (and profit) losses would be recouped even if they convert to high-volume vertical line vessels. Waters (1996), found that, on average, a low-volume longline vessel in the eastern Gulf landed about 46,000 pounds of all reef fish annually while a high-volume vertical line vessel landed only about 26,000 pounds of all reef fish. It is no wonder that, as shown in an earlier table, a low-volume longline

vessel generates about $95,000 in annual gross revenues while a high-volume vertical line vessel generates only about $59,000 in annual gross revenues. The profit margin for a low-volume longline vessel (73 percent) is also higher than that for a high-volume vertical line vessel (71 percent). Further, most of the losses from longline vessels that cannot convert to vertical line vessels would not be recouped, unless perhaps there is a major increase in vertical line vessels.

The foregoing discussion presupposes that the actual distribution of fish that can be harvested by longline vessels is as what is reported in available information sources that are highly fishery-dependent. Although current information collection systems have some inherent weakness as pointed out above, there is no available information to contradict the mentioned assumption. Amendment 1 to the Reef Fish FMP noted that the use of bottom longlines, at least by domestic producers, to harvest grouper started to become popular in the early 1980s. Over the last 20 years or so, it is not too unreasonable to expect that explorations for possible longline fishing in deeper areas must have been conducted by some fishermen. If the results of such exploration were highly successful, it would have translated to a different distribution of longline catch than considered above. Regardless of the result of such explorations, the fact that most catches are made inside of 50 fathoms may be regarded as a result of fishermen's decision to balance their ability to catch grouper in deeper waters with the cost of fishing, given market conditions for grouper. At the very least then, moving longline fishing to deeper waters implies incurring higher costs that would not be substantially compensated by revenues generated from increased harvest in deeper waters.

The economic implications of regulations affecting the longline fishery are further discussed in Section 7.6.3.1.

Appendix B - Issues returned to Amendment 18 for Consideration

At the December 2001 Council meeting, the Council decided to remove the red grouper rebuilding plan from Draft Reef Fish Amendment 18 and develop it as a separate regulatory amendment. A press release dated January 25, 2002 announced the list of issues to be removed from Amendment 18 and included in the regulatory amendment. Subsequently, at the January 2002 Council meeting, the Council voted to narrow the scope of the regulatory amendment to include only issues that were essential to the rebuilding plan. As a result, the following issues that were originally in Draft Amendment 18, and preliminarily moved to the red grouper regulatory amendment, were placed back in Draft Amendment 18:

- Closed areas
- Phase out the use of longlines and buoy gear for reef fish fishing
- Set a boundary line for the commercial use of bandit gear or other vertical hook and line gear
- Alternate months in which longline/buoy gear and bandit/vertical line gear can be used in the commercial reef fish fishery
- Add/remove drift style and bottom style buoy gear from the list of allowable reef fish fishing gear
- Clarify the allowance or prohibition of recreational bag limits of reef fish on a commercial reef fish vessel.

These issues, and the alternatives and discussion, are available for review in Draft Amendment 18, which is available from the Council. They will not be considered as part of this regulatory amendment.

Appendix C - Summary of the 1999 Assessment and Supplemental Analyses

The 1999 assessment was initially reviewed by the Reef Fish Stock Assessment Panel (RFSAP) in September 1999. It included several major changes from past stock assessments, as well as updates of the commercial and recreational catches of red grouper in U.S. waters. Major changes included a new growth curve obtained from a tagging study, and an estimate of the total catch of red grouper since 1940 by using a long data set that included historical catch data from the Cuban fleet (1940-1977) as well as from the US fleet (1950-1997).

Previous assessments were unable to estimate current fishing mortality or current SPR because of problems in assigning ages to individuals in the catch. These problems resulted from differences in available growth models caused by sampling. For the 1999 assessment, a new growth curve was calculated, based on the lengths at capture and recapture from a tagging study conducted by Mote Marine Lab. This new growth curve, although obtained independently of the data used in the past, provided estimates of the parameters of the growth curve, termed L(infinity) and K, that were very similar to the values obtained by an examination of pooled otoliths. The similarity gave confidence that the recent estimates of growth rates for red grouper were accurate, thus allowing estimation of current (as of 1997) stock status.

With the addition of six more years of data since the last assessment in 1993 (landings through 1997), trends in both commercial and recreational catches showed a continuing decline. To expand the time series and to make use of the historic commercial catch data that are available, historic recreational catches were estimated using a relationship between the population size on the West Coast of Florida and the number of private angler trips. Although this method makes many assumptions about recruitment and stock size, the historical time series of total catch showed a continuing decline in catches since the peak in the 1950s (Figure 1).

Two models were applied to red grouper: ASPIC (A Stock-Production Model Incorporating Covariates; Prager 1994) and ASAP (Age-Structured Assessment Program; Legault and Restrepo 1998). ASPIC is a simple surplus production model which incorporates three major population components: recruitment, growth, and natural mortality. It requires a minimal amount of data for fitting, but lacks the precision of more sophisticated models. ASAP is similar to a separable virtual population analysis (VPA), which separates fishing effects by different gears into year and age components (Schirripa et al. 1999). The RFSAP felt that, while the surplus-production model was useful because it required fewer assumptions, the ASAP model was a better representation of the stock. The ASAP model took full advantage of all available data and allowed for uncertainty in parameter estimation. The RFSAP therefore used the ASAP model to determine ABC recommendations for red grouper.

The initial ASAP model run showed that the best estimate for MSY was 8.4 MP, which is achieved at an F of 0.27 per year. The spawning stock biomass at MSY was 563 million grams female gonad weight (used as a proxy for spawning stock biomass). The estimated F and spawning stock biomass in 1997 was 0.88 per year and 144 MP. Thus, the 1997 estimated biomass was 26% of stock biomass at MSY, well below the 80% default threshold for determining an overfished condition.

The model showed an increase in fishing mortality in recent years. With decreased catch, this implied a reduced abundance of red grouper. Estimated fishing mortalities increased

from an average of about 0.3 on 1986 to 0.5 in 1997. Estimates of spawning stock biomass and recruitment showed a decline since at least 1985. In all model simulations, the red grouper stock was overfished and overfishing was occurring.

However, the Standing and Special Reef Fish Scientific and Statistical Committee (SSC) subsequently questioned several portions of the assessment and Panel report, including questions related to the validity of the long-term Cuban data upon which the Panel ABC recommendations were based. The RFSAP met again in August 2000 and reviewed updated landings, the SSC report, the NMFS response to the SSC report, and an independent review of the red grouper assessment by Dr. Patrick J. Sullivan, Cornell University (Sullivan 1999). In addition, the Panel heard a presentation by Dr. Trevor Kenchington and comments from participants in the grouper fishery who attended the meeting.

The August 2000 RFSAP meeting focused on the data, methods, and assumption used in the 1999 stock assessment. Based on information in Wilson and Burns (1996) and data collected during the 1994 NMFS bycatch observer study (NMFS 1995) which was provided to the RFSAP by the NMFS Galveston laboratory, a release mortality rate of 33% was used for all commercial releases in the new analyses, rather than using release mortality rates specific to handlines (33%) and longlines (90%), as done in the original assessment. The RFSAP also was concerned that the discard rates predicted in the assessment appeared greater than suggested by the limited observer data available. A discard rate of 30% was deemed to be reasonable and near the low end of the likely range. This conclusion was based on the size distribution of red grouper catches by depth (TIP data) prior to the 1990 implementation of a 20-inch minimum size limit and the 1994 observer data. In addition, the validity of the Cuban time series was re-evaluated in light of new information presented about the Cuban fishery prior to 1963.

At the December RFSAP meeting, and again at a subsequent RFSAP meeting in December 2000, the ASAP model was run under several combinations of spawner-recruit steepness indices, discard rates and data used as tuning indices. All of the model runs continued to show the stock to be overfished and that overfishing was occurring based on the NMFS default recommendations for overfished and overfishing thresholds (Restrepo et al. 1998), except for one, which showed that the stock was overfished but that overfishing may not be occurring. However, in this model run the spawner-recruit steepness was estimated by the model to be 1.0, a highly unrealistic steepness value.

The RFSAP concluded that the most realistic model runs were those that used the short time series (1986-1997) of landings as tuning indices, a 33% release mortality rate for all commercial harvest, and a discard rate tuned so that the predicted discard rate in 1994 matched the observed discard rate from the 1994 observer program (NMFS 1995). These analyses also included updated harvest estimates for 1998 and 1999. The RFSAP judged that spawner-recruit steepness values of 0.7 and 0.8 provided the best scientific advice and that this range of steepness values was most consistent with values reported for other stocks.

Based upon these analyses, t_{min} (recovery time in the absence of fishing mortality) was estimated to be 2 to 4 years. Thus, the allowable rebuilding period is not to exceed ten years. The stock biomass was estimated to be at 56% of B_{MSY} under a spawner-recruit steepness of 0.7, and 70% of B_{MSY} under a spawner-recruit steepness of 0.8. In both cases, the biomass was below the default 80% of B_{MSY} threshold for declaring a stock to be overfished. In addition, the current (as of 1997) fishing mortality rate was estimated to be

F = 0.302, above the maximum threshold of F_{MSY} for declaring that overfishing was occurring (F_{MSY} = 0.223 under a spawner-recruit steepness of 0.7 and 0.270 under a spawner-recruit steepness of 0.8).

The RFSAP provided ABC ranges for recovery of the red grouper stock to the B_{MSY} level in 10 years using either a constant catch or a constant F rebuilding strategy. However, the rebuilding plan was based on using a starting year of 2000. The Panel warned that if actual catches in the year 2000 and beyond exceeded the ABC ranges indicated above, then reduced ABCs may be needed in future years to rebuild to target levels within ten years.

The red grouper rebuilding plan was originally included as part of draft Reef Fish Amendment 18, which included an overall review of the Gulf of Mexico grouper fishery as well as requiring the drafting of a Supplemental Environmental Impact Statement. Consequently, draft Amendment 18 did not proceed to public hearings until the Summer 2001. Potential management alternatives were presented in terms of achieving a certain percent reduction from a baseline average of recent years landings. However, it was discovered that the baseline landings used were in whole weight while the ABC recommendations from the RFSAP were in GW, making the comparisons incorrect. In addition, it was becoming apparent that ABC ranges based on a year 2000 start were becoming obsolete. In September 2001, NMFS presented an updated analyses in which the ASAP models from the December 2000 RFSAP meeting were re-run using the same input parameters, but with updated harvest estimates through 2000 and a projected harvest for 2001 (the average of 1999 and 2000), so that a new set of ABC estimates would be generated assuming a year 2002 start (NMFS 2001). The constant catch and constant F ABCs resulting from that analyses are presented in Table 6.1, and are the ABCs used in this amendment. The overfishing/overfished results are summarized in Table 6.2.

Appendix D - Scoping Meetings and Notice of Intent to Prepare a DSEIS

A series of seven scoping meetings were held in the following communities between February 18-21, 2002: Ft. Myers FL, Tampa FL, Crystal River FL, Panama City FL, Biloxi MS, New Orleans LA, and Galveston TX. The exact locations and dates are listed in Section 14 (Public Review). The scoping meetings and a Notice of Intent to prepare a Draft Supplemental Environmental Impact Statement were announced in a Council news release dated February 7, 2002, and were published in the Federal Register on February 15, 2002 (volume 67, number 32, pages 7123-7124). Subsequently a Notice of Intent to prepare an Environmental Assessment was published in the Federal Register on October 3, 2003 (volume 68, number 192, page 57400)

In addition to the above meetings, a public hearing on the Secretarial Amendment/DSEIS (including the deep-water grouper and tilefish quota alternatives was held during the Council meeting in May 2002 in Destin, Florida, and during the Council meeting in July 2002 in Mobile, Alabama, and Sarasota, Florida. After the initial version of this Secretarial Amendment was completed, a new NMFS red grouper stock assessment was produced in 2002. Following that assessment, additional public testimony was taken during the Council meeting in January 2003 in San Antonio, Texas.

Further, red grouper in the Gulf of Mexico were declared to be overfished and undergoing overfishing by NOAA Fisheries in October 2000. Secretarial Amendment 1 was developed to establish a rebuilding plan. As the actions being considered were likely to have a significant social and economic impact under NEPA, a Draft Supplemental Environmental Impact Statement (DSEIS) was planned instead of a less comprehensive EA. However, the proposed actions in this revised Secretarial Amendment 1 are not presently expected to have a significant impact on the human environment. Consequently, NOAA Fisheries is initially preparing an EA, rather than proceeding directly to a DSEIS, in support of Secretarial Amendment 1 to the Reef Fish FMP.