

**REGULATORY AMENDMENT
TO THE
REEF FISH FISHERY MANAGEMENT PLAN
FOR THE 1998 RED SNAPPER
TOTAL ALLOWABLE CATCH
AND THE RECREATIONAL BAG LIMIT**

*(Includes Environmental Assessment,
and Regulatory Impact Review)*

FEBRUARY 1998



Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619-2266

813-228-2815
813-225-7015 (FAX)
gulf.council@noaa.gov (e-mail)

This is a publication of the Gulf of Mexico Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA87FC0003.

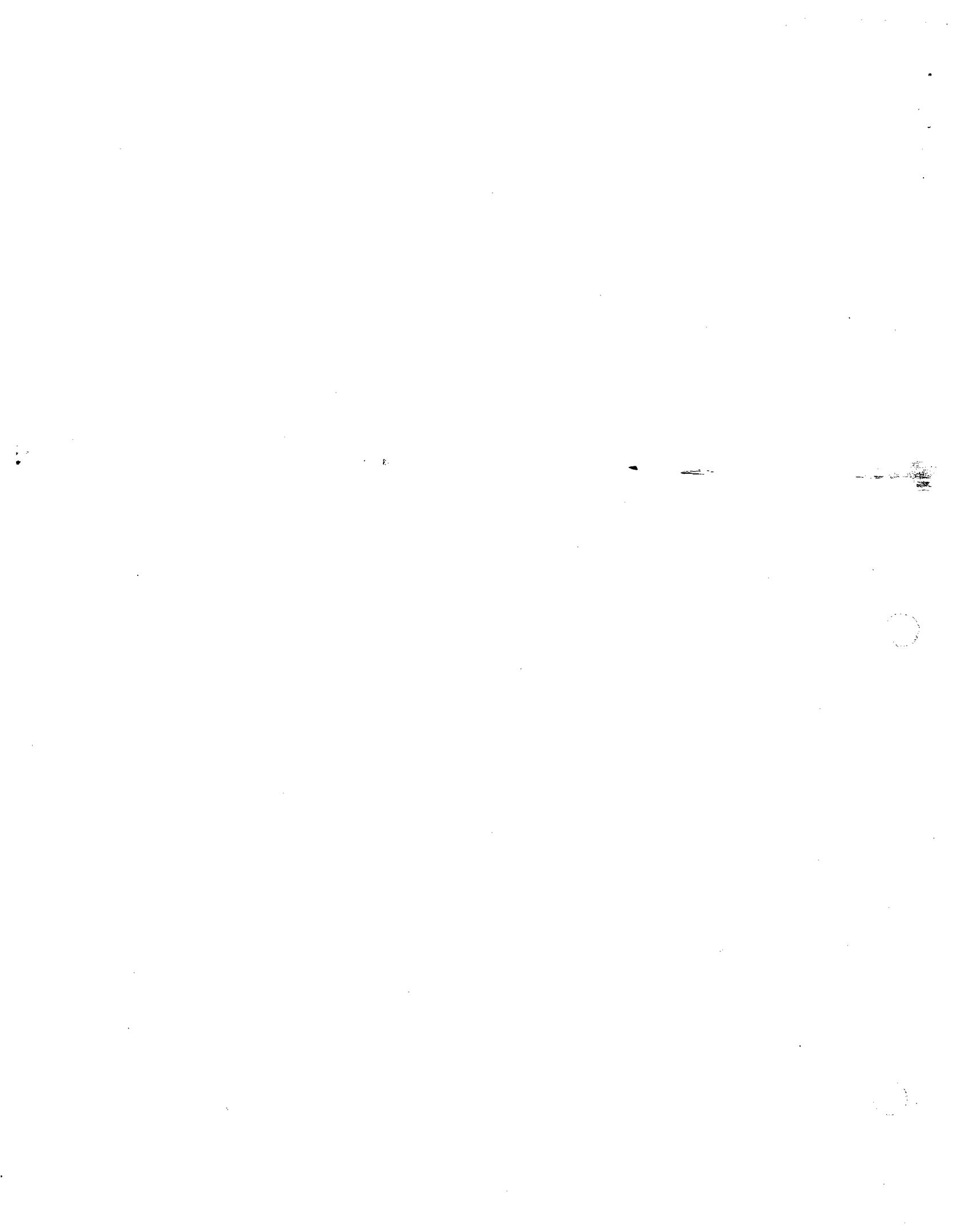


TABLE OF CONTENTS

1. INTRODUCTION	1
2. HISTORY OF MANAGEMENT RELATING TO RED SNAPPER	1
2.1 Management Activities Other Than Regulatory Amendments	1
2.2 Regulatory Amendments	4
3. PURPOSE AND NEED FOR ACTION	5
4. PROPOSED ACTIONS	6
5. MANAGEMENT OBJECTIVE AND OPTIMUM YIELD	7
Optimum Yield	7
Definition of Overfishing	7
6. REEF FISH FRAMEWORK PROCEDURE AS SPECIFIED IN THE FMP	7
7. STATUS OF RED SNAPPER STOCK	10
Recruitment Trends	11
Harvest Trends	11
Spawning Potential Ratio (SPR) Estimates and ABC Range	14
8. CHARACTERIZATION OF THE FISHERY AND PARTICIPANT GROUPS	17
General Description	17
Recreational and For-Hire Sectors	17
Commercial Sector	20
9. MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEW	22
Proposed Alternatives	22
Rationale	23
Biological Impacts	26
Rejected Alternatives	26
Rationale	27
Biological Impacts	28
Economic Impacts	28
Short-run Impacts on the Commercial Sector	28
Short-term Impacts on the Recreational Sector	30
Long-run Impacts	38
Private and Public Costs	40
Summary of Economic Impacts	40
Determination of a Significant Regulatory Action	41
Determination of the Need for an Initial Regulatory Flexibility Analysis	42
10. ENVIRONMENTAL ASSESSMENT	44
Environmental Consequences	44
Finding of No Significant Environmental Impact	45
11. OTHER APPLICABLE LAW	46
Habitat Concerns	46
Vessel Safety Considerations	46
Coastal Zone Consistency	46
Paperwork Reduction Act	46
Federalism	47
12. PUBLIC REVIEW	47
LIST OF AGENCIES CONSULTED	47
13. REFERENCES	48

Abbreviations Used in This Document

ABC	Allowable Biological Catch
EEZ	Exclusive Economic Zone
F	Rate of instantaneous fishing mortality
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
M	Rate of instantaneous natural mortality
NMFS	National Marine Fisheries Service
OY	Optimum Yield
Plan	Reef Fish FMP for the Gulf of Mexico
RD	Regional Director (NMFS Southeast Regional Office)
RFA	Regulatory Flexibility Act of 1980
RFSAP	Reef Fish Scientific Assessment Panel
RIR	Regulatory Impact Review
RSAP	Red snapper Advisory Panel
SEAMAP	Southeast Area Monitoring and Assessment Program (fishery-independent data program)
SEFC or SEFSC	Southeast Fisheries Center, Miami, Florida (NMFS Southeast Regional Office)
SEP	Socio-economic Panel
SPR	Spawning Potential Ratio
SSBR	Spawning Stock Biomass Ratio (an older term for SPR)
TAC	Total Allowable Catch
VPA	Virtual Population Analysis (a method for estimating mortality rates and number of fish at age from catch-at-age data)
YPR	Yield Per Recruit

1. INTRODUCTION

This regulatory amendment specifies the total allowable catch (TAC) and associated management measures, other than size limit, for red snapper for the 1998 fishing year, in accordance with the framework procedure established in the Reef Fish Fishery Management Plan. An earlier regulatory amendment was submitted to NMFS in November 1997 that set the red snapper minimum size limit at 15 inches total length for 1998 and canceled a proposed red snapper minimum size limit increase to 16 inches. However, further management measures relating to TAC were deferred, pending additional review of the NMFS 1997 red snapper stock assessment plus review of additional independent biological information provided to the Reef Fish Stock Assessment Panel.

2. HISTORY OF MANAGEMENT RELATING TO RED SNAPPER

2.1 Management Activities Other Than Regulatory Amendments

The Reef Fish Fishery Management Plan was implemented in November 1984, and established a minimum size limit of 13 inches total length for red snapper with the exceptions that for-hire boats were exempted until 1987 and each angler could keep 5 undersize fish.

The first red snapper assessment in 1988 indicated that red snapper was significantly overfished and that reductions in fishing mortality rates of as much as 60 to 70 percent were necessary to rebuild red snapper to a recommended 20 percent spawning stock potential ratio (SPR - See Section 5 below). The 1988 assessment also identified shrimp trawl bycatch as a significant source of mortality.

Amendment 1 to the Reef Fish Fishery Management Plan, implemented in 1990, 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 percent spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing. It set a red snapper 7 fish recreational bag limit and 3.1 million pound commercial quota that together were to reduce fishing mortality by 20 percent and begin a rebuilding program for that stock. A framework procedure for specification of TAC was created to allow for annual management changes, and a target date for achieving the 20 percent SSBR goal was set at January 1, 2000. This amendment also established a longline and buoy gear boundary 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. shark) was limited to the recreational bag limit.

In November, 1990, NMFS set a Control Date for the reef fish fishery, and announced that 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 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 did not prevent any other date for eligibility or other method for controlling fishing effort from being proposed and implemented.

At the direction of the Council, the Reef Fish Scientific Assessment Panel (RFSAP) met in March 1990 and reviewed the 1990 NMFS Red Snapper Stock Assessment. The recommendation of the panel at that

time was to close the directed fishery because the Allowable Biological Catch (ABC) was being harvested as bycatch of the shrimp trawl fishery. No viable alternatives were identified that would achieve the 20 percent SPR goal by the year 2000 without closure of the directed fishery; because no means existed for reducing trawl bycatch. As a result, 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 optimum yield and overfishing and framework procedure for TAC by replacing the 20 percent SSBR target with 20 percent spawning potential ratio (SPR). The amendment also established a new red snapper target year of 2007 for achieving the 20 percent SPR goal.

On August 24, 1991, the commercial red snapper fishery was closed as a result of the 2.04 million pound quota being reached. This was the first time that a closure of the commercial red snapper fishery occurred.

In 1992, the commercial red snapper fishery opened on January 1 and closed after just 53 days when a derby fishery developed and the quota was quickly filled. An emergency rule, implemented in 1992 by NMFS at the request of the Council, reopened the red snapper fishery from April 3, 1992 through May 14, 1992 with a 1,000 pound trip limit. This rule was implemented to alleviate economic and social upheavals that occurred as a result of the 1992 red snapper commercial quota being rapidly filled. Although this emergency rule resulted in a quota overrun of approximately 600,000 pounds, analysis by NMFS biologists determined that this one time overrun would not prevent the red snapper stock from attaining its target SPR.

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 considered a more comprehensive effort limitation program. It allowed 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.

An emergency rule effective December 30, 1992 created a red snapper endorsement to the reef fish permit for the start of the 1993 season. The endorsement was issued to owners or operators of federally permitted reef fish vessels who had annual landings of at least 5,000 pounds of red snapper in two of the three years from 1990 through 1992. For the duration of the emergency rule, while the commercial red snapper fishery is open permittees with red snapper endorsements are allowed a 2,000 pound possession limit of red snapper, and permittees without the endorsement are allowed 200 pounds. This emergency action was initially effective for 90 days, and was extended for an additional 90 days with the concurrence of NMFS and the Council. A related emergency rule delayed the opening of the 1993 commercial red snapper season until February 16 to allow time for NMFS to process and issue the endorsements.

Amendment 6, implemented in June, 1993, extended the provisions of the emergency rule for red snapper endorsements for the remainder of 1993 and 1994, unless replaced sooner by a comprehensive effort limitation program. In addition, it allowed the trip limits for qualifying and non-qualifying permittees to be changed under the framework procedure for specification of TAC.

Amendment 8, which proposed establishment of a red snapper Individual Transferable Quota (ITQ) system, was approved by NMFS and final rules were published in the Federal Register on November 29, 1995. This amendment provided for an initial allocation of percentage shares of the commercial red snapper quota to vessel owners and historical operators based on fishermen's historical participation in the fishery during the years 1990-1992, set a for year period for harvest under the ITQ system, during which time the Council and NMFS would monitor and evaluate the program and decide whether to extend, terminate or modify it, and established a special appeals board, created by the Council, to consider requests who contest their initial allocations of shares or determination of historical captains. The appeals board was originally scheduled to meet during January 1996, with the ITQ system itself to become operational in April 1996. However, the federal government shutdown of December 1995-January 1996 forced an indefinite postponement of the appeals board meetings, and 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.

Amendment 11 was implemented in January 1996. Approved provisions implemented a new reef fish permit moratorium for no more than 5 years or until December 31, 2000, while the Council considers limited access for the reef fish fishery, and allowed permit transfers to other persons with vessels by vessel owners (not operators) who qualified for their reef fish permit. NMFS disapproved a proposal to redefine Optimum Yield from 20 percent 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 Optimum Yield definition with a new proposal to redefine Optimum Yield as 30 percent SPR. The re-submission document is currently under review by NMFS.

Following the Congressional repeal of the red snapper ITQ system in Amendment 9, an emergency interim action was published in the Federal Register on January 2, 1996 to extend the red snapper endorsement system for 90 days. That emergency action was superseded by another emergency action, published in the Federal Register on February 29, 1996, that extended the red snapper endorsement system through May 29, 1996, and subsequently, by agreement of NMFS and the Council, for an additional 90 days until August 27, 1996.

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 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.

Amendment 15, implemented in January 1998, established of a permanent two-tier red snapper license limitation system to replace the temporary red snapper endorsement system. Under the new system, Class 1 licenses and initial 2,000 pound trip limits are issued to red snapper endorsement holders as of March 1, 1997, Class 2 licenses and initial 200 pound trip limits issued to other holders of reef fish permits as of March 1, 1997 who had any landings of red snapper between January 1, 1990 and March 1, 1997 and vessels without a Class 1 or Class 2 red snapper license are prohibited from commercial harvest of red snapper. Licences are fully transferable. The commercial red snapper season is split in two, with two thirds of the quota allocated to a February 1 opening and the remaining quota to a September 1 opening, and the commercial fishery will open from noon of the first day to noon of the fifteenth day of each month during the commercial season.

2.2 Regulatory Amendments

A March 1991 regulatory amendment reduced the red snapper TAC from 5.0 million pounds to 4.0 million pounds to be allocated with a commercial quota of 2.04 million pounds and a 7 fish recreational daily bag limit (1.96 million pound allocation) beginning in 1991. This amendment also contained a proposal by the Council to effect a 50 percent reduction of red snapper bycatch in 1994 by the offshore EEZ shrimp trawler fleet, to occur through the mandatory use of finfish excluder devices on shrimp trawls, reductions in fishing effort, area or season closures of the shrimp fishery, or a combination of these actions. This combination of measures was projected to achieve a 20 percent SPR by the year 2007. The 2.04 million pound quota was reached on August 24, 1991, and the red snapper fishery was closed to further commercial harvest in the EEZ for the remainder of the year. In 1992, the commercial red snapper quota remained at 2.04 million pounds. However, extremely heavy harvest rates resulted in the quota being filled in just 53 days, and the commercial red snapper fishery was closed on February 22, 1992.

An October 1992 Regulatory Amendment raised the 1993 red snapper TAC from 4.0 million pounds to 6.0 million pounds to be allocated with a commercial quota of 3.06 million pounds and a recreational allocation of 2.94 million pounds (to be implemented by a 7 fish recreational daily bag limit). The amendment also changed the target year to achieve a 20 percent red snapper SPR from 2007 to 2009, based on the Plan provision that the rebuilding period may be for a time span not exceeding 1.5 times the potential generation time of the stock and an updated estimated red snapper generation time of 13 years (Goodyear 1992).

An October 1993 Regulatory Amendment 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 purpose of this amendment was to facilitate enforcement of the trip limits, minimize fishing during hazardous winter weather, and ensure that the commercial red snapper fishery is open during Lent, when there is increased demand for seafood. The Total Allowable Catch (TAC) was retained at the 1993 level of 6 million pounds, with a 3.06 million pound commercial quota and 2.94 million pound recreational allocation.

An October 1994 regulatory amendment retained the 6 million pound red snapper TAC and commercial trip limits and set the opening date of the 1995 commercial red snapper fishery as February 24, 1995. However, because the recreational sector exceeded its 2.94 million pound red snapper allocation each year since 1992, this regulatory amendment reduced the daily bag limit from 7 fish to 5 fish, and increased the minimum size limit for recreational fishing from 14 inches to 15 inches a year ahead of the scheduled automatic increase.

A regulatory amendment to set the 1996 red snapper TAC, dated December 1995, raised the red snapper TAC from 6 million pounds to 9.12 million pounds, with 4.65 million pounds allocated to the commercial sector and 4.47 million pounds allocated to the recreational sector. Recreational size and bag limits remained at 5 fish and 15 inches total length. The recovery target date to achieve 20 percent SPR was extended to the year 2019, based on new biological information that red snapper live longer and have a longer generation time than previously believed. A March 1996 addendum to the regulatory amendment split the 1996 and 1997 commercial red snapper quotas into two seasons each, with the first season opening on February 1 with a 3.06 million pound quota, and the second season opening on September 15 with the remainder of the annual quota.

A March 1997 regulatory amendment changed the opening date of the second 1997 commercial red snapper season from September 15 to September 2 at noon and closed the season on September 15 at noon, and thereafter opened the commercial fishery from noon of the first day to noon of the fifteenth day of each month until the 1997 quota was reached. It also complied with the new Magnuson-Stevens Act requirement that recreational red snapper be managed under a quota system by authorizing the NMFS Regional Administrator to close the recreational fishery in the EEZ at such time as projected to be necessary to prevent the recreational sector from exceeding its allocation.

A November 1997 regulatory amendment canceled a planned increase in the red snapper minimum size limit to 16 inches that had been implemented through Amendment 5, and retained a 15 inch total length minimum size limit. This action was taken to avoid unnecessary release mortality of undersized red snapper, and in response to an analysis in the 1997 red snapper stock assessment that a size limit increase to 16 inches would have little impact on SPR.

3. PURPOSE AND NEED FOR ACTION

Since implementation of the red snapper stock recovery plan, the Council has conducted annual reviews of the status of red snapper stocks. Typically, a new assessment has been prepared by the NMFS/SEFSC every two years with a comprehensive update in the intervening years. In October 1997, the Reef Fish Stock Assessment Panel (RFSAP) reviewed a new stock assessment for red snapper (Schirripa and Legault 1997) for the purpose of recommending the 1998 ABC. However, the RFSAP was unable to recommend a TAC that included a probability distribution because of a lack of a probability analysis. In addition, new proposed guidelines for the National Standards based on the recently re-authorized Magnuson-Stevens Act will probably call for new overfishing definitions and criteria in developing recovery targets for overfished stocks. The RFSAP was uncertain as to what recovery target the ABC range should address. NMFS subsequently clarified that, until new overfishing definitions and rebuilding plans were developed and approved by NMFS, management of red snapper should continue to be based on the existing rebuilding target of 20 percent SPR within 1.5 generation times.

The RFSAP reconvened in January 1998 to review additional analysis by NMFS, as well as an independent red snapper stock assessment prepared by Dr. Brian Rothschild (Rothschild et al. 1997) and the results of an independent peer review into the data collection programs, research, and management of red snapper (MRAG Americas 1997). Upon reviewing this additional information, the RFSAP recommended a range of Allowable Biological Catch of 3 to 6 million pounds, a reduction from the existing TAC of 9.12 million pounds. In making this recommendation, the RFSAP was pessimistic that sufficient bycatch reduction would be achieved in 1998, and the RFSAP desired to begin a transition to management strategy based on constant fishing mortality (F) with a more risk adverse philosophy. In reviewing the data on bycatch reduction based on realistic expectations for soon-to-be-approved bycatch reduction devices (BRDs), the Council noted that it could maintain TAC at the 9.12 million pound level with at least a 50 percent probability of achieving the 20 percent SPR goal by 2019. The Council also noted a lack of information on the impact that a reduction in TAC would have on the red snapper fishing industries and fishing communities. During public testimony received at its January 19-23, 1998 meeting in Point Clear, Alabama, the Council received various recommendations for reducing TAC (reduced bag limits, closed seasons, etc.). The Council also heard testimony that an immediate reduction in TAC to 6 million pounds or lower would have severe impacts on the social and economic aspects of the red snapper industry, both commercial and recreational. The Council also requested and subsequently received additional analysis based on realistic scenarios for bycatch reduction in the future (Table 3). These analysis show that the Council can reach its goal of a 20 percent SPR in 2019 while maintaining the 9.12 million pound TAC in 1998, and probably in subsequent years. Maintaining the present TAC will also help avoid immediate, severely negative social and economic impacts and provide time to evaluate various measures to reduce these impacts, if a reduction in TAC is determined to be necessary in the future. In reviewing all available information and analysis, the Council determined that a TAC of 9.12 million pounds represented the most appropriate level of harvest that would best balance the biological, social, and economic aspects of the fishery to provide the optimum benefits to the Nation.

A bag and size limit analysis prepared by NMFS projected that, if TAC were kept at the status quo level and the recreational bag and size limits were left unchanged, the 1998 recreational quota would be filled between mid-October and mid-December. Given the likelihood of a recreational quota closure in late 1998, the Council sought changes to the recreational harvest regulations that could extend the recreational season while maintaining optimum benefits to recreational fishermen and the recreational fishing industry. The rationale and impacts of the proposed and considered changes are discussed in Section 9.

4. PROPOSED ACTIONS

The rationale, biological impacts, and economic impacts for the Proposed Alternatives and the Rejected Alternatives are discussed in Section 9 - Management Alternatives and Regulatory Impact Review.

Keep the 1998 red snapper TAC at status quo - 9.12 million pounds, with 4.47 million pounds allocated to the recreational fishery and 4.65 million pounds allocated to the commercial fishery¹.

¹This allocation ratio in terms of weight is 51 percent commercial and 49 percent recreational, based on the landings data contained in Amendment 1, Table 8.1.

Implement the recreational allocation by retaining the daily bag limit of 5 fish for recreational fishers, and setting a bag limit of 0 fish for the captain and crew of for-hire vessels, under the 9.12 million pound TAC. (This measure is to be implemented only on condition that the 9.12 million pound TAC is approved.)

5. MANAGEMENT OBJECTIVE AND OPTIMUM YIELD

Optimum Yield

(Note: The Council has proposed, through resubmission of a rejected Amendment 11 proposal, a revision of the Optimum Yield definition that would set the biological component of OY at 30 percent SPR. This revision is presently in the process of being reviewed by NMFS. Until it is implemented, the following is the existing definition of OY.)

The primary objective and definition of Optimum Yield (OY) for the Reef Fish Fishery Management Plan is any harvest level which maintains, or is expected to maintain, over time a survival rate of biomass into the stock of spawning age to achieve at least a 20 percent spawning potential ratio (SPR).

Definition of Overfishing

The following is the definition of overfishing contained in Amendment 1 of the Reef Fish Fishery Management Plan (FMP).

1. A reef fish stock or stock complex is overfished when it is below the level of 20 percent SPR.
2. When a reef fish stock or stock complex is overfished, overfishing is defined as harvesting at a rate that is not consistent with a program that has been established to rebuild the stock or stock complex to the 20 percent SPR level.
3. When a reef fish stock or stock complex is not overfished, overfishing is defined as a harvesting rate that, if continued, would lead to a state of the stock or stock complex that would not at least allow a harvest of optimum yield on a continuing basis.

6. REEF FISH FRAMEWORK PROCEDURE AS SPECIFIED IN THE FMP

The following is the framework procedure for specification of TAC, as established in Amendment 1 and modified in Amendments 11 and 14, and as modified in 1997 by regulatory amendment to comply with the requirement that the recreational red snapper fishery be managed as a quota. The specified recovery date for red snapper reflects the current recovery criteria that overfished stocks be recovered to 20 percent SPR within 1.5 generation times.

Procedure for Specification of TAC:

1. Prior to October 1 each year, or such other time as agreed upon by the Council and RA, the NMFS Southeast Fisheries Science Center (SEFSC) and Economics and Trade Division (ETD), Southeast Regional Office (SERO) will: a) update or complete biological and economic assessments and analysis of the present and future condition of the stocks and fisheries for red snapper and other reef fish stocks or stock complexes; b) assess to the extent possible the current SPR levels for each stock; c) estimate fishing mortality (F) in relation to $F_{20 \text{ percent SPR}}$ and F_{OY} ; d) estimate annual surplus production, F_{max} or other population parameters deemed appropriate; e) summarize statistics on the fishery for each stock or stock complex; f) specify the geographical variations in stock abundance, mortality, recruitment, and age of entry into the fishery for each stock or stock complex; and g) provide information for analyzing social and economic impacts of any specification demanding adjustments of allocations, quotas, bag limits or other fishing restrictions.
2. The Council will convene a Scientific Reef Fish Stock Assessment Panel (RFSAP), and a Socioeconomic Assessment Panel (SEP) appointed by the Council, that will, as working groups, review the SEFSC and ETD assessments, current harvest statistics, economic, social, and other relevant data. The RFSAP will prepare a written report to the Council specifying a range of ABC for each stock or stock complex which is in need of catch restrictions for attaining or maintaining OY. The ABCs 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. For overfished stocks, the range of ABCs shall be calculated so as to achieve reef fish population levels at or above the 20 percent SPR goal by January 1, 2000, for all reef fish except red snapper which has a January 2019 target date, or by a time period (target date), or set of time periods (target dates) specified by the RFSAP. Any time period specified by the stock assessment panel for consideration by the Council under this framework procedure cannot exceed a period equal to 1.5 times the potential generation time of the stock or such other time period as specified by plan amendment. Generation times are to be specified by the stock assessment panel based on the biological characteristics of the individual stocks. For stock or stock complexes where data in the SEFSC reports are inadequate to compute an ABC based on the spawning stock biomass per recruit or SPR models, the RFSAP will use other available information as a guide in providing their best estimate of an ABC range that should result in at least a 20 percent SPR level. The ABC ranges will be established to prevent an overfished stock from further decline. To the extent possible, a risk analysis should be conducted indicating the probabilities of attaining or exceeding the stock goal of 20 percent SPR, the annual transitional yields (i.e., catch streams) calculated for each level of fishing mortality within the ABC range. The SEP will examine the economic and social impacts associated with fishing restrictions required to attain those levels. The working groups reports may include recommendations on bag limits, size limits, specific gear limits, season closures, and other restrictions required to attain management goals, along with the economic and social impacts of such restrictions, and the research and data collection necessary to improve the assessments. The RFSAP may also recommend additional species for future analysis.
3. The Council will conduct a public hearing on the RFSAP and SEP reports at, or prior, to the time it is considered by the Council for action. Other public hearings may be held also. The Council

will request review of the reports by its Reef Fish Advisory Panel and Scientific and Statistical Committees and may convene these groups before taking action.

4. The Council in selecting a TAC level, and a stock restoration time period (target date), if necessary, for each stock or stock complex for which an ABC range has been identified will, in addition to taking into consideration the recommendations and information provided for in (1), (2), and (3), utilize the following criteria:
 - a. Set TAC within or below the first ABC range or set a series of annual TACs to obtain the ABC level within the first three years or less.
 - b. Subdivide the TACs into commercial and recreational allocations which maximize the net benefits of the fishery to the nation. The allocations will be based on historical percentages harvested by each user group during the base period of 1979-1987. However, if for an overfished stock the harvest in any year exceeds the TAC due to either the recreational or commercial user group exceeding its allocation, subsequent allocations pertaining to the respective user group will be adjusted to assure meeting the specified target date for achieving the spawning potential ratio (SPR) goal.
5. The Council will provide its recommendations to the NMFS Regional Administrator for any specifications in TACs and stock restoration target dates for each stock or stock complex, and the quotas, bag limits, trip limits, size limits, closed seasons, and gear restrictions necessary to attain the TAC, along with the reports, a regulatory impact review and environmental assessment of impacts, and the proposed regulations before October 15, or such other time as agreed upon by the Council and Regional Administrator.
6. Prior to each fishing year, or other such time as agreed upon by the NMFS Regional Administrator and Council, the Regional Administrator will review the Council's recommendations and supporting information; and, if he concurs that the recommendations are consistent with the objectives of the FMP, the Magnuson-Stevens Act National Standards, and other applicable law, he shall forward for publication notice of proposed rules for TACs and associated harvest restrictions by November 1, or such other time as agreed upon by the Council and Regional Administrator (providing up to 30 days for additional public comment). The Regional Administrator will take into consideration all public comment and information received and will forward for publication in the Federal Register the notice of final rule by December 1, or such other time as agreed upon by the Council and Regional Administrator.
7. The commercial allocations of reef fish TACs, and the recreational allocation of red snapper TAC, shall be considered to be quotas. Appropriate regulatory changes that may be implemented by proposed rule in the Federal Register include:
 - a. The TACs for each stock or stock complex that are designed to achieve a specific level of ABC within the first year, or annual levels of TAC designed to achieve the ABC level within three years.
 - b. Bag limits, size limits, vessel trip limits, closed seasons or areas, gear restrictions, and quotas designed to achieve the TAC level.

- c. The time period (target date) specified for rebuilding an overfished stock with the restriction that a time period specified under this framework procedure cannot exceed a period equal to 1.5 times the generation time of the stock under consideration.
8. The NMFS Regional Administrator is authorized, through notice action, to conduct the following activities:
 - a. Close the commercial fishery of a reef fish species or species group that has a commercial quota or sub-quota at such time as projected to be necessary to prevent the commercial sector from exceeding its allocation for the remainder of the fishing year or sub-quota season.
 - b. Close the recreational red snapper fishery in the EEZ, i.e., reduce the red snapper bag limit to zero, at such time as projected to be necessary to prevent the recreational sector from exceeding its allocation for the remainder of the fishing year.
 - c. Reopen a commercial or recreational season that had been prematurely closed if needed to assure that an allocation can be reached.
9. If the NMFS decides not to publish the proposed rule of the recommended management measures, or to otherwise hold the measures in abeyance, then the Regional Administrator must notify the Council of his intended action within 30 days of receipt of the Council's proposal and the reasons for NMFS concern along with suggested changes to the proposed management measures that would alleviate the concerns. Such notice shall specify: 1) the applicable law with which the amendment is inconsistent, 2) the nature of such inconsistencies, and 3) recommendations concerning the actions that could be taken by the Council to conform the amendment to the requirements of applicable law.

7. STATUS OF RED SNAPPER STOCK

The following is taken from the executive summary of the 1997 NMFS red snapper stock assessment (Schirripa and Legault 1997).

Recent upward trends in the estimated relative year-class strength from 1993 to 1995 would seem to indicate that management actions, first put in place in 1990, may be having a positive effect and that the red snapper stock may be showing signs of the beginning of a recovery.

Simulations indicate that the present management scenario (TAC of 9.12 million, bycatch reduction of 44%) will not achieve the goal of a 20% SPR in the year 2019. Further analysis under the model assumptions noted indicates that for this goal to be achieved, either TAC need be lowered to approximately 6 million pounds (with a reduction in bycatch of 44%) , or bycatch need be reduced by approximately 55% (with a TAC of 9.12 million pounds). To achieve a goal of 30% SPR in the year 2019, bycatch must be reduced by approximately 65%, with little regard to a TAC for the directed fishery. The simulated possible future levels of SPR were much more sensitive to differences in bycatch mortality than to differences in levels of TAC.

Recruitment Trends

Recruitment estimates of year-class strength of red snapper at age 1, based on the abundance and mean weights of red snapper in the fall groundfish survey and the summer SEAMAP survey, have shown annual increases since 1990 (Figure 1).

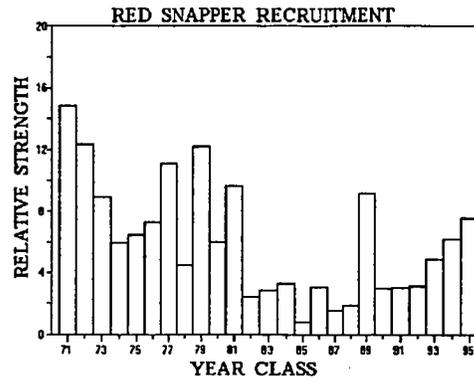


Figure 1. Trends in red snapper year-class strengths based on the resource survey data.

Harvest Trends

Commercial: Gulf of Mexico red snapper harvested by U.S. fishermen are primarily caught in the northern Gulf from Panama City, Florida to Galveston, Texas. The fishery is primarily prosecuted in federal waters, offshore, and outside of state waters. From 1975 to 1990, the commercial red snapper fishery has consolidated. In 1975, peak landings were coming from statistical grid 13 (eastern Louisiana); in 1995-96 peak landings came from grid 17 (Texas/Louisiana border) showing a gradual yet obvious movement west (Figure 2). Furthermore, the Florida fishery that existed in the mid-1970's is virtually economically extinct.

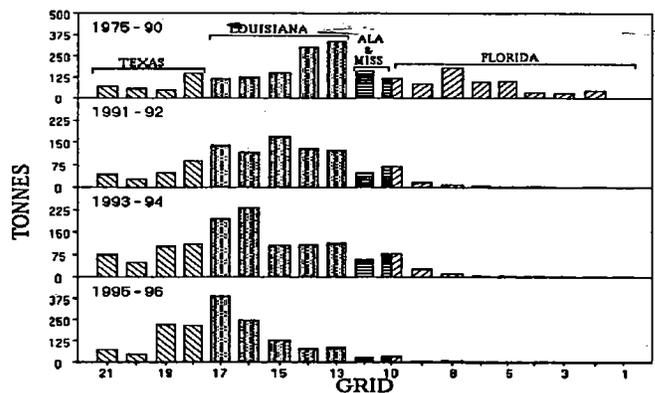


Figure 2. Spatial distribution of the commercial catch of red snapper in the Gulf of Mexico for four time periods, regardless of the locations where they were landed (Schirripa and Legault 1997).

The commercial quota and harvest since 1990 is shown in the table below. The commercial quota was initially 3.1 MP in 1990 and was subsequently set at 51 percent of TAC when adjustments were made. TAC was initially set at 4 million pounds in 1991, and was increased in 1993 (to 6 million pounds) and in 1996 (to 9.12 million pounds). For 1996, the commercial harvest was split into two segments, with 3.06 million pounds allocated to a February 1 opening and the remaining quota allocated to a September 15 opening. The February 1 season was open for 64 days and closed on April 5. The September 15 season was open for 22 days and closed on October 6. Preliminary estimates are that commercial sector was slightly over its quota for 1997.

COMMERCIAL RED SNAPPER HARVEST

Year	Commercial Quota	Commercial Harvest
1990	3.10 MP	2.66 MP
1991	2.04 MP	2.23 MP
1992	2.04 MP plus emergency season	3.14 MP
1993	3.06 MP	3.45 MP
1994	3.06 MP	3.12 MP
1995	3.06 MP	2.95 MP
1996	4.65 MP	4.35 MP

Recreational: Recreational red snapper harvest allocations since 1991 have been set at 49 percent of the TAC, or 1.96 MP in 1991 and 1992, 2.94 MP for 1993 through 1995 and 4.47 MP for 1996 and 1997. Actual recreational harvests in pounds of red snapper have exceeded the allocation in every year.

RECREATIONAL RED SNAPPER HARVEST

Year	Recreational Allocation	Recreational Harvest
1990	No allocation was explicitly specified	1.28 MP
1991	1.96 MP	2.08 MP
1992	1.96 MP	3.71 MP
1993	2.94 MP	5.91 MP
1994	2.94 MP	5.24 MP
1995	2.94 MP	4.19 MP
1996	4.47 MP	3.85 MP

Recreational red snapper harvest in pounds of fish is shown in Figure 3. Separate estimates by fishing mode were made from 1986 onward. The catch by anglers from private/rental vessels is approximately the same as for the headboats and charter vessels.

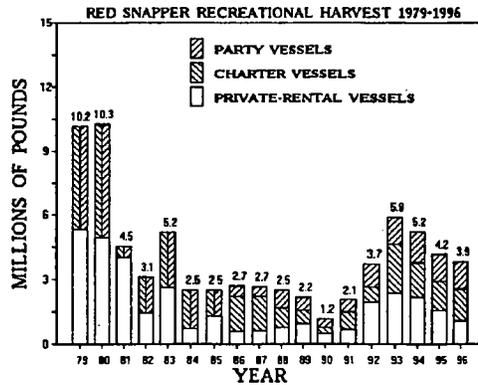


Figure 3. Recreational harvest (weight) estimates of red snapper from the Gulf of Mexico, 1979-96 (Schirripa and Legault 1997).

The MRFSS, in addition to harvest, estimates the number of fish that are caught and released (Figure 4). Red snapper were rarely released in the early years of the survey, but more than half of those caught were being released by 1990. The proportion released declined until 1993, and then increased thereafter. This pattern reflects changes in the length frequency of the red snapper harvested and is likely due to changes in minimum size limits in 1990 and 1994 as well as the growth of the 1989 and subsequent year classes.

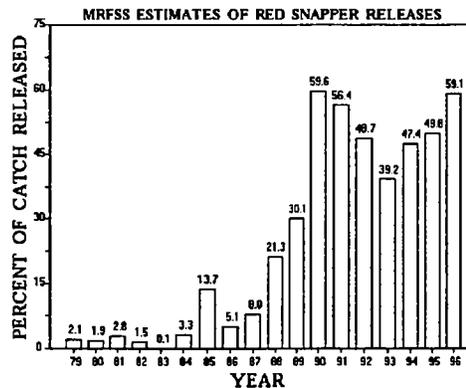


Figure 4. Estimated fractions of red snapper caught and released by recreational fishers 1979-96 (Schirripa and Legault 1997).

Overall Harvest: The Council established TAC levels of 4 MP in 1991 and 1992, 6 million pounds from 1993 to 1995, and 9.12 million pounds in 1996 and 1997. Total directed fishery harvests during 1990 through 1996 are listed in the table below and in Figure 5.

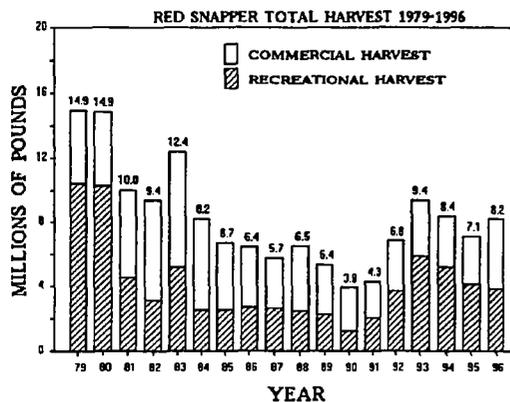


Figure 5. Combined commercial and recreational harvest of red snapper from the Gulf of Mexico, 1979-96 (Schirripa and Legault 1997).

OVERALL RED SNAPPER HARVEST

Year	TAC	Total Directed Harvest
1990	No TAC explicitly specified	3.94 MP
1991	4.0 MP	4.31 MP
1992	4.0 MP plus emergency season	6.85 MP
1993	6.0 MP	9.36 MP
1994	6.0 MP	8.36 MP
1995	6.0 MP	7.14 MP
1996	9.12 MP	8.20 MP

Spawning Potential Ratio (SPR) Estimates and ABC Range

Under the natural mortality estimate of $M=0.10$, the current transitional SPR estimate is about 0.4 percent, essentially unchanged from 1984. This lack of change in the SPR index should not be misconstrued as a lack of improvement in the stock. On the contrary, other indices such as the recruitment

index show a decided improvement in the stock at younger age-classes. However, as pointed out in the 1995 assessment (Goodyear 1995), maximum egg production in the absence of fishing occurs at age-14. The current management regime began in 1990, and significant changes in the SPR index cannot be expected until those year-classes produced under management reach these older ages. In this respect, SPR is a “back-loaded” index of stock health that will show most of its improvement in the latter stages of the recovery.

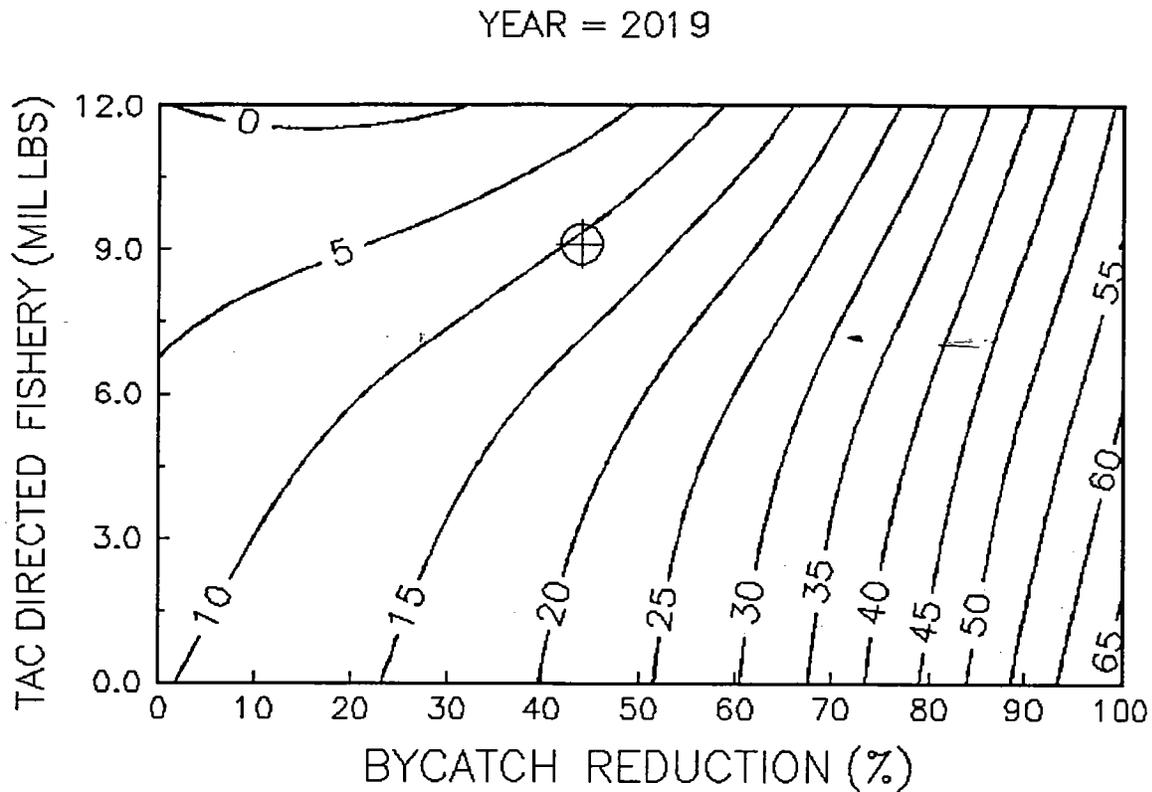


Figure 6. SPR isopleths for the year 2019 as a function of shrimp bycatch reduction and directed fishery TAC, assuming a minimum size of 16 inches for the directed fishery. Circle corresponds to present management scenario of a 9.12 million pound TAC and a 44 percent bycatch reduction in 1998 (from figure 16 in Schirripa and Legault 1997). Note: The percent bycatch reduction indicated is in addition to 10.1 percent reduction that has already occurred since 1994 (GMFMC 1997).

Figure 6 shows the outcomes of possible future condition of the red snapper stock. The future condition of the red snapper stock is dependent upon both the level of directed harvest and the level of shrimp trawl bycatch reduction. The vertical nature of the lines in Figure 6 indicate that future levels of SPR are much more sensitive to differences in bycatch mortality than to differences in levels of TAC.

The isopleths in Figure 6 represent point estimates of SPR at the 50th percentile of the probability distribution. The exact SPR values for these points are shown in Table 1 for 3, 6, and 9 million pound TACS in combination with bycatch reduction levels of 45%, 60%, and 80%. The probability distributions SPR at a 60% shrimp trawl bycatch reduction and TACs of 3, 6, and 9 million pounds are shown in Figure 7. (Note: The distributions in Figure 7 assume that 60% bycatch reduction begins in 1997.

A delay in implementing bycatch reduction until 1998 shifts the distributions to the left.)

The Reef Fish Stock Assessment Panel noted that, with a 60% bycatch reduction in 1998, it would still be possible to achieve 20.9% SPR in 2019 (see Table 1). However, this would occur only if 100 percent BRD implementation and compliance occurs in 1998, and if the BRDs can actually achieve 60% bycatch reduction under actual use. The RFSAP felt that these assumptions were unrealistic. In summary, the RFSAP recommended that TAC be set no higher than 6 million pounds because 1) a reduction in TAC

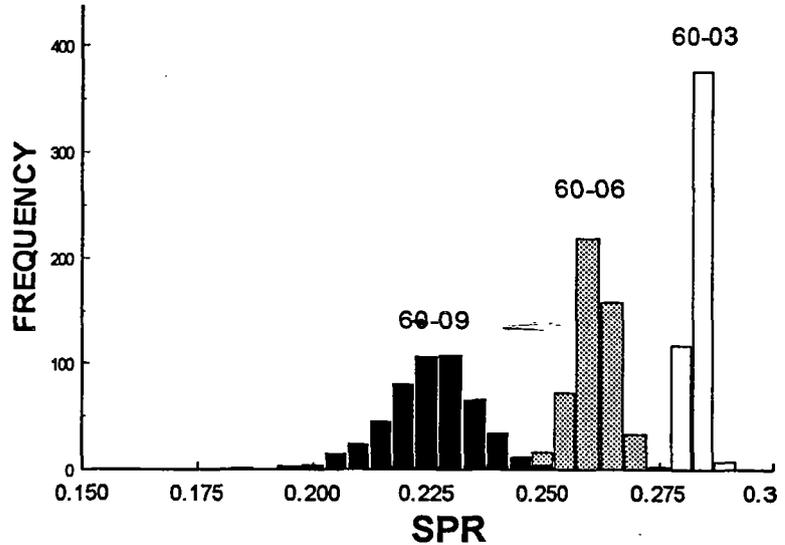


Figure 7. Frequency distribution of estimated SPR in the year 2019 assuming a reduction in shrimp bycatch of 60% and TACs of 3, 6, and 9 million pounds in 1997 (Schirripa 1998).

over status quo begins the transition to management based upon constant F, as recommended by the Peer Review Panels.; 2) real bycatch levels of red snapper in the shrimp fishery are unknown; 3) a lower TAC is risk adverse, as described by the Peer Review Panels., especially given that measures to reduce bycatch have been postponed; and, 4) the forthcoming need to reach an MSY management threshold within 10 years will result in substantially lower TACs (GMFMC 1998).

In assessing the status of the red snapper stock and making a recommendation, the RFSAP only considered scenarios for bycatch reduction of 45, 60, and 80 percent and scenarios for TAC of 3, 6, and 9 million pounds (Table 1). The bycatch reduction scenarios assumed the three reduction levels would be achieved in 1998. As discussed in Section 9.0, a risk adverse ABC range of 3 to 9 million pounds can be established based on different and more realistic scenarios for bycatch reduction (Table 3).

8. CHARACTERIZATION OF THE FISHERY AND PARTICIPANT GROUPS

General Description

The fishery for red snapper is composed of a directed commercial fishery managed by quota since 1990, a directed for-hire recreational fishery and private recreational anglers. Since the advent of TAC and allocations in the fishery, its history can be described as one of attenuated seasons and depressed prices for the food commercial sector and overruns of allocations by the recreational sectors. The reaction by the Council has been the implementation of an effort management system for the food commercial sector, the establishment of a permit system for the for-hire recreational fishery, and the implementation of increased minimum sizes on red snapper for the anglers. In addition and as mandated by the Magnuson-Stevens Act, the recreational allocation has been considered a quota, accordingly the recreational fishery was closed for the first time from November 27 to December 31, 1997, when the quota was taken.

As mentioned elsewhere, the allocation of TAC is 51 percent commercial and 49 percent recreational, although the actual landing percentages over the last seven years (1990-1996) averaged at 45 percent commercial and 55 percent recreational. Worth noting is the fact that in 1996, the percentage landings settled at 53 percent commercial and 47 percent recreational. The 1997 landings may be expected to be close to the respective sectors' allocations as both sectors experienced closures that year.

Recreational and For-Hire Sectors

Recreational landings have been identified from three survey sources: Texas Parks and Wildlife Department (TPWD), NMFS-Headboat and NMFS-MRFSS. All three surveys reflect an increasing trend in landings over the years. Figure 8 displays the relative contribution to recreational catch by state using only the MRFSS and TPWD sources. Headboat data combine red snapper landings in Alabama and Florida. A decline in recreational landings since 1993 is readily observable from the Figure 8. One other feature that stands out here is the shift in state shares of the recreational landings, notably the recovery of landings in Florida and the growth of landings in Louisiana and Alabama.

Figure 8. Recreational red snapper catches by state, 1986-1996 (MRFSS/TPWD)

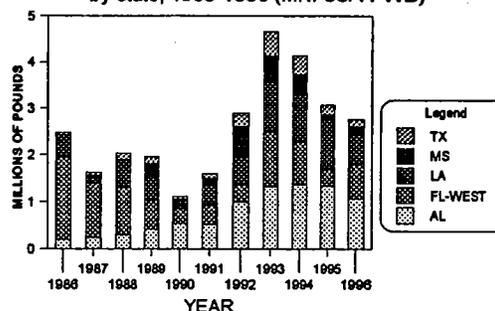
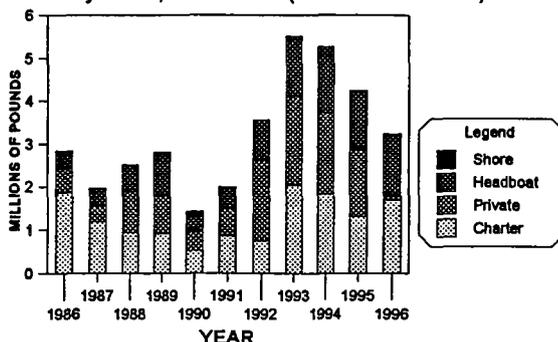


Figure 9 displays landings by mode for the period 1986 to 1996. Charterboat landings have a bimodal distribution with highs in 1986 and 1993; the private boat and headboat modes suggest a trend of growing catches, although private boat landings significantly fell in 1996. Noticeable here is the relative share of the charterboat fleet and of the for-hire sector generally. The estimation of landings for the mode is controversial because of the reanalysis of the 1993 and 1994 data. NMFS-MRFSS staff concluded that those years were correct estimates while 1990-92 were possibly underestimates. It is worth noting that the approach taken by the stock assessment was to average those years and therefore to detrend the 1993 and 1994 data.

Figure 9. Recreational red snapper catches by mode, 1986-1996 (MRFSS/Headboat)



In 1997, a quota monitoring group was established to monitor and project recreational harvests. This group estimated recreational harvests of 3.737 million pounds by the end of August and projected a total harvest for 1997 of 5.491 million pounds without closure. Based on the group's projection of 5.125 million pounds by the end of November and relative to the 1997 recreational quota of 4.47 million pounds, the Regional Administrator closed the fishery on November 27.

Per MRFSS records only, the number of recreational anglers in the Gulf of Mexico averaged at 1.87 million annually for the period 1990-1994. These anglers took 16.9 million trips annually for the same period. Figures 10 through 13 present some information on angler trips in which red snapper was targeted (target trips) or caught (catch trips) for the period 1988-1996. In Figure 10, note the following trends in red snapper target trips by state between 1988 and 1996: 1) there was little perceptible

Figure 10. Recreational red snapper target trips by state, 1988-1996 (MRFSS)

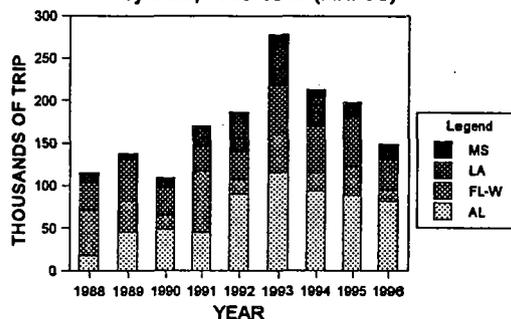
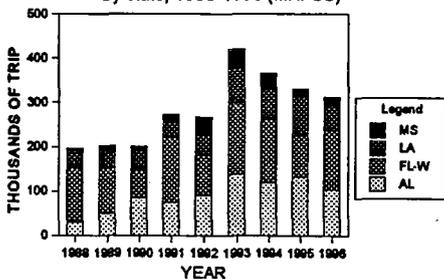


Figure 11. Recreational red snapper catch trips by state, 1988-1996 (MRFSS)



effect on target trips after the implementation of Amendment 1 to the reef fish FMP; 2) comparing the last 4 years to the prior 5 years, anglers increased average annual target trips by roughly 91 percent in Alabama, 71 percent in Florida, 50 percent in Louisiana, and 71 percent in Mississippi.

Figure 11 displays angler trips in which red snapper was caught, whether or not red snapper was targeted. Except in Florida, the catch trips

correlated well with the target trips, although not so much in terms of magnitudes of changes. In Alabama and Mississippi, the catch trips increased and decreased in the same direction as the target trips. Comparing the last 4 years to the prior 5 years, average annual catch trips rose by 86 percent and 82 percent in Alabama and Mississippi, respectively. The increase was only 25 percent in Florida, but was 80 percent in Louisiana. Florida's proportion of catch trips was however, larger than the state's proportion in target trips while the opposite seemed to be the case for Mississippi.

Figures 12 and 13 break down the recreational target and catch trips into shore, charter, and private boat trips. The shore mode comprises a minimal portion of both total target and catch trips. The charterboat mode indicates a steady increasing trend in both target trips (Figure 12) and catch trips (Figure 13). The private mode has dominated the target trips. The same can be said of the catch trips, except in 1993 and 1994 when the charterboat mode had higher proportional share of total catch trips. Figure 13 appears to bear out the growing importance of the charterboat mode in accounting for recreational catches of red snapper.

Figure 12. Recreational red snapper target trips by mode, 1988-1996 (MRFSS)

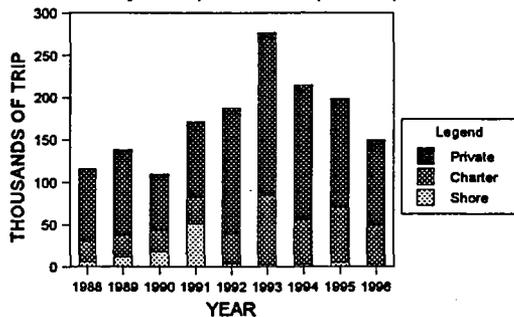
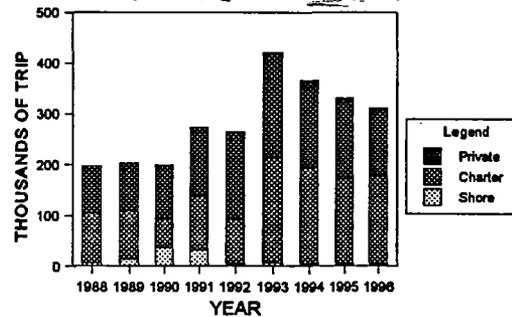


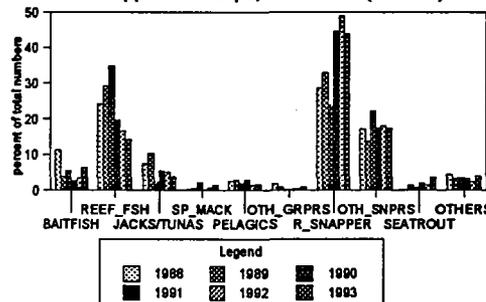
Figure 13. Recreational red snapper catch trips by mode, 1988-1996 (MRFSS)



While target and catch trips can give some information about future catch, catch composition suggests some of the species effects of further regulation of anglers and the for-hire sector. Figure 14 illustrates the catch composition of red snapper catch trips, i.e., trips catching red snapper whether or not red snapper was targeted. This figure appears to imply that the composition of species caught together with red snapper has remained relatively stable.

Among the various species caught, there also appears to be no trend as to which species are caught as regulations are changed on the red snapper fishery.

Figure 14. Composition of recreational catches in red snapper catch trips, 1988-1993 (MRFSS)



Commercial Sector

In more recent years in the U.S., red snapper was mainly caught and landed in the northern and western Gulf comprising the area from Bay County, Florida to Texas. For this reason the ensuing discussion focuses on commercial reef fishing activities in this area. There are, however, two points worth mentioning at this stage. First, commercial landings in the early years until 1988 included harvests from both U.S. and Mexican waters. In fact, catches from Mexican waters comprised about half of total landings until about 1967, and then gradually dropped over time until 1988. Since then landings have come solely from U.S. waters. Second, in those early years red snapper was also landed in other areas in Florida south of Bay County, Florida. In the 1990's, however, landings of red snapper in the northern and western Gulf accounted from a low of 95.7 percent to a high of 99.4 percent of all red snapper landings.

Commercial landings of reef fishes in the northern and western Gulf declined from over 15 million pounds (whole weight) in 1964 (a good portion of which was from Mexican waters) to a low of 5.5 million pounds in 1978. Landings recovered during the late 1970s, and have averaged 8.9 million pounds per year between 1981 and 1996 with a range of 6.5 million pounds in 1991 to 11.0 million pounds in 1988 (Figure 15). However, the species composition of the catch changed markedly. Landings of red snapper declined from approximately 12.2 million pounds in 1964 to 2.2 million pounds in 1991, the first year of management with quotas. Red snapper now compose the vast majority of the catch on red snapper trips. In the northern and western Gulf, red snapper represented 47% of the total commercial landings of reef fishes in 1996 compared with 72% in 1980 and 85% in 1970. Note, however, that in the 1970's, a significant portion of red snapper landed in the area was caught in foreign waters, mainly Mexico.

Ex-vessel value of reef fish received by commercial reef fishermen in the northern and western Gulf increased from \$2.9 million in 1962 to \$18.6 million in 1988, declined to \$11.9 million in 1991, and then increased to \$17.1 million in 1996 (Figure 16). Much of the increase prior to 1988 was due to inflation, as measured by the consumer price index for all items and all urban consumers (CPI-U, with a 1982-1984 base period). After adjusting for inflation, total ex-vessel value tended to mirror the trend in landings (compare Figures 15 and 17). Real ex-vessel value remained relatively constant from 1981 through 1987, peaked in

Figure 15. Comm_landings of reef fishes
in the northern and western Gulf

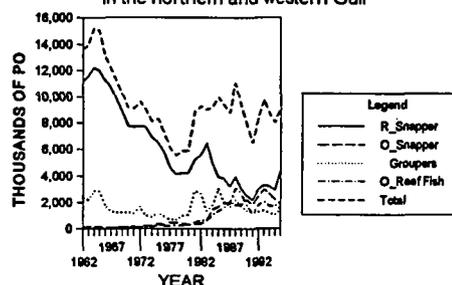
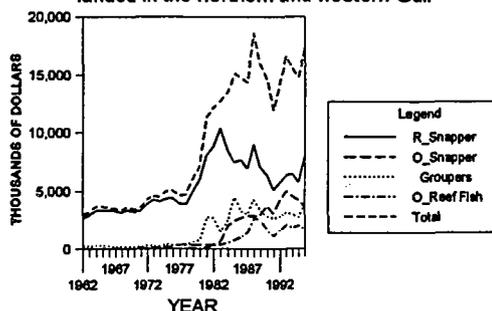
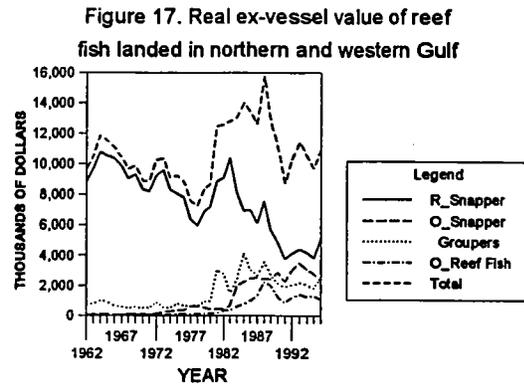


Figure 16. Ex-vessel value of reef fish
landed in the northern and western Gulf



1988, and then declined. The real ex-vessel revenues received in 1991 and 1992 were the lowest since 1980 (Figure 17).

Commercial fishermen in the northern and western Gulf received \$7.9 million from red snapper in 1996. Historically, red snapper has been the most valuable species in the fishery, but its relative importance has declined (Figures 17 and 19), partly due to the closure of Mexican waters to U.S. vessels and to more restrictive management especially in the 1990's. In 1996, red snapper contributed 46% to overall value received, whereas it contributed 83% in 1980 and 93% in 1970. Red snapper prices generally rose more quickly than the general price level prior to the derby fishery. Since then, however, red snapper prices have declined markedly and monthly price fluctuations are large. Waters (1997) estimated that the derby in the red snapper fishery shifted the demand for red snapper downward, causing a reduction in ex-vessel price per pound by \$0.85 in real (1982-84) dollars or \$1.35 in 1996 dollars.



Reef Fish Commercial Permits

The permit data file identifies vessels with permits to fish for reef fishes in Federal waters of the Gulf of Mexico. The data indicate a decline from approximately 2,365 in 1993 to about 1,450 in 1997. The reason for the decline is unknown, but it is presumed that vessels which were only marginally active or not active at all in the reef fish fishery have not chosen or have not been able to have the permits renewed. When the red snapper endorsement system took effect in 1993, 131 vessels qualified for the endorsement which allowed them to harvest up to 2,000 pounds per day trip. The rest of reef fish fishermen were limited to a 200-pound limit per day trip. Beginning in 1998, the red snapper endorsement system has been converted to a license limitation system, with the same dual trip limits of 2,000 pounds for Class I licensees and 200 pounds for Class II licensees.

An economic survey was conducted in the fall of 1994 and spring of 1995 by interviewers in face-to-face meetings with owners or operators of randomly selected vessels. The questionnaire primarily asked fishermen about their fishing histories, their capital investments in vessel and equipment, and about their average catches, revenues, and costs per trip for their two most important fishing activities for reef fishes during the 1993 calendar year.

Standard statistical procedures were used to estimate the total number of trips for red snapper, as well as landings, revenues and trip costs. It was estimated that a total of nearly 3.7 million pounds of red snapper worth \$7.4 million were landed on 4,328 trips. Fishermen on high-volume boats with vertical hook-and-line gear accounted for nearly 62% of total landings and ex-vessel revenues of red snapper. Fishermen spent nearly \$2.2 million for routine trip costs such as fuel, ice, bait, food, and minor gear replacement and repair. These estimated costs exclude fixed costs and payments to owner, captain, and crew.

9. MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEW

Introduction

The National Marine Fisheries Service (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 any proposed regulation is a "significant regulatory action" under certain criteria provided in Executive Order 12866 and whether any 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). The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively: "small entities") of burdensome regulatory and record keeping requirements. The RFA requires that if regulatory and record keeping requirements are not burdensome, then the head of a Federal agency must certify that the requirement, if promulgated, will not have a significant effect on a substantial number of small entities.

This RIR analyzes the probable impacts that the proposed alternatives for the Reef Fish Fishery Management Plan (FMP) would have on the directed commercial and recreational red snapper fisheries. Although the current FMP subject to proposed regulatory amendment covers only reef fish within its management unit, the proposed management measures are considered with the major assumption that the bycatch mortality rate of juvenile red snapper in the shrimp fishery would be reduced beginning in 1998. The shrimp fishery has been identified as a major source of juvenile red snapper fishing mortality due to incidental catches in shrimp trawls. Currently, however, implementation of an amendment to the shrimp FMP that would require bycatch reduction devices in shrimp trawls is imminent. The succeeding analysis focuses mainly on impacts on the red snapper fishery.

In this document, the "Economic Impacts" subsection comprises the bulk of the RIR. The problems and objectives are described in previous sections of this regulatory document as part of the RIR by reference.

Proposed Alternatives

Proposed Alternative 1. Maintain the 1998 TAC for red snapper at status quo - 9.12 million pounds, with 4.65 million pounds allocated to the commercial quota and 4.47 million pounds allocated to the recreational fishery.

Proposed Alternative 2. Implement the recreational allocation by retaining the daily bag limit of 5 fish for recreational fishers, and setting a bag limit of 0 fish for the captain and crew of for-hire vessels, under the 9.12 million pound total TAC.

Rationale:

Red Snapper TAC: Comparisons have been made between the condition of the red snapper fishery in the Gulf of Mexico and the groundfish fishery off the northeast Atlantic coast. In the latter case, inadequate management measures failed to stop a stock decline, ultimately leading to a total closure of the groundfish fishery. Unlike the groundfish fishery, however, the red snapper stock is not declining, but rebuilding. Rebuilding in recent years has been constant and substantial. It is highly probable that the stock will continue to rebuild at the current 9.12 million pound TAC, and will eventually reach its target SPR of 20 percent provided bycatch reduction in the shrimp trawl fishery is achieved. The question is not one of whether the stock is declining or rebuilding, but whether rebuilding is proceeding fast enough to meet the recovery target date. The risk of the red snapper stock not rebuilding fast enough to meet the recovery target date is altogether different from the risks taken by management in the groundfish fishery where measures were not adequate to stop or reverse decline in the groundfish stocks.

Evidence of this recovery is shown in both scientific and anecdotal information that indicates that the red snapper stock is expanding geographically into areas where the fish were not previously taken or were not very abundant. Goodyear (1997) reported that:

“It is noteworthy that the strength of the 1995 year class, which was predicted from the 1996 Summer SEAMAP Survey data, may underestimate the actual year-class size. Inspection of the spatial distribution of the data indicate that in 1996, red snapper were taken on the edges of the sampling region in places where they had not been previously encountered. This suggests a more widespread distribution of the 1995 year class with respect to past sampling years. One anticipated consequence of the recovery plan is an expansion of the resource into formerly occupied habitat. The observations related to the apparent increased spatial distribution of the 1995 year class in 1996 may reflect the beginning of the expected trend. An unfortunate byproduct of this expansion will be an erosion in the utility of the relations between the historical resource survey and recruitment. Some attention should be given to this problem if the resource survey data are to remain a central component of the assessment process for red snapper.”

In recommending an ABC range of 3 to 6 million pounds rather than 3 to 9 million pounds, the RFSAP noted that this suggestion was based on the premises that: 1) a reduction in TAC would begin a transition process toward a management strategy based on constant F as recommended by the Peer Group Review Panels, 2) real bycatch levels of red snapper by the shrimp fishery are unknown, 3) a lower TAC is risk adverse, and 4) there is a forthcoming need to reach an MSY management threshold within 10 years resulting in substantially lower TACs. Some of these assumptions are not only improbable, they are outside of the responsibility of the RFSAP. First, it is the Council's and NMFS' responsibility to decide whether to change the management strategy to a constant F and to determine an acceptable level of risk in management, not the RFSAP's or the Peer Review Panels'. The Council has not chosen to proceed under a constant F strategy for a number of reasons; some of which are outlined under "Economic Impacts". The Council has in most cases, however, looked at a probability range between 15 and 85 percent, with a midpoint of 50 percent, in setting TAC based on its management goal. In the case of red

snapper, the management goal is 20 percent SPR by the year 2019; and there is a 50 percent probability that this goal will be reached with a 9 million pound TAC and reasonable bycatch reduction. The assertion that there is a need to reduce TAC at this time in order to reach an MSY management threshold in 10 years has not been established. In fact, the guidelines for overfishing definitions under National Standard 1 are still under development by NMFS, and in the meantime the Council is required to set TAC under its current rebuilding program. The RFSAP recommendation assumed that NMFS would be unable to effectively implement BRD regulations in 1998. In so doing, the RFSAP assumed a likelihood that is contrary to what has been stated by NMFS and is outside of its responsibility. In advising the Council that ABC should range from 3 to 6 million pounds the RFSAP interjected itself into judgements that are the responsibility of the Council.

Although the RFSAP recommended an ABC range of 3 to 6 million pounds, supplemental analyses to the red snapper stock assessment (Schirripa 1998) indicated that there is a 50 percent probability of attaining 20 percent SPR by 2019 with a 60% shrimp trawl bycatch reduction at the status quo 9.12 million pound TAC. Additional analyses provided by NMFS and presented in Table 3 provide a more realistic view of current expectations with regard to bycatch reduction and its effects on the Council's rebuilding schedule. Information provided to the Council by Watson et al. (1997a and b) and in his personal communication before the Council in January 1998 indicate that a 60 percent reduction in bycatch, and possibly an even higher level, is possible with BRDs currently being tested.

As reported in the 1996 red snapper stock assessment (Schirripa and Legault 1997), future levels of SPR are much more sensitive to differences in bycatch reduction than to differences in levels of TAC. Table 1 shows that there would be a gain in SPR of only 3.6% in the target year (2019) with a 6 million pound versus a 9 million pound TAC and a 60% bycatch reduction (24.5% vs. 20.9%). In contrast, there would be a 7.4% gain in SPR at a 9 million pound TAC and a 60% versus 45% bycatch reduction (20.9% vs. 13.5%). Additionally, the probability distribution for SPR levels in 2019 with a 9 million pound TAC and 60% bycatch reduction is quite broad (Figure 7) (Table 2).

Analyses presented in Table 3 indicate that even if bycatch reduction is below the 60 percent level in the first few years, there is still a 50 percent probability of reaching the 20 percent SPR target by 2019. Although it is likely that a 60 percent bycatch reduction would not be achieved in 1998, it is reasonable to expect compliance to increase and the performance of BRDs to increase as shrimp fishermen learn how to properly use BRDs. The primary risk appears to be whether or not BRD regulations are implemented. Testimony provided by the NMFS Office of Sustainable Fisheries at the January 1998 Council meeting indicated that implementation is imminent.

Testimony presented to the Council at its January 1998 meeting in Point Clear, Alabama indicated that a cut in the red snapper TAC would have substantial negative economic impacts, particularly to the recreational for-hire industry and to fishing communities dependent upon recreational fishing and the tourist industry. The year of recovery (2019) was projected based on a stock assessment analysis that uses a mathematical model which scientists have agreed is not designed to make 20-year projections. As noted by Goodyear (1995) improvements in SPR, using this method for stock analysis, are primarily evident in the later years of a recovery period. There is also legitimate disagreement among competent scientists on how to conduct this assessment, in particular, whether it is more appropriate to use fecundity-based rather than weight-based SPR and the value used for natural mortality (M). The Council has been advised that this method is the best available; however, its precision to determine stock status in 20 years, or more, is low. The only consequence involved if the model underprojects the recovery date and the stock

stock does not reach its target on that precise date is to delay for a year or two the transition from a recovery plan to a plan for stock maintenance and further building toward Optimum Yield. The consequences of a delayed transition are minor, if not insignificant, when compared to the near certain social and economic disruption that an immediate cut to a 6 million pound TAC would cause.

The Council's action does not abandon the target for recovery by 2019, and it is expected that future biological advice will continue to support the probability of meeting this target. The Council feels that a status quo TAC of 9.12 million pounds represents the most acceptable balance of risk between failure to meet the 2019 recovery deadline and harm to the resource users because: 1) a 60% or higher level of bycatch reduction has been demonstrated to be feasible and probable given an initial implementation period; 2) the 60 percent reduction would not be required until the year 2001 (Table 3), allowing time for technology transfer and increased compliance with the use of BRDs; 3) the level of bycatch reduction has a far greater impact on future SPR levels than the level of TAC; and 4) a cut in TAC would entail severe economic and social disruptions with relatively little impact on future SPR.

Analyses of the actual level and effects of bycatch reduction are needed. Such analyses will, however, require additional sampling efforts and funding that have heretofore not been available. In the meantime, it is contrary to the Magnuson-Stevens Act and to sound fishery management to implement drastic cuts in TAC that will have only a minor impact on SPR levels in 2019, but will have severe and immediate economic and social impacts on the fishing community. Maintaining a constant TAC during the phase-in of bycatch reduction regulations will allow management to assess the actual impact of bycatch reduction without the complicating factor of a fluctuating TAC.

While the RFSAP specified an ABC range of 3 to 6 million pounds, the Council is not required to choose a TAC within this range. In the January 1998 Council meeting, NOAA General Counsel stated that an ABC range specified by the RFSAP is a recommendation and should the Council choose a TAC outside this ABC range, it must provide sufficient rationale for doing so. It is deemed that the rationale provided herein is more than sufficient to support the Council's choice of a TAC for the 1998 fishing year.

Red Snapper Bag Limits: The Council proposes setting a zero bag limit for the captain and crew of for-hire vessels under the 9.12 million pound quota. Bag and size limit analyses by NMFS Holiman (1998) project that with a recreational TAC of 4.47 million pound (status quo or 9.12 million pound total TAC) and the existing 5-fish bag limit and 15-inch recreational minimum size limit, the recreational quota closure would occur between mid-October and mid-December. Additionally, some of the MRFSS charterboat data show individuals landing red snapper in excess of the bag limit. There are various reasons why this excess harvest could occur, e.g., for-hire vessels out over 24 hours and returning with a two day bag limit allowance, noncompliance, or the captain and crew of for-hire vessels sharing their bag limits with paying customers. By assuming that 50% of the excess harvest is due to the captain and crew sharing their catch, Holiman (1998) suggests that a zero bag limit for captain and crew could reduce total recreational harvest by about 140,000 pounds, or about 3% of the projected 1998 harvest. This would extend the recreational season by one to two weeks, and significantly shorten, if not eliminate, a fall recreational quota closure.

The Council explicitly linked the proposed zero bag limit for captain and crew to the status quo 9.12 million pound TAC. At this level, the proposed action will have a significant impact on reducing or eliminating the relatively small recreational quota closure that is currently projected. However, if TAC were reduced, the recreational quota closure would occur much sooner in the year. In this situation, any

reduction in the closed season would be negligible, and insufficient to justify denying the captain and crew of for-hire vessels their recreational bag limits.

Biological Impacts: With implementation of the recreational quota and closure, the recreational allocation overruns that have occurred in 5 of the first 6 years of red snapper TACs will be more effectively constrained than in the past. In 1993, the total directed harvest of red snapper was 9.36 million pounds, exceeding both the 1993 TAC of 6 million pounds and the current TAC of 9.12 million pounds. Despite this excess, age-1 recruitment in 1994 and 1995 continued to improve, suggesting that increases in recruitment can continue to occur at the 9.12 million pound TAC.

When or even if the stock will eventually reach its target of 20% transitional SPR is primarily dependent upon the level of shrimp trawl bycatch reduction achieved; however, TAC is also a factor. If a 45% bycatch reduction is effectively implemented in 1998 (in addition to the 10.1% reduction already accorded to the fishery), there is a 50% probability of reaching the 20.0% SPR in 2019, assuming that bycatch reduction increased to about 60 percent by 2001 and is maintained at 60 percent for the remainder of the recovery period (Table 3). If there is additional bycatch reduction to approximately 70 percent in 2003 and maintained throughout the recovery period, the SPR estimate in 2019 increases to 27.2 percent (Table 3). Based on testimony by NMFS scientists at the January 1998 Council meeting, there is a high probability that the reductions presented in Scenario A of Table 3 can be achieved. There is also a real possibility that the more optimistic reductions presented in Scenario C could be achieved. In either case, the data conclude that the Council will be able to achieve its goal of a 20 percent SPR by 2019 and maintain a 9.12 million pound TAC, or status quo.

Under the Reef Fish FMP's framework procedure for setting TAC, the Council could have increased the recovery period to the year 2021. As shown in (Table 3), SPR estimates under Scenario A (22.8 percent) and Scenario C (30.7 percent) with a 2021 recovery period, provide greater certainty that the red snapper stock will be rebuilt above the 20 percent SPR level.

Schirripa (1998) presented the range of probability distributions for SPR in 2019 assuming various TACs and specified levels of bycatch reduction beginning in 1997 (Table 2). With a 9 million pound TAC and 60% bycatch reduction in 1998, Table 1 (line for 2018 which allows for the one-year lag in implementation of BRDs) indicates that SPR in 2019 would be 19.3 percent. The more realistic scenarios presented in (Table 3) and discussed above indicate there is no need to reduce the current TAC of 9.12 million pounds in order to meet the current rebuilding goal of 20 percent SPR by the year 2019.

Rejected Alternatives

RED SNAPPER TAC

Rejected Alternative 1: Set the red snapper TAC at 6.0 million pounds (or a lower TAC).

RECREATIONAL BAG LIMITS

Rejected Alternative 2: Set recreational bag and size limits at a more restrictive level than status quo.

Rationale:

Red Snapper TAC: Although the RFSAP recommended an ABC range of 3 to 6 million pounds, supplemental analyses to the red snapper stock assessment (Schirripa 1998) indicated that there is a 50 percent probability of attaining 20 percent SPR by 2019 with a 60% shrimp trawl bycatch reduction at the status quo 9.12 million pound TAC. Additional analyses provided by NMFS and presented in Table 3 provide a more realistic view of current expectations with regard to bycatch reduction and its effects on the Council's rebuilding schedule. Information provided to the Council by Watson et al. (1997a and b) and in his personal communication before the Council in January 1998 indicate that a 60 percent reduction in bycatch, and possibly an even higher level, is possible with BRDs currently being tested. In public testimony to the Council at its January 1998 meeting, charterboat operators and a representative of the Orange Beach tourist industry testified that there would be severe economic disruption to the recreational for-hire industry and to communities dependent upon that industry under a reduced TAC and the resultant lengthening of a recreational quota closure. The Council noted the concerns expressed by the RFSAP and others as to whether BRD regulations would actually be implemented in 1998 and whether they would be effective enough in the initial years to attain 60% bycatch reduction. The Council felt confident, based on statements made by NMFS representatives at the meeting, that such regulations would be implemented in early 1998 and would be sufficiently effective in 1998 and subsequent years to retain the status quo, 9.12 million pound TAC. The Council also noted the need for additional analyses based on scenarios of bycatch reduction at less than 60% in 1998 and perhaps for a few years. Council members expressed concern about the adequacy of the data used in the stock assessment, in particular: the accuracy of the MRFSS charterboat effort estimates; the assumed level of natural mortality for juvenile red snapper; the possibility that higher levels of bycatch reduction may have already occurred due to untrawleable bottom that has not been incorporated into the assessment; and the possibility that a significant number of older red snapper exist in the population and have not been adequately sampled in the fishery-dependent surveys because these fish live off of reefs and in small groups, making them less vulnerable to reef-oriented fishing methods. The Council also felt that a stable TAC level would enhance assessing the effect of BRD reductions of red snapper bycatch on restoration of the stock. Furthermore, because the level of bycatch reduction has a much greater impact on the recovery of the red snapper stock than the level of TAC, the Council felt it was inappropriate to invoke the economic hardships on the industry that would result from a reduction in TAC until BRD regulations have been implemented and the results evaluated.

Red Snapper Bag Limits: With the advent of the recreational quota closure, there is greater certainty that the recreational sector will be constrained to its allocation. Thus, the decision of whether to reduce the bag limit in order to shorten or eliminate a quota closure is primarily based on social and economic factors. In testimony before the Council, charterboat operators, while decidedly unenthusiastic about either alternative, felt that a reduction in the bag limit below 5 fish would hurt their ability to attract paying clients, and would be more damaging to their businesses than a closure. Virtually all who testified on bag limits opposed any reduction from the status quo 5-fish bag limit. Many of those who testified suggested that they could accept a zero bag limit for the captain and crew of for-hire vessels as a means to extend the recreational season. The impacts of such an action were analyzed by NMFS (Holiman 1998) and are summarized in this document under the rationale for the Proposed Alternative. Because of the strong objection to any reduction in the 5-fish bag limit, even if it could shorten or eliminate a quota closure, the Council rejected any reduction in the bag limit, except for the modification to set a zero bag limit for captain and crew of for-hire vessels.

Biological Impacts: The success of the red snapper recovery program is dependent upon implementation of bycatch reduction regulations on the shrimp trawl fishery, and the level of bycatch reduction that is actually attained. At TACs below the proposed alternative (Rejected Alternative 1), there would be only a modest impact on the speed of recovery; however, a lower TAC would require a reduction in recreational harvest resulting in the quota closure occurring at a much earlier date.

Under a 6 million pound TAC, the 1998 recreational quota closure could occur as early as mid-August, and even earlier under lower TACs (Holiman 1998). According to data in the 1995 red snapper stock assessment (Goodyear 1995), age-3 red snapper being recruited into the harvestable size range reach a mean size of 15 inches during June. However, there is variation in the size of age-3 fish above and below this mean. If most of the recreational fishing occurs in the months before the age-3 fish have been recruited into the harvestable fishery, it is possible that an early quota closure will cause fishermen to selectively harvest the faster growing fish within this age-class, leaving the slower growing fish to survive and reproduce. Goodyear (1995) demonstrated that growth rate selectivity is possible when size limits are part of a management program, and warned that, if individual growth is a heritable trait, then strong selection for slower growing parents would have ominous implications for the future productivity of the stock. This growth rate selectivity could also be a consequence of the commercial red snapper "derby" fishery, but is less likely to be affected by the commercial fishery than by the recreational. The commercial harvest is spread out over time by a split season. In addition, the commercial fishery is less heavily concentrated on smaller fish. In 1993, red snapper measuring 15 inches or less constituted 28% of the commercial harvest vs 45% of the recreational harvest (Goodyear 1994).

By spreading harvest out over a longer time period, a reduced bag limit could reduce the potential for the theoretical growth rate selectivity described above. A reduced bag limit may, however, encourage high-grading by recreational fishermen who continue fishing after they have filled their bag limit, discarding the smaller fish and returning with only the largest fish of their catch.

Economic Impacts

There are two major actions considered in this amendment, namely, TAC setting and recreational bag limits. The first proposed action is to retain the 9.12 million pound TAC for the 1998 fishing season; the corresponding rejected alternative is to set the TAC at a lower level, e.g., 6.0 million pounds. Regarding recreational bag limits, the proposed action is to retain the 5-fish bag limit for all anglers, except for captain and crew of for-hire vessels for whom a zero bag limit is proposed. The corresponding rejected alternative is to lower the bag limits for all recreational anglers. Considering the fact that the proposed alternatives, except for the zero bag limits for captain and crew of for-hire vessels, would maintain the status quo, the proceeding analysis attempts to depict the likely effects of the rejected alternatives using the proposed alternatives as benchmarks.

Short-run Impacts on the Commercial Sector

The commercial fishery for red snapper has been managed from 1990 to the present with quotas set at 51% of TAC and seasonal closures upon reaching each year's quota. The season was first closed in August of 1991. The result since then has been derby-like fishing conditions in which fishermen are compelled to harvest fish as quickly as possible to maximize their shares of the overall quota before the season is closed. Seasons have become shorter despite implementation of trip limits and larger minimum size limits. Dockside prices have also fallen to enable the market to absorb the large volume of fish that

are landed during relatively short periods of time. In 1996 and 1997, the commercial quota was set at 4.65 million pounds with 3.06 million pounds to be allocated to a spring season and the remainder allocated to a fall season. The 1997 fall season opened on a 15-day on and 15-day off schedule. Table 4 below presents annual commercial red snapper quota and length of fishing year. About 120 vessels with red snapper endorsement and 300 vessels without endorsement participated in the red snapper fishery in 1996. Vessels with endorsement accounted for as much as 95 percent of total red snapper landings in 1996.

Table 4. Commercial Red Snapper Quota, Size Limit, and Length of Fishing Season

Year	Quota (Million Pounds)	Size Limit (Inches TL)	Duration (Days)
1990	3.10	13	365
1991	2.04	13	235
1992	2.04	13	53 ¹
1993	3.06	13	95
1994	3.06	14	78
1995	3.06	14	51 ²
1996	4.65	15	77 ³
1997	4.65	15	74 ⁴

¹Re-opened for 43 days under a 1,000-pound trip limit.

²Re-opened for 36 hours due to pre-mature closure of the fishery on April 15, 1995.

³Split season.

⁴Split season with second subseason open for first 15 days of each month until the quota was reached.

A TAC of 6.0 million pounds would reduce the corresponding commercial quota by 34 percent, from 4.65 million pounds to 3.06 million pounds. Using the 1996 ex-vessel value for red snapper of about \$7.99 million, the 34 percent quota reduction would translate to a \$2.72 million loss in vessel revenues. (Note: Actually the revenue loss would be slightly less, since given an inflexible demand curve for red snapper, the price may be expected to increase slightly with a reduction in landings). Considering various linkages in economic activities among fishery related industries throughout the Gulf region, this loss would ripple through these industries. Using multipliers based on the Bureau of Economic Analysis' RIMS II input-output model, a \$2.72 million loss in vessel revenues would translate to losses of \$5.96 million in total sales, \$1.9 million in income, and 143 full-time jobs.

Based on a survey of commercial reef fish vessels, Waters (1995) estimated that in 1993 hook-and-line vessels in the northern Gulf, on average, generated revenues from red snapper trips (selling all species caught from these trips) amounting to about \$53,000 and \$11,000 for high- and low-volume vessels,

respectively². From 1993 to 1996, average prices rose by about 8.6 percent so that in 1996 dollars, the average annual revenues per vessel would be about \$58,000 and \$12,000 for high-volume and low-volume vessels, respectively. Given these numbers, a reduction in total industry revenues of \$2.72 million would equate to the revenues of 47 high-volume vessels or 267 low-volume vessels. While the revenue reduction would likely be shared proportionally by all licensed red snapper vessels and no vessels would likely leave the fishery due to the quota reduction, it is not too farfetched to state that a \$2.72 million reduction in industry revenues would force out 47 high-volume "equivalent" vessels or 267 low-volume "equivalent" vessels. Considering that high-volume vessels would likely be holders of red snapper Class I licenses and low-volume vessels of Class II licenses, an equivalent of more than a third of Class I vessels (134), or close to half of all Class II vessels (579), would be "forced out" of the fishery.

It is important to reiterate here that the foregoing discussion was undertaken in the context of "equivalent" vessels, and that no vessels may be expected to exit the fishery entirely. In fact, exiting the fishery without being replaced by another vessel would not be a rational decision given that licenses in a limited access program, such as the case in the commercial red snapper fishery, would command monetary values. Additionally, stacking of two or more licenses on one vessel is not allowed in the red snapper fishery, at least until October 1, 2000, and thus would preclude sale of a license and exit of subject vessel without being offset by entry of another vessel. An owner of a license would be better off either holding on to his/her license until the fishery improves (or license prices go up with improvements in the fishery), or simply sell the license to another vessel owner.

Beginning this year, the commercial fishery will be managed under a license limitation system that is practically the same as the previous endorsement system in terms of the number of participating vessels and trip limits. Given that and as illustrated in Table 4 above, a choice of a 6.0 million pound TAC would likely revert to the 1995 condition with the quota most likely taken in 51 days or less, which is approximately 31 percent fewer days than those in 1997. This time though the 51 days will be spread over several months due to the current rule of opening the fishery for the first 15 days of each month commencing in February. With the reduction in the number of fishing days there would consequently result a reduction in the number of trips taken by vessels, further resulting in reductions of both revenues and fishing costs. As already mentioned above, revenue reductions would approximately amount to \$2.72 million. Waters (1995) estimated total annual cost of all red snapper fishing trips (excluding payments to owners, captains, and crew) at \$2.2 million in 1993, or \$2.4 million in 1996 dollars. Assuming a 31 percent reduction in fishing trips and costs, the resulting reduction in costs would amount to \$0.74 million. Thus vessel net earnings would be reduced by \$1.98 million (\$2.72 million less \$0.74 million), which is a large amount relative to the size of the commercial red snapper fishery. This is the loss that would be borne by owners, captains and crew of vessels in the red snapper fishery.

Short-term Impacts on the Recreational Sector

Table 5 below shows salient features of regulatory rules governing the recreational red snapper fishery. Until 1997, the recreational red snapper fishery had not been closed upon filling its allocation. Instead bag and size limits had been the major tools used to keep this sector within its allocation. The recreational

²Waters used the 75th percentile of annual reef fish landings as reported on logbooks to categorize vessels as high-volume or low-volume.

sector exceeded its allocation every year from 1991 through 1995, although harvests had been declining since 1993. In 1995, this sector experienced further restrictive management through an increase in the minimum size limit from 14 to 15 inches and a reduction in the bag limit from 7 to 5 fish. Harvests in 1996 were still higher than the old allocation, but lower than the increased allocation. In 1997, this sector was projected to exceed its allocation, and pursuant to the Magnuson-Stevens Act requirement, the fishery was closed on November 27, 1997. Four of the five states in the Gulf of Mexico were unable to or did not close their state waters to recreational fishing for red snapper. Per public testimony at the January Council meeting, the recreational fishery closure disrupted many for-hire and tourist businesses mainly through fishing trip cancellations or postponements.

Table 5. Management Features of the Recreational Red Snapper Fishery

Year	Allocation ¹ (Million Pounds)	Size Limit (Inches TL)	Bag Limit (Number of Fish)
1990	2.97	13	7
1991	1.96	13	7
1992	1.96	13	7
1993	2.94	13	7
1994	2.94	14	7
1995	2.94	15	5
1996	4.47	15	5
1997 ²	4.47	15	5

¹Considered a quota beginning 1997.

²The recreational fishery in the EEZ was closed on Nov. 27 - Dec., 1997.

Unlike the case with the commercial sector, there are likely to be changes in the recreational sector even if the status quo TAC and recreational quota are maintained. This is primarily due to the new provision that the fishery be closed upon reaching its quota. Holiman (1998) conducted 1998 harvest and closure projections under various assumptions regarding bag limits and average weight of fish caught, among others. Table 6 below summarizes these projections assuming the average weight of recreationally caught red snapper in 1998 to be the same as that in 1997, i.e., 3.85 pounds.

Table 6. Recreational Harvest and Closure Projections for 1998

Bag Limit	Harvest (MP)	Closure Date	
		TAC=9.12 MP Quota=4.47 MP	TAC=6.0 MP Quota=2.94 MP
5	4.72	Mid-December	End of July
4	3.85	No Closure	Early October
3	3.29	No Closure	End of November
2	2.53	No Closure	No Closure

Note: Bag limits are assumed to be uniform for all anglers, including captain and crew of for-hire vessels.

While there is also a proposal to reduce the bag limit for captain and crew to zero under a TAC of 9.12 million pounds, this has been estimated to effect a mere 3 percent reduction in projected harvest (Holiman, 1998). In essence the closure scenarios depicted in Table 6 would only be minimally altered. This minimal effect nonetheless could reduce further the possibility of closure in the recreational fishery under a TAC of 9.12 million pounds and bag limit of 5 fish, because under this scenario there is virtually only a two-week closure of the recreational fishery.

It appears that to assure no closure in the recreational fishery, the bag limit needs to be reduced. The amount of the reduction depends on the TAC (and quota) chosen, and thus ranges from 1 fish under status quo TAC to 3 fish under a TAC of 6.0 million pounds. Under the reduced TAC, the recreational fishery is faced with a trade-off between a shorter season with higher bag limits and a longer season with lower bag limits. From an economic efficiency standpoint, the trade-offs can take place until the marginal benefits from longer season equal the marginal costs from reduced bag limits. The relevant economic values here include those pertaining both to anglers and to for-hire vessel operations. In the absence of estimates of such values, the ensuing discussions will focus only on the economic implications of reducing the TAC to 6.0 million pounds.

Under a TAC of 6.0 million pounds and a bag limit of 5 fish, the recreational fishery would be closed from August through December. Based on 1995 and 1996 MRFSS data by wave (Holiman, 1997), an average of 132,000 red snapper catch trips were undertaken from August through December. This number is approximately equivalent to 41 percent of all red snapper catch trips for the entire year. For the same period, anglers took an average of 33,000 red snapper target trips, or about 19 percent of all red snapper target trips for the year. Worth noting here is the fact that 51 percent of anglers listed no target species. The economic implications of these reductions will be discussed below.

Catch trips refer to angler trips by all fishing modes, i.e., shore, private, and charter, during which red snapper are caught. Target trips refer to trips for which anglers specified red snapper as their primary or secondary target regardless of whether red snapper is caught. As shown earlier in Figure 13, charterboats accounted for most of the trips, followed by private/rental mode. Catch trips by shore mode were negligible. A similar picture is displayed in Figure 12 for target trips. Catch trips also refer to trips during which red snapper is caught but not necessarily landed. In fact, Holiman (1998) reported that 17 percent of total red snapper catch trips by charterboats and 31 percent of total red snapper catch trips by private mode did not land red snapper. These trips caught and released red snapper. It is also noted that of the total red snapper catch trips, about 12 percent in the charter mode and 2 percent in the private mode landed more than the 5-fish red snapper bag limit. Also, since the MRFSS survey covers two months every wave, the August trips are taken to be half of all trips in Wave 4 (July/August).

For purposes of the ensuing discussion, it is assumed that a closure from August through December would reduce fishing trips by 19 to 41 percent. It is likely that the actual reduction in trips would be less than 41 percent for a variety of reasons. One such reason is that, in effect, closure in this fishery may be considered equivalent to zero bag limits, since the bag limit rule is a possession rule. Catch and release then may still be practiced under this condition, although this may be more likely for the private mode than for the charter/headboat mode. It is to be noted, nonetheless, that target trips would unlikely be taken during the closure, especially through the charter/headboat mode. Another reason is that anglers have landed more than the bag limit. They may still catch and land red snapper during the closure; however, the likelihood of getting caught would be higher. The basic assumption then in using the upper limit of

the percentage reduction in trips is that both those landing no red snapper and those landing more than the bag limit would be forced to quit fishing during the closed period.

The estimated reduction in trips has a corresponding economic value, but presently there is no estimate of economic value for a red snapper fishing trip in the Gulf. There is, however, some information in other fisheries. In a general survey of empirical evidence of valuing marine recreation, Freeman (1993) found the value to range from \$0.97 to \$799 per trip. Estimates for fisheries in the Gulf and Florida in particular fall within this range. For example, Bell et al. (1982) reported a value of \$58 per trip which was estimated within the context of Florida residents' valuation of access to Florida marine fisheries. Leeworthy (1990) estimated for king mackerel a value of \$47 per trip. Greene et al. (1994) showed a value for reef fish of \$676 per trip. Since there is no compelling reason to use one estimate over the others, the general range reported by Freeman (1993) may be used to provide a general range of impacts. Using this range, a closure of the recreational fishery from August through December would reduce economic value from \$32,000 to \$128,000 using the value of \$0.97 per trip. Assuming instead the value of \$799 per trip, total loss to the recreational sector would range from \$26.4 million to \$105.5 million. Although the estimated values provide a general picture of the range of effects of closing the red snapper fishery from August to December, it is deemed that the "true" impacts of the closure on recreational anglers would be substantially greater than \$32,000 and less than \$105.5 million.

Another sector potentially affected by the August to December closure of the recreational red snapper fishery is the for-hire vessel industry which is comprised mainly of charter and headboats. For-hire vessels are required by all Gulf states to secure licenses in order to operate in state waters. Only since January 1996, as implemented through Amendment 11, have for-hire vessels been required to secure federal permits. This federal permitting rule also stipulates that such vessels possess appropriate licenses required by states (e.g., charter, head, or guide boat licenses). NMFS records show that as of February 1998, about 717 for-hire permits have been issued for the entire Gulf. This number is rather low even compared to the 930 charter and headboats operating in the Gulf in 1987 (see Ditton et al., 1988 and Holland and Milon, 1989). In fact, this number is well below that determined to comprise the population of charter and headboats used for survey purposes. Holiman (pers. comm., 1998) reported that there are about 165 headboats in the Gulf, of which 57 are in Alabama and Florida (west coast), 9 in Louisiana, and 18 in Texas. Of the reported Alabama and Florida head boats, there is a strong possibility that 5 are in Alabama and the rest in Florida. He also reported that, exclusive of Texas for which there are no estimates of charterboats, there are 2,392 charterboats in the Gulf, of which 89 are in Alabama, 1,987 in Florida (west coast), 249 in Louisiana, and 67 in Mississippi. Excluding charterboats in Texas, it is estimated that only 28 percent of charter and headboats in the Gulf have federal charter/headboat reef fish permits. It is possible that this low proportion of federally permitted for-hire vessels is indicative of the majority operating mainly in state waters. It is also possible that this could be a result of a lack of knowledge about the federal permitting system, despite the fact that the federal permit requirement has been in effect for two years. A case like this occurred with the coastal migratory pelagic charter/headboat permitting system for several years after its implementation. In that fishery, there were reportedly many for-hire vessels that did not possess the required federal permit apparently due to lack of knowledge of such a requirement. This problem surfaced only a couple of years ago when the Council entertained (but did not adopt) a proposal to impose a moratorium on such permits. Even then, the required federal permit had already been in existence for about 10 years. At any rate, a range of 717 to 2,557 for-hire vessels operating in the Gulf may be considered to be adversely affected by the August-December recreational fishery closure under a TAC of 6.0 million pounds.

At this stage, there are two points worth raising regarding the number of for-hire vessels that may be affected by a potential closure of the recreational red snapper fishery. First, the lower number is based on NMFS permit file for the entire Gulf. There would naturally be some permitted vessels that do not participate in the red snapper fishery, but at this time this information is not readily available, so that the lower limit of 717 is maintained. Second, the upper number does not include charterboats operating off of Texas. In addition, some for-hire vessels in Florida may not participate in the red snapper fishery. In an earlier survey of Texas for-hire industry, Ditton et al. (1988) reported that 112 charterboats operated in Texas. There are, however, some reports that the number could be as high as 400 or even 800, but in the absence of more reliable information, the number of charterboats in Texas may be considered to equal 112. In the case of Florida, for-hire vessels in the Panhandle area are the ones most likely to participate in the red snapper fishery. In an earlier study of for-hire vessels in Florida, Holland and Milon (1989) reported that about 27 percent of all charter and headboats in the west coast of Florida operated out of the Panhandle. Applying this percentage to the number of for-hire vessels in Florida yields 536 charterboats and 14 head boats operating in the Panhandle area. Given these adjustments, the number of for-hire vessels participating in the red snapper fishery could range from 717 to 1,099. The state-by-state distribution of charterboats would be: 89 in Alabama, 536 in Florida, 249 in Louisiana, 67 in Mississippi, and 112 in Texas. The corresponding distribution for headboats would be: 5 in Alabama, 14 in Florida, 9 in Louisiana, none in Mississippi, and 18 in Texas.

Based on an earlier study of charter and headboats in the Gulf (Ditton et al., 1988; Holland and Milon, 1989), Table 7 is generated showing the average gross revenue of for-hire vessels, with the dollar value converted to 1996 dollars.

Table 7. Average Annual Gross Revenue of Representative For-hire Vessels

State	Charterboat (Dollars)	Headboat (Dollars)
Florida	85,746	153,870
Alabama	44,229	124,827 ¹
Louisiana	63,204	
Mississippi	52,164	
Texas	35,561	

¹Average for head boats in Alabama, Louisiana, Mississippi, and Texas.

There is a good possibility that some of these numbers would be relatively low compared to more recent conditions in the industry. For example, an economic impact study of charter fishing in Orange Beach, Alabama (Malone, 1994) reported that 105 boats earned a total of about \$10.4 million in 1994 from charter fees and miscellaneous crew fees (fish cleaning, tips, etc.), or roughly \$99,000 per boat. This is more than twice that reported in Table 7. At any rate, the numbers reported in Table 7 can provide general approximations of the impact on for-hire vessel revenues resulting from an August-December closure.

Based on 1995-1996 MRFSS data, angler trips catching red snapper through the charterboat mode averaged 72,000 for the August-December period. This represents approximately 42 percent of all red snapper angler catch trips for the year taken through charterboats. Based on 1994-1995 headboat surveys (NMFS, 1996), an average of 176,000 angler days were taken in headboats operating in Northwest Florida through Texas. Of this total, about 63,000 were taken during the August-December period, or approximately 36 percent of total angler days for the year. In the absence of information regarding the amount of vessel revenue specifically generated from fishing for red snapper during the months of August through December, it is simply assumed that for-hire vessel in Alabama through Texas would cease fishing entirely during the closed months, or if they continue fishing, earn only a relatively minimal amount. In this case, the revenue loss would be about 42 percent for charterboats and 36 percent for headboats. For-hire vessels in Florida are less likely to be as dependent on red snapper as those in the rest of the Gulf states. To account for this condition, the percentage reduction of trips for Florida for-hire vessels is modified by the proportion of time expended by these vessels in targeting snappers. According to Holland and Milon (1989), the mean percent of time expended in targeting snappers by for-hire vessels operating in Florida Panhandle is approximately 21 percent for charterboats and 38 percent for headboats during the period August to December. Table 8 below summarizes the potential revenue impacts of a 42 percent and 36 percent reduction in red snapper trips by charter and headboats, respectively.

Table 8. Gross Revenue Reductions from an August-December Closure of the Red Snapper Fishery

State	Charterboats (Million Dollars)	Headboats (Million Dollars)
Florida	4.50	0.30
Alabama	1.65	1.44 ¹
Louisiana	6.61	
Mississippi	1.47	
Texas	1.67	
Total	15.90	1.74

¹Average for headboats in Alabama, Louisiana, Mississippi, and Texas.

There are several points worth mentioning regarding the results shown in Table 8. First, the estimates refer to gross revenues while the more important economic variable would be net profit. Second, if the Alabama experience mentioned earlier is indicative of the general present conditions for charter fishing operations throughout the Gulf, then potentially the impacts of a closure could be twice as much as those reported in Table 8. Third, dependence on red snapper varies across the Gulf so that there would arise more differential impacts on for-hire vessel operations across the Gulf than possibly indicated in the table. Those vessels in areas that depend more on red snapper as a major selling point of charter and headboat trips would bear more of the impacts, since species substitution would not be a viable alternative for success in their operations. Fourth, there is a good possibility that an August to December closure of the fishery would be too burdensome for many for-hire vessels to remain in the fishery. It is likely that some trips previously taken during the period August to December may be re-scheduled early in the year, but this would likely fall short of offsetting the loss of the August-December trips. The number of trips made

by for-hire vessels would be limited by the number of days open for fishing. While the number of vessels possibly exiting the fishery cannot be determined, it may be noted that the revenue losses shown in Table 8 in conjunction with Table 7 would be equivalent to the gross revenues of about 52 charterboats in Florida, 38 charterboats in Alabama, 104 charterboats in Louisiana, 28 charterboats in Mississippi, and 46 charterboats in Texas. The corresponding headboat number would be 2 in Florida and 11 in other areas of the Gulf. In the event that vessels exit the fishery, additional losses would be incurred in terms of reduction in the value of boat and other boat-related investments.

If instead of a closure, a reduction in bag limit is instituted, Table 6 shows that, under a TAC of 6.0 million pounds, the bag limit needs to be reduced to 2 fish in order to keep the fishery open year round. This lower bag limit is equivalent to a 60 percent reduction in the expected catch rate. It may be noted, however, that not every angler catches his/her bag limit, although some anglers reported keeping more than the legal limit of 5 fish. This is partly borne out by the level of projected landings reported in Table 6, which shows a decline of only about 46 percent (from 4.72 to 2.53 million pounds). On the other hand, this reduction is higher than the 34 percent reduction in recreational quota from 4.47 million pounds to 2.94 million pounds. In examining the catch distribution by fishing mode based on MRFSS data, Holiman (1998) estimated that a reduction in the bag limit from 5 to 2 fish would reduce recreational catch by 26 percent in the private/rental mode and 33 percent in the charter mode. This assumes no change in fishing behavior, especially by those keeping more than 5 fish, with the reduction in bag limit. While a similar analysis has not been done for headboat catches, it appears that a fair amount of reduction in catch would come from this segment of the recreational fishery. In 1996 alone, headboat landings of red snapper accounted for 34 percent of all recreational red snapper landings. In addition, headboats are dependent on red snapper, with this dependence increasing as one moves from Florida to Texas. Based on 1995-1996 headboat catches, Holiman (pers. comm., 1998) reported that red snapper relative to total headboat catches comprised about 6 percent in Florida and Alabama, 38 percent in Louisiana, and 64 percent in Texas.

The reduction in catch rate resulting from a lower bag limit cannot be translated in economic terms due to the absence of recreational red snapper demand estimates. Current recreational demand estimates in other fisheries in the Gulf are quite variable. Milon (1988) estimated the demand for king mackerel trips in the Gulf using travel cost techniques, and found a statistically significant relationship between catch rates and angler trips. Analogous statistically significant results were found by Green (1989) for red drum and Leeworthy (1990) for Gulf king mackerel. Leeworthy's (1990) estimates, while showing a statistically significant relationship between angler trips and catch rates of king mackerel in the South Atlantic area, the relationship was negative. This result is rather counterintuitive since it would mean that improving catch rates would lead to reductions in angler trips. He rejected this relationship in favor of the positive, significant results for the Gulf area. Milon (1993) re-estimated the demand for king mackerel in the Gulf using more recent data (1990 and 1991), and found no statistically significant relationship between angler trips and king mackerel catch rates. His comparison of king mackerel demand estimates led him to state that ". . . it is not possible to conclude that king mackerel catch rates influence the number of trips taken by anglers who target king mackerel." This statement refers to overall anglers and does not distinguish anglers by mode of fishing. Greene et al. (1994) estimated the recreational demand for reef fish in the Gulf under various specifications. Their generalized least squares estimates resulted in a statistically significant but negative relationship between catch rates and angler trips for the combined data set. On the other hand, the trip and catch rate relationship was found to be positive and statistically significant for single day Florida trips. However, Greene et al. (1994) cautioned against using this estimate in calculating consumer surplus. The model is based on single day Florida trips, and more

importantly, the estimated price coefficient is negative and not statistically significant from zero. A price term approaching zero implies that recreational fishing would command an infinite value at this range. Given existing recreational demand estimates, it is not possible to translate the projected reduction in catch rates into angler economic surplus.

A reduction in the bag limit would adversely affect the revenue and profitability conditions of for-hire vessels through reductions in catch and expected catch rates. The severity of impacts depends mainly on the amount of reduction in catch and expected catch rates. In principle, both catch and expected catch rates play an important role in the recreational fishery. Expected catch rate plays an even more important role in the for-hire vessel industry, because it serves as a major feature in selling trips. In that event, the for-hire industry would be faced with the potential impacts of a catch reduction greater than the estimated 33 percent based on catch distribution or 34 percent based on quota reduction. The catch reduction that this industry has to contend with could be as high as 60 percent, which is the equivalent of reducing the bag limit from 5 to 2 fish.

Basically, the impacts on for-hire vessel revenues and profits resulting from a reduction in catch and expected catch rates depend on the reaction of fishing customers in terms of the number of trips taken. There are individuals that would take fewer trips or stop fishing at all even if expected catch rates are only slightly reduced. On the other hand, there are others that would continue to fish even at relatively low catch rates. Part of the reason for this behavior is the particular individual's valuation of a red snapper trip. Another part of the reason is the presence of other factors, such as income and leisure time, shaping one's demand for a red snapper trip. Such behavior can be quantitatively captured by estimating the demand for red snapper trips, and in particular the demand for red snapper trips through for-hire vessels. A usual demand function would show the reduction in trips taken as catch rates are reduced. Unfortunately, as discussed earlier, an estimate of recreational demand for red snapper trips is not available. In addition, demand estimates for other fisheries in the Gulf found contrasting results regarding the relationship between trips and catch rates.

Another piece of information that is not available but essential in determining the revenue or profitability impacts on for-hire vessels is a revenue or profit function for these vessels. Through this function, reductions in the number of trips can be translated to revenue or profit losses of for-hire vessels. In general, both revenues and costs would fall as the number of trips taken is reduced. Interestingly, profits could fall, remain constant, or even rise under the condition of reduced revenues and costs depending on the relative changes in revenues and costs. At any rate, for-hire vessels could continue to operate even at a reduced number of trips so long as operating revenues (mainly composed of charter fees and other fees, such as bait, food and drinks, fish cleaning, use of rod and reel, etc.) cover operating expenses. Below this "shut-down" point, it would be less costly for vessel owners to stop operation entirely and liquidate the assets. This point ultimately corresponds to some level of expected catch rate or bag limit and likely varies across vessels. That specific bag limit could be 4 fish for some vessels, 3 fish for others, or even lower for some other vessels. Unfortunately, the absence of relevant information precludes determination of that specific bag limit.

In the absence of needed information mentioned above, the impacts of bag limit reduction on the operation of for-hire vessels is conducted in the same manner as was done for the closure alternative -- an estimation of gross revenue impacts. For this purpose, a range of impacts is calculated, except for Florida. Similar to the case of the closure alternative, it may be contended that charterboats in Florida are not as dependent on red snapper as those in other Gulf states. The upper limit of this range assumes that vessel revenues

would be reduced by the full amount of expected catch rate reduction, i.e., 60 percent for both charter and headboats. The lower limit takes into account the percent of each trip attributed to fishing for red snapper. This percentage would vary across vessels and across the Gulf. The estimates of Ditton et al. (1988) and Holland and Milon (1989) of the mean percent of time targeted for snappers (none specific to red snapper) by charterboats are: 21 in Florida, 51.1 in Alabama, 8 in Mississippi, 14.1 in Louisiana, and 8.1 in Texas. The corresponding percentages for headboats are: 38 in Florida and 50.4 in Alabama through Texas. There is no compelling reason that these percentages have not changed through the years, but in the absence of more recent information, these percentages will be used to estimate the lower bounds of impacts. Table 9 presents results of the described calculations.

Table 9. Gross Revenue Reductions from a Reduction in the Bag Limit from 5 to 2 Fish

State	Charterboats (Million Dollars)	Headboats (Million Dollars)
Florida	5.79	0.49
Alabama	1.21 - 2.36	2.40 ¹
Louisiana	1.33 - 9.44	
Mississippi	0.17 - 2.10	
Texas	0.19 - 2.39	
Total	8.69 - 22.08	2.89

¹Average for headboats in Alabama, Louisiana, Mississippi, and Texas.

Similar points earlier raised in the closure alternative apply here. In addition, it may be noted that the lower bound in revenue reductions due to a bag limit reduction are smaller than those estimated for the closure alternative. A major reason here is the adjustment made to the percentage in bag limit reduction by the mean percent of time expended by charterboats in targeting red snapper. This adjustment is made to take into account the possibility that some charterboats may remain in operation throughout the year under the bag limit reduction. In the case of closure, it was assumed that charterboats cease operation entirely during the closed months of August to December.

Long-run Impacts

As discussed above, reducing TAC from 9.12 million pounds to 6.0 million pounds would entail relatively large short-run economic losses to both the commercial and recreational sectors. Whether these losses can be more than compensated for in the long run depends on how fast the stock recovers and therefore allows less restrictive management. Red snapper TAC and the level of bycatch reduction in the shrimp trawl fishery are the key parameters in the recovery of the red snapper stock to the target level of 20 percent SPR by 2019 (see Table 3); however, bycatch reduction is the most significant .

In addition and as intimated by the RFSAP, management could also be altered from a constant catch to constant F strategy.

An interplay of TAC and bycatch reduction has been explored in the "Biological Impacts" section of this document. One major conclusion from that discussion is that a TAC of 9 million pounds combined with a 60 percent bycatch reduction in 1998 would allow a 50 percent probability of reaching the target SPR by 2019. Other scenarios for bycatch level reduction were also explored, with the conclusion that there is a high probability that the 20 percent SPR goal will be reached by the target date of 2019.

While the RFSAP noted Schirripa and Legault's (1998) estimate that a TAC of 9.0 million pounds could be maintained and still practically meet the target SPR by 2019 or thereabout so long as the bycatch reduction of 60 percent is achieved, they recommended an ABC range of 3.0 to 6.0 million pounds. They stipulated four reasons in support of this recommendation. These reasons have been mentioned and discussed elsewhere in this document, but one of these is relevant to the issue at hand. The RFSAP noted that a reduction in TAC over status quo begins the transition to management based upon constant F. This management strategy was recommended by the Peer Review Panels although the concept has been discussed in various occasions in the past by the RFSAP. A constant F strategy is a radical change in the management of red snapper, and is particularly relevant in assessing the potential long-run impacts of management for red snapper.

An economic evaluation of alternative TACs and corresponding commercial and recreational quotas entails maximization of the net present value of catches over a fairly long time horizon. For regulations to be effective, catches must be reduced in the short-term, and later may be increased when the fish population increases in size. A lower TAC would yield smaller benefits in the short-term, but would also lead to a faster realization of the benefits of a larger red snapper resource in the future made possible by faster recovery of the fish stock. Conversely, a higher TAC would generate larger short-term benefits at the expense of a slower stock recovery. Thus, the economic problem is characterized as a tradeoff in benefits (and losses) due to changes in catches over time.

Considering that in the red snapper case, losses or forgone benefits during the rebuilding period are expected to be incurred through restrictive management, the major issue turns to determining the nature and magnitude of benefits after the rebuilding period. The SEP (1997) has already laid down some of the details in analyzing the long-term economic implications of managing the red snapper resource. An important component of this analysis is information regarding the potential harvest over time, particularly at that time when less restrictive regulations may be instituted. Some of this information is already available, but most still needs to be generated. Schirripa and Legault (1998) estimated some potential yield streams under a constant F strategy. At a bycatch reduction level of 44 percent and a 16-inch minimum size limit, a constant $F_{20\%SPR}$ strategy would attain a potential yield of 44 million pounds in 2020. At a higher bycatch reduction level of 66 percent and the same 16-inch minimum size limit, a constant $F_{20\%SPR}$ strategy would allow a potential yield of 126 million pounds. These terminal numbers are definitely very high especially when contrasted with other current information about the potential stock size of red snapper. NMFS (1995) through a publication entitled "Our Living Oceans" listed the long-term potential yield for red snapper in the U.S. Gulf of Mexico at 15,000 metric tons, or about 33.0 million pounds. In addition, the maximum historical landing of red snapper by the commercial sector occurred in 1964 and 1965 and stood at about 14.1 million pounds, half of which was taken from Mexican waters. Whatever the actual level of future harvest level in the distant future, one major consideration that demands attention is that these strategies would imply imposition of a TAC of 1.2 million pounds and 2.4 million pounds, respectively, in 1998. These are very restrictive TACs that would definitely result in short-run losses to both the commercial and recreational sectors far greater than those

estimated above with a TAC of 6.0 million pounds. Although there is the general feeling that higher allowable catches would mean higher benefits, the long-term effects are actually not that easy to assess.

In addition to modeling issues (the biological model appears to be in better shape at this stage than its economic counterpart), there are more fundamental issues to contend with over the long-run. On the biological side, such issues as the effects of greater red snapper abundance on other species and the nature and extent of the carrying capacity would take on more important roles. On the economic side, the management system adopted for both the commercial and recreational sectors and the nature of the commercial and recreational market for red snapper would become major determinants in assessing the economic effects of greater red snapper abundance. On top of all these, there is the issue of impacts on fishing communities. There is currently a dearth of information on fishing communities to assess short-run impacts of management changes, and if information is not improved, assessment of the long-term impacts of management on fishing communities and overall assessment of long-term effects will fall far short of being considered adequate.

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.....	\$37,500
NMFS administrative costs of document preparation, meetings, and review.....	\$ 24,000
Law enforcement costs.....	\$ none
Public burden associated with permits.....	\$ none
NMFS costs associated with permits.....	\$ none
TOTAL.....	\$61,500

The Council and Federal costs of document preparation are based on staff time, travel, printing and any other relevant items where funds were expended directly for this specific action. The proposed measures are not expected to incur additional enforcement cost and permit cost to either the public or NMFS.

Summary of Economic Impacts

In principle, maintaining the status quo for TAC and general recreational bag limit would entail no direct changes on both the commercial and recreational participants in the red snapper fishery. Potential

closures in both commercial and recreational sectors of the fishery are not direct results of maintaining the status quo.

The proposed measure to reduce to zero the bag limit for captain and crew of for-hire vessels is expected to reduce projected recreational harvest by 3 percent. While this measure would potentially reduce the benefits of captain and crew, such reduction is compensated for by reducing the possible length of closure in the recreational red snapper fishery. No estimation of net effect was conducted due to the absence of relevant data.

Although the proposed measures, except the zero bag limit for captain and crew of for-hire vessel, would maintain the status quo, the foregoing analysis explored the potential impacts of lowering the TAC to 6.0 million pounds. Results from that analysis indicate that such reduction would result in the commercial sector experiencing fewer number of fishing days with the attendant adverse effects. In general, annual ex-vessel revenues would decline by about \$2.72 million, or when expanded by economic multipliers, by \$5.96 million in total sales, \$1.9 million in income, and 143 full-time equivalent jobs. Commercial vessel net earnings would be reduced by about \$1.98 million.

A TAC of 6.0 million pounds would either result in closing the recreational fishery from August to December under a 5-fish bag limit or in keeping the fishery open year round under a 2-fish bag limit. Results of either option cannot be translated directly into economic terms due to absence of relevant information. Use of estimates in other fisheries, or marine recreation in general, indicates that a closure would reduce annual economic benefits to anglers from a low of \$32,000 to a high of \$105.5 million. Both the lower and upper limits, however, are deemed to be unrealistic. The closure may also be expected to reduce annual gross revenues to the for-hire vessels by as much as \$17.64 million. The corresponding losses to these vessels by reducing the bag limit to 2 fish in order to keep the fishery open year round could range from \$11.58 million to \$24.97 million. Corresponding losses to recreational anglers from such reduction in bag limits cannot be estimated.

The long-term impacts of reducing TAC could not be estimated, but several issues have been raised when assessing the long-term effects of managing the red snapper resource.

Government costs are estimated at \$61,500, and all cost items pertain to the Council and NMFS costs in preparing this document.

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) an annual effect on the economy of \$100 million or more; b) a major increase in costs or prices for consumers, individual industries, Federal, State, or local government agencies, or geographic regions; c) significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets; 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.

The entire commercial red snapper fishery had an ex-vessel value of about \$7.99 million in 1996. There is currently no adequate measure of the recreational red snapper fishery impacted by the proposed regulation. Results from demand estimates in other fisheries indicate that the economic impacts from

lowering the TAC to 6.0 million pounds could be substantial although given the estimates used for the current purpose, it is deemed that the impacts would not exceed the \$100 million mark. Considering that the proposed action is to maintain status quo, it is concluded that any revenue or cost impacts on the fishery would be significantly less than \$100 million annually.

In maintaining the TAC at 9.12 million pounds, commercial and for-hire vessel costs of fishing operations remain unaffected. In addition, prices to consumers are not expected to be affected by the proposed action. The proposed zero bag limit for captain and crew is expected to reduce catch by only 3 percent. Note, however, that this reduction is relative to the projected harvest under status quo which has been estimated to exceed the recreational quota. As can be gleaned from the cost estimates, there are no major increases in cost to the Federal, State, or local government agencies. In fact the costs incurred by these agencies are only those that are directly related to the formulation of the proposed regulation. Since the proposed regulation has no adverse effects on the commercial and for-hire sectors, except potentially on captain and crew of for-hire vessels, any of the sub-items under item (c) above would not apply.

Maintaining the status quo for TAC and the bag limit, except for captain and crew of for-hire vessels, is not expected to raise novel legal or policy issues.

Based on the foregoing, it is concluded that this regulation if enacted would not constitute a "significant regulatory action" under any of the criteria enumerated above.

Determination of the Need for an Initial Regulatory Flexibility Analysis

Introduction

An Initial Regulatory Flexibility Analysis (IRFA) is conducted primarily to determine whether the proposed 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 IRFA provides an estimate of the number of small businesses affected, a description of the small businesses affected, and a discussion of the nature and size of the impacts.

The Regulatory Flexibility Act requires a determination as to whether or not a proposed rule has a significant impact on a substantial number of small entities. If the rule does have this impact then an Initial Regulatory Flexibility Analysis (IRFA) has to be completed for public comment. The IRFA becomes final after the public comments have been addressed. If the proposed rule does not meet the criteria for "substantial number" and "significant impact," then a certification to this effect must be prepared.

Determination of Significant Economic Impact on a Substantial Number of Small Entities

In general, a "substantial number" of small entities is more than 20 percent of those small entities engaged in the fishery (NMFS, 1992). In 1992, a total of 2,195 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 1,532 active permits, of which 134 also hold red snapper Class I licenses and 579 hold red snapper Class II licenses. Others are in the process of being renewed. There are currently 717 permits issued to charterboats and party boats operating in the Gulf, although based on population of for-hire vessels used for survey purposes, there could be as many as 2,557 for-hire vessels operating in the Gulf.

The Small Business Administration (SBA) defines a small business in the commercial fishing activity as a firm with receipts of up to \$3.0 million annually. SBA also defines a small business in the charterboat activity as a firm with receipts up to \$5 million per year.

All of the commercial reef fish harvesting entities affected by the rule will qualify as small business entities because their gross revenues are less than \$3 million annually. In addition, for-hire vessels in the Gulf affected by the proposed rule generally earn less than \$5 million in annual revenues and are thus considered to be small business entities. Hence, it is clear that the criterion of a substantial number of the small business entities comprising the commercial reef fish harvesting industry and the for-hire sector being affected by the proposed rule will be met. The outcome of "significant impact" is less clear but can be triggered by any of the five conditions or criteria discussed below.

The regulations are likely to result in a change in annual gross revenues by more than 5 percent. Of the two measures proposed none is expected to reduce gross revenues of commercial and for-hire vessels. However, the proposed zero bag limit for captain and crew of for-hire vessels would potentially reduce the income of these persons by an unknown amount. To the extent, however, that such bag limit would allow for-hire vessels to operate longer in the season, the gross revenues of these vessels would likely be enhanced although by less than 5 percent of total revenues.

Annual compliance costs (annualized capital, operating, reporting, etc.) increase total costs of production for small entities by more than 5 percent. No production cost increases are expected by maintaining the status quo for TAC and the 5-fish bag limit for anglers.

Compliance costs as a percent of sales for small entities are at least 10 percent higher than compliance costs as a percent of sales for large entities. All the firms expected to be impacted by the rule are small entities and hence there is no differential impacts to contend with.

Capital costs of compliance represent a significant portion of capital available to small entities, considering internal cash flow and external financing capabilities. There are no expected change in capital costs of complying with the proposed rule.

The requirements of the regulation are likely to result in a number of the small entities affected being forced to cease business operations. This number is not precisely defined by SBA but a "rule of thumb" to trigger this criterion would be two percent of the small entities affected. Considering that status quo is maintained for TAC and bag limit for recreational anglers, no business entity is expected to cease operation, except through the normal course of business. The zero bag limit for captain and crew of for-hire vessels would not impinge on the financial viability of for-hire vessels.

Conclusion

In view of the determination that none of the criteria for considering the proposed rule as effecting a significant economic impact on small business entities would be met, it is concluded that an IRFA is not needed.

10. ENVIRONMENTAL ASSESSMENT

Environmental Consequences

Physical and Human Environment: The actions proposed in this amendment will have no impact on the physical environment. Had a reduced TAC or reduced bag limit been implemented, there would have been a decreased ability of recreational for-hire boats to attract customers and an increased time when the recreational fishery is closed. During closed seasons, losses would be sustained not only by the owners and operators of the for-hire vessels, but also by tackle shops, hotels, restaurants, and other industries in the fishing communities that are dependent upon the fishing tourist industry. The proposed actions minimize this negative impact, and provide stability in the recreational red snapper regulations for at least one more year.

Fishery Resource: Provided that a 60% shrimp trawl bycatch reduction can be achieved, the actions proposed in this amendment are consistent with the Council's objective of rebuilding the overfished red snapper stock within one and a half generation times. The proposed TAC of 9.12 million pounds is within the 50% probability of achieving 20 % SPR by 2019 under these assumptions. Of course, the expected impact of bycatch reduction is based on assumptions about natural mortality rates and computer projections. Implementing bycatch reduction and observing, rather than projecting, its impact should result in improved management in the future. Maintaining a constant TAC during the phase-in of bycatch reduction regulations will allow management to assess the actual impact of bycatch reduction without the complicating factor of a fluctuating TAC.

Charterboat fishermen testified at the January 1998 Council meeting that they were able to attract few customers during the 1997 recreational closure. If this behavior persists, then effort shifting to other species during the closed seasons may be insignificant. However, it is also possible that, as fishermen adjust to having a red snapper open and closed season, effort on alternative species may begin to increase over time. Species such as vermilion snapper or triggerfish may be likely substitute species in the reef fish fishery, but it is also possible that effort shifting could affect non-reef fish species such as mackerels or other coastal species.

Effect on Endangered Species and Marine Mammals: It is requested that NOAA conduct a consultation under Section 7 of the Endangered Species Act. It is anticipated that the proposed actions will not jeopardize the recovery of endangered or threatened species or their critical habitat.

Effect on Wetlands: The proposed action will have no effect on flood plains, wetlands, or rivers.

Mitigating Measures: No mitigating measures related to the proposed actions are necessary because there are no harmful impacts to the environment.

Unavoidable Adverse Effects: The proposed action does not create unavoidable adverse affects.

Irreversible and Irretrievable Commitments of Resources: There are no irreversible commitments of resources expected from implementation of this regulatory amendment.

Finding of No Significant Environmental Impact

The proposed amendment is not a major action having significant impact on the quality of the marine or human environment of the Gulf of Mexico. The proposed actions are adjustments of the original regulations of the FMP under the framework procedure set forth in Amendment 1 to rebuild overfished reef fish stocks. The proposed actions should not result in impacts significantly different in context or intensity from those described in the environmental impact statement and environmental assessment published with the regulations implementing the FMP and Amendment 1.

Having reviewed the environmental assessment and available information relative to the proposed actions, I have determined that there will be no significant environmental impact resulting from the proposed actions. Accordingly, the preparation of a formal environmental impact statement on these issues is not required for this amendment by Section 102(2)(c) of the National Environmental Policy Act or its implementing regulations.

Approved: _____
Assistant Administrator for Fisheries

Date

11. OTHER APPLICABLE LAW

Habitat Concerns

Reef fish habitats and related concerns were described in the FMP and updated in Amendments 1 and 5. The actions in this regulatory amendment do not affect the habitat.

Vessel Safety Considerations

A determination of vessel safety with regard to compliance with 50 CFR 605.15(b)(3) has been requested from the U.S. Coast Guard. Actions in this regulatory amendment are not expected to affect vessel safety; however, rejected alternatives that would reduce the red snapper TAC could result in a more intense derby fishery in the commercial sector and jeopardize vessel safety.

Coastal Zone Consistency

Section 307(c)(1) of the Coastal Zone Management Act of 1972, as amended, requires that all federal activities that 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 either existing or proposed state regulations.

While it is the goal of the Council 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.

Both the proposed and rejected levels of TAC are likely to result in a recreational quota closure of red snapper in federal waters. In 1997, none of the Gulf coastal states implemented compatible closures in state waters, resulting in an inconsistency between state and federal regulations. Recreational red snapper quota management in federal waters is required under Section 407(d) of the Magnuson-Stevens Fishery Conservation and Management Act, and is consistent with the objective of preventing overfishing by the recreational sector while maintaining bag limits at levels acceptable to the recreational for-hire industry. Except as noted, this regulatory 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 has been 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.

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. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The Council does not propose, through this regulatory amendment, to establish any additional reporting requirements or burdens.

Federalism

No federalism issues have been identified relative to the actions proposed in this regulatory amendment. Therefore, preparation of a federalism assessment under Executive Order 12612 is not necessary.

12. PUBLIC REVIEW

Public hearings to obtain public comments on this regulatory amendment were held during the Gulf Council meeting in November 1997 in Longboat Key, Florida, and during the Council meeting in January 1998 in Point Clear, Alabama. Copies of this document may be obtained from the Gulf of Mexico Fishery Management Council office, 3018 U.S. Highway 301 North, Suite 1000, Tampa, Florida 33619-2266, (813)228-2815.

LIST OF AGENCIES CONSULTED

Gulf of Mexico Fishery Management Council's

- Reef Fish Stock Assessment Panel
- Socioeconomic Panel
- Standing and Special Reef Fish Scientific and Statistical Committee
- Red Snapper Advisory Panel

National Marine Fisheries Service

- Southeast Regional Office
- Southeast Fisheries Science Center

RESPONSIBLE AGENCY:

Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North, Suite 1000
Tampa, Florida 33619-2266
(813)228-2815

LIST OF PREPARERS

Gulf of Mexico Fishery Management Council

- Steven Atran, Population Dynamics Statistician
- Wayne Swingle, Fishery Biologist
- Richard Leard, Fishery Biologist
- Antonio Lamberte, Economist

13. REFERENCES

- Bell, F.W., P.E. Sorenson, and V.R. Leeworthy. 1982. The economic impact and valuation of saltwater recreational fisheries in Florida. Florida Sea Grant College Report No. 47, Gainesville, FL.
- Ditton, R.B., J.R. Stoll, and D.A. Gill. 1988. The social structure and economics of the charter and party boat fishing fleets in Alabama, Mississippi, Louisiana, and Texas. Prepared for the NMFS-SERO, 9721 Executive Center Drive, North, St. Petersburg, Florida 33702.
- Freeman, A. M. 1993. The economics of valuing marine recreation: a review of empirical evidence. Report submitted to the Office of Policy Planning and Evaluation, U.S. Environmental Protection Agency, Washington DC.
- Green, T.G. 1989. The economic value and policy implications of recreational red drum success rate in the Gulf of Mexico. Final report prepared for the NMFS-SERO, St. Petersburg, FL.
- Greene, G., C.B. Moss, and E.M. Thunberg. 1994. Estimation of recreational anglers' value of reef fish in the Gulf of Mexico. Final report prepared for the NMFS-SERO, St. Petersburg, FL.
- GMFMC. 1998. January 1998 report of the reef fish stock assessment panel. Gulf of Mexico Fishery Management Council, Tampa, Florida. 14 p.
- GMFMC. 1997. October 1997 report of the reef fish stock assessment panel. Gulf of Mexico Fishery Management Council, Tampa, Florida. 38 p.
- GMFMC. 1997. Report of the socioeconomic panel meeting on reef fish. Gulf of Mexico Fishery Management Council, Tampa, Florida. 34 p.
- GMFMC. 1995. Report of the socioeconomic panel meeting on reef fish. Gulf of Mexico Fishery Management Council, Tampa, Florida. 17 p.
- GMFMC. 1994. Report of the socioeconomic panel meeting on reef fish. Gulf of Mexico Fishery Management Council, Tampa, Florida. 8 p.
- GMFMC. 1993. Report of the socioeconomic panel meeting on reef fish. Gulf of Mexico Fishery Management Council, Tampa, Florida. 9 p.
- Goodyear, C. P. 1992. Red snapper in U.S. waters of the Gulf of Mexico. Contribution: MIA 91/91-170. National Marine Fisheries Service, Southeast Fisheries Center, Miami, Florida. 156 p.
- Goodyear, C. P. 1994. Red snapper in U.S. waters of the Gulf of Mexico. Contribution: MIA 93/94-63. National Marine Fisheries Service, Southeast Fisheries Center, Miami, Florida. 150 p.
- Goodyear, C. P. 1995. Red snapper in U.S. waters of the Gulf of Mexico. Contribution: MIA 95/96-05. National Marine Fisheries Service, Southeast Fisheries Center, Miami, Florida. 171 p.

- Goodyear, C.P. 1997. An evaluation of the minimum reduction in the 1997 red snapper shrimp bycatch mortality rate consistent with the 2019 recovery target. Manuscript prepared for the Gulf of Mexico Fishery Management Council, Tampa, Florida. 16 p.
- Holiman, S.G. 1998. 1998 Gulf of Mexico red snapper recreational harvest projections (revised version). National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, Florida. 22 p.
- Holiman, S.G. 1998. Personal communication. National Marine Fisheries Service, 9721 Executive Center Drive, North, St. Petersburg, Florida 33702.
- Holiman, S.G. 1997. Recreational catch and effort for red snapper and other reef fish species. Staff Report, Division of Economic Trade Analysis, NOAA, NMFS, Southeast Regional Office, St. Petersburg, FL 33702.
- Holland, S.M. and J.W. Milon. 1989. The structure and economics of the charter and party boat fishing fleet on the Gulf coast of Florida. Prepared for the NMFS-SERO, 9721 Executive Center Drive, North, St. Petersburg, Florida 33702.
- Leeworthy, V.R. 1990. An economic allocation of fishery stocks between recreational and commercial fishermen: the case of the king mackerel. Doctoral Dissertation at Florida State University, Department of Economics, Tallahassee, FL.
- Malone, H.J. 1994. The economic impact of charter fishing in Orange Beach, Alabama. Prepared for the Orange Beach Fishing Association, Gulf Shores, Alabama 36547, 7 p.
- Milon, J.W. 1993. A study of recreational demand for Gulf of Mexico group king mackerel using 1990 and 1991 MRFSS data. Final report prepared for the Gulf of Mexico Fishery Management Council, Tampa, FL 33619.
- Milon, J.W. 1988. Estimating recreational angler participation and economic impact in the Gulf of Mexico mackerel fishery. Final report prepared for the NMFS-SERO, St. Petersburg, FL.
- MRAG Americas. 1997. Consolidated report on the peer review of red snapper (*Lutjanus campechanus*) research and management in the Gulf of Mexico. Prepared by MRAG Americas Inc. for the Office of Science and Technology, National Marine Fisheries Service. Looseleaf notebook.
- NMFS. 1996. Our living oceans. Report on the status of U.S. living marine resources, 1995. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-19, 160 p.
- Rothschild, B.J., A.F. Sharov, and A.V. Bobyrev. 1997. Red snapper stock assessment and management for the Gulf of Mexico. University of Massachusetts, Center for Marine Science and Technology, Dartmouth, Massachusetts. Submitted to the Office of Science and Technology, National Marine Fisheries Service. 173 p.
- Schirripa, M.J. 1998. Stochastic analysis of possible values of SPR for Gulf of Mexico red snapper in the year 2019. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory. Contribution MIA-97/98-10. 5 p.

- Schirripa, M.J. and C.M. Legault. 1997. Status of the red snapper in U.S. waters of the Gulf of Mexico updated through 1996. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory. Contribution MIA-97/98-5. 37 p.
- Waters, J. R. 1997. Economic assessment of the commercial reef fishery in the U.S. Gulf of Mexico. SERO/NMFS, NOAA, 9721 Executive Center Drive, North, St. Petersburg, Florida 33702.
- Waters, J. R. 1996. An economic survey of commercial reef fish vessels in the U.S. Gulf of Mexico. SERO/NMFS, NOAA, 9721 Executive Center Drive, North, St. Petersburg, Florida 33702.
- Waters, J. R. 1995. Economic assessment of the commercial reef fishery in the U.S. Gulf of Mexico. SERO/NMFS, NOAA, 9721 Executive Center Drive, North, St. Petersburg, Florida 33702.
- Watson, J.W., D.G. Foster, and A Shah. 1997a. Report on the results of evaluations of the Jones/Davis BRD. National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratory. 8 p.
- Watson, J.W., A. Shah, S. Nichols, and D. Foster. 1997b. Bycatch reduction estimates for selected species in the Gulf of Mexico for bycatch reduction devices evaluated under the regional bycatch program. National Marine Fisheries Service, Southeast Fisheries Science Center, Mississippi Laboratory. 16 p.

Table 1 (Table 2 from Schirripa 1998). Estimated 50th percentile of the probability distribution of SPR by year for Gulf of Mexico red snapper for several bycatch-reductions (percentages) and TACs (in millions of pounds) for a post bycatch natural mortality rate of 0.10.

		45%			60%			80%		
YEAR		3	6	9	3	6	9	3	6	9
(1998)	1997	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
(1999)	1998	0.005	0.004	0.003	0.005	0.004	0.003	0.005	0.004	0.003
(2000)	1999	0.007	0.005	0.004	0.007	0.005	0.004	0.007	0.005	0.004
(2001)	2000	0.009	0.006	0.004	0.009	0.006	0.004	0.009	0.006	0.004
(2002)	2001	0.013	0.008	0.005	0.013	0.009	0.005	0.013	0.009	0.006
(2003)	2002	0.017	0.012	0.006	0.018	0.013	0.007	0.021	0.015	0.009
(2004)	2003	0.023	0.016	0.008	0.026	0.018	0.011	0.031	0.023	0.015
(2005)	2004	0.031	0.021	0.011	0.036	0.026	0.015	0.045	0.035	0.024
(2006)	2005	0.040	0.028	0.015	0.048	0.036	0.022	0.062	0.050	0.036
(2007)	2006	0.050	0.036	0.020	0.061	0.047	0.030	0.083	0.069	0.051
(2008)	2007	0.062	0.046	0.026	0.077	0.061	0.040	0.107	0.090	0.069
(2009)	2008	0.074	0.056	0.032	0.094	0.076	0.052	0.133	0.114	0.089
(2010)	2009	0.087	0.067	0.040	0.112	0.092	0.065	0.161	0.141	0.113
(2011)	2010	0.100	0.079	0.049	0.131	0.109	0.079	0.190	0.168	0.138
(2012)	2011	0.113	0.091	0.059	0.149	0.127	0.094	0.220	0.197	0.164
(2013)	2012	0.126	0.103	0.069	0.168	0.145	0.110	0.249	0.225	0.191
(2014)	2013	0.139	0.116	0.080	0.186	0.163	0.127	0.278	0.254	0.219
(2015)	2014	0.151	0.128	0.091	0.204	0.180	0.144	0.307	0.282	0.246
(2016)	2015	0.163	0.140	0.102	0.221	0.197	0.160	0.334	0.309	0.273
(2017)	2016	0.175	0.151	0.113	0.238	0.214	0.177	0.360	0.335	0.299
(2018)	2017	0.186	0.162	0.124	0.253	0.230	0.193	0.384	0.360	0.325
(2019)	2018	0.196	0.173	0.135	0.268	0.245	0.209	0.407	0.384	0.349
(2020)	2019	0.205	0.183	0.146	0.281	0.259	0.224	0.429	0.406	0.372
(2021)	2020	0.214	0.193	0.157	0.294	0.272	0.238	0.449	0.427	0.394

Note: The original probability distribution table assumed that the indicated bycatch reduction level would commence in 1997. Since the starting year is now 1998 at the earliest, the "Year" column needs to be incremented by 1, i.e., the SPR values in the row labeled 2018 are now the projections for 2019.

Table 2 (Table 1 from Schirripa 1998). Estimated probability distribution of SPR in the year 2019 for Gulf of Mexico red snapper for several management alternatives and a post-bycatch natural mortality rate of 0.10. The first number in the column header refers to the bycatch reduction (%) and the second refers to the TAC (millions of pounds). Table assumes that bycatch reduction begins in 1997.

PERCT	45-03	45-06	45-09	60-03	60-06	60-09	80-03	80-06	80-09
0.01	0.201	0.173	0.118	0.277	0.248	0.197	0.424	0.394	0.346
0.02	0.202	0.174	0.122	0.278	0.250	0.201	0.424	0.396	0.350
0.03	0.202	0.175	0.124	0.278	0.250	0.202	0.425	0.397	0.352
0.04	0.202	0.176	0.125	0.278	0.251	0.204	0.425	0.397	0.354
0.05	0.203	0.176	0.127	0.278	0.252	0.205	0.425	0.398	0.355
0.10	0.203	0.178	0.132	0.279	0.253	0.211	0.426	0.400	0.359
0.15	0.204	0.179	0.135	0.280	0.255	0.214	0.427	0.401	0.362
0.20	0.204	0.180	0.138	0.280	0.255	0.215	0.427	0.402	0.363
0.25	0.204	0.180	0.140	0.280	0.256	0.217	0.427	0.403	0.366
0.30	0.205	0.181	0.141	0.281	0.257	0.219	0.428	0.404	0.367
0.35	0.205	0.182	0.143	0.281	0.257	0.220	0.428	0.405	0.369
0.40	0.205	0.182	0.144	0.281	0.258	0.221	0.428	0.405	0.370
0.45	0.205	0.183	0.145	0.281	0.258	0.223	0.428	0.406	0.371
0.50	0.205	0.183	0.146	0.281	0.259	0.224	0.429	0.406	0.372
0.55	0.206	0.184	0.148	0.282	0.259	0.225	0.429	0.407	0.373
0.60	0.206	0.184	0.149	0.282	0.260	0.226	0.429	0.407	0.375
0.65	0.206	0.184	0.150	0.282	0.261	0.227	0.429	0.408	0.376
0.70	0.206	0.185	0.151	0.282	0.261	0.228	0.430	0.408	0.378
0.75	0.206	0.186	0.152	0.282	0.262	0.230	0.430	0.409	0.379
0.80	0.207	0.186	0.153	0.283	0.262	0.231	0.430	0.409	0.381
0.85	0.207	0.187	0.155	0.283	0.263	0.233	0.430	0.410	0.383
0.90	0.207	0.188	0.158	0.283	0.264	0.235	0.431	0.411	0.385
0.95	0.208	0.189	0.161	0.284	0.265	0.239	0.431	0.413	0.388
0.96	0.208	0.189	0.162	0.284	0.266	0.239	0.432	0.413	0.388
0.97	0.208	0.190	0.163	0.285	0.266	0.240	0.432	0.414	0.390
0.98	0.208	0.191	0.165	0.285	0.267	0.243	0.432	0.415	0.391
0.99	0.209	0.192	0.167	0.285	0.268	0.245	0.433	0.416	0.392
1.00	0.210	0.195	0.172	0.286	0.271	0.249	0.434	0.418	0.396

Table 3. Estimated 50th percentile of the probability distribution of SPR for red snapper in the Gulf of Mexico assuming three scenarios of shrimp bycatch reduction and three TACs (in millions of pounds). See Goodyear (1995) and Schirripa and Legault (1996) for further model assumptions.

Scenario A: A 45% reduction in 1998, 50% in 1999, 55% in 2000, and 60% for the remaining years through 2021.
Scenario B: A 45% reduction in 1998, 50% in 1999, 55% in 2000, 60% in 2001, and 65% for the remaining years through 2021.
Scenario C: A 45% reduction in 1998, 50% in 1999, 55% in 2000, 60% in 2001, 65% in 2002 and 70% for the remaining years through 2021.

YEAR	A			B			C		
	3	6	9	3	6	9	3	6	9
1998	0.004	0.004	0.003	0.004	0.004	0.003	0.004	0.004	0.003
1999	0.006	0.004	0.003	0.006	0.004	0.003	0.006	0.004	0.003
2000	0.008	0.005	0.003	0.008	0.005	0.003	0.008	0.005	0.003
2001	0.012	0.007	0.003	0.012	0.007	0.004	0.012	0.007	0.004
2002	0.016	0.010	0.005	0.016	0.010	0.005	0.016	0.010	0.005
2003	0.023	0.015	0.006	0.023	0.015	0.008	0.023	0.015	0.008
2004	0.031	0.021	0.009	0.031	0.021	0.013	0.031	0.021	0.013
2005	0.041	0.029	0.014	0.041	0.029	0.019	0.041	0.029	0.019
2006	0.053	0.039	0.020	0.054	0.039	0.028	0.054	0.039	0.028
2007	0.067	0.051	0.027	0.068	0.052	0.039	0.069	0.052	0.039
2008	0.083	0.064	0.036	0.085	0.066	0.052	0.086	0.067	0.053
2009	0.099	0.079	0.047	0.102	0.082	0.066	0.105	0.084	0.069
2010	0.116	0.095	0.060	0.121	0.100	0.083	0.125	0.103	0.086
2011	0.134	0.111	0.074	0.141	0.118	0.100	0.146	0.123	0.106
2012	0.152	0.128	0.088	0.160	0.137	0.119	0.167	0.144	0.126
2013	0.170	0.146	0.104	0.180	0.156	0.138	0.189	0.165	0.147
2014	0.187	0.163	0.120	0.199	0.176	0.157	0.211	0.187	0.169
2015	0.204	0.179	0.136	0.218	0.195	0.176	0.232	0.208	0.190
2016	0.219	0.196	0.153	0.236	0.213	0.195	0.253	0.229	0.212
2017	0.235	0.211	0.169	0.254	0.231	0.214	0.273	0.249	0.233
2018	0.249	0.226	0.184	0.270	0.248	0.231	0.292	0.269	0.253
2019	0.263	0.240	0.200	0.286	0.264	0.248	0.309	0.287	0.272
2020	0.275	0.254	0.214	0.300	0.279	0.264	0.326	0.305	0.290
2021	0.287	0.266	0.228	0.314	0.294	0.279	0.342	0.321	0.307

Goodyear, C.P. 1995. Red snapper in U.S. waters of the Gulf of Mexico, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory, Miami MIA—95/96-05.

Schirripa, M.J. and C.M. Legault. 1997. Status of the red snapper in U.S. waters of the Gulf of Mexico: updated through 1996. National Marine Fisheries Service, Southeast Fisheries Science Center, Miami Laboratory, Miami MIA—97/98-05.

h:\reef\regamend.98b.wpd