REGULATORY AMENDMENT

TO THE

REEF FISH FISHERY MANAGEMENT PLAN

TO SET 1996 RED SNAPPER

TOTAL ALLOWABLE CATCH

(Includes Environmental Assessment, and Regulatory Impact Review)

DECEMBER 1995

Gulf of Mexico Fishery Management Council
Lincoln Center, Suite 331
5401 West Kennedy Boulevard
Tampa, Florida 33609

813-228-2815

This is a publication of the Gulf of Mexico Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA67FC0002, which is funded 100 percent with Federal money at the current funding level of $1,262,300.

Table of Contents

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. INTRODUCTIONa

This is a regulatory amendment, sometimes known as a framework procedure amendment, to the Reef Fish Fishery Management Plan. A regulatory amendment is used to implement changes to the Total Allowable Catch (TAC) for a reef fish stock or stock complex, along with any changes to fishing regulations (size limits, bag and trip limits, etc.) that are needed to achieve the TAC. The TAC is a level of fishing intended to obtain Optimum Yield and to prevent overfishing, or to follow a recovery plan when a stock is overfished. Regulatory amendments differ from a plan amendments in that they are used to set TACs and associated fishing regulations, whereas plan amendments are used to make changes in the basic policies and procedures defined in a fishery management plan. A regulatory amendment is limited in its scope and follows a specific procedure which is described later in this document.

This regulatory amendment proposes changes to the red snapper TAC for 1996. The following information is intended to guide readers who are looking for specific information within the document (refer to the Table of Contents for page numbers). The reasons why changes are being considered is discussed in the section titled "Purpose and Need for Action". The proposed 1996 TAC and other actions are summarized under "Proposed Actions". A brief overview of the current stock assessment and findings of the Reef Fish Stock Assessment Panel is in "Status of Red Snapper Stock". A detailed discussion of the rationale, biological impacts, socioeconomic impacts, and regulatory impacts of both the proposed and rejected alternatives is in "Management Alternatives and Regulatory Impact Review". The "History of Management" provides a summary of all changes to the Reef Fish FMP since it was implemented.

2. HISTORY OF MANAGEMENTa

The Reef Fish Fishery Management Plan was implemented in November 1984. The regulations, designed to rebuild declining reef fish stocks, included: (1) prohibitions on the use of fish traps, roller trawls, and powerhead-equipped spear guns within an inshore stressed area; (2) 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; and, (3) data reporting requirements.

The National Marine Fisheries Service (NMFS) has collected commercial landings data since the early 1950's, recreational harvest data since 1979, and in 1984 initiated a dockside interview program to collect morea detailed data on commercial harvest. The first red snapper assessment in 1988 indicated that red snapper wasa significantly overfished and that reductions in fishing mortality rates of as much as 60 to 70 percent werea necessary to rebuild red snapper to a recommended 20 percent spawning stock potential ratio (SPR - Seea Section 5 below). The 1988 assessment also identified shrimp trawl bycatch as a significant source ofa mortality.a

Amendment 1 to the Reef Fish Fishery Management Plan, implemented in 1990, set as a primary objectivea of the FMP the stabilization of long term population levels of all reef fish species by establishing a survivala rate of biomass into the stock of spawning age to achieve at least 20 percent spawning stock biomass pera recruit (SSBR), relative to the SSBR that would occur with no fishing. It set a red snapper 7 fish recreationala bag limit and 3.1 million pound commercial quota that together were to reduce fishing mortality by 20 percenta and begin a rebuilding program for that stock. This amendment also established a 5 fish recreational bag limita

and 11.0 million pound commercial quota[1] for groupers, with the commercial quota subdivided into a 9.2 million pound shallow-water quota and a 1.8 million pound deep-water quota. 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. Subsequent changes to the longline/buoy boundary could be made through the framework procedure for specification of TAC.

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

In November, 1990, NMFS announced that anyone entering the commercial reef fish fishery in the Gulf of Mexico and South Atlantic after a control date of November 1, 1990 may not be assured of future access to the reef fish fishery if a management regime is developed and implemented that limits the number of participants in the fishery. The purpose of this announcement was to establish a public awareness of potential eligibility criteria for future access to the reef fish resource, and does not prevent any other date for eligibility or other method for controlling fishing effort from being proposed and implemented.

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 transferred speckled hind from the shallow-water grouper quota category to the deep-water grouper quota category and established a new red snapper target year of 2007 for achieving the 20 percent SPR goal.

During 1991 several regulatory amendments were implemented to adjust the TACs and quotas for reef fish:

A 1991 regulatory amendment raised the 1991 quota for shallow-water groupers to 9.9[2] million pounds. This action was taken to provide the commercial fishery an opportunity to harvest 0.7 million pounds that were unharvested in 1990 due to an early closure of the fishery in 1990. NMFS had projected the

---

[1] These values have been subsequently modified to correct for revisions adopted in the gutted to whole weight ratio. Historically, the conversion ratio used was 1.18, subsequently, the ratio has been corrected and 1.05 is used. This results in these values being 9.8, 8.2 and 1.6 million pounds respectively, for total, shallow-water and deep-water grouper quotas (e.g., 11.0 ÷ 1.18 x 1.05 = 9.8). There is no impact on the commercial fishery from the revision as fish have always been reported in gutted weight and that data is transformed to whole weight for NMFS records.

[2] The corrected 1991 quota, using the revised conversion factor, was 8.8 million pounds. The corrected 1990 actual harvest was 7.6 million pounds.

9.2 million pound quota to be reached on November 7, but subsequent data showed that the actual harvest was 8.5 million pounds.

A 1991 regulatory amendment set the red snapper TAC at 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.

A 1991 regulatory amendment set the 1992 commercial quota for shallow-water groupers at 9.8 million pounds, which was 1.6 million pounds higher than the adjusted 1991 base level quota of 8.2 million pounds.

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 considers a more comprehensive effort limitation program. It allows the transfer of permits between vessels owned by the permittee or between individuals when the permitted vessel is transferred. Amendment 4 also changed the time of the year that TAC is specified from April to August and included additional species in the reef fish management unit.

Amendment 5, implemented in February 1994, established restrictions on the use of fish traps in the Gulf of Mexico EEZ, implemented a three year moratorium on the use of fish traps by creating a fish trap endorsement and issuing the endorsement only to fishermen who had submitted logbook records of reef fish landings from fish traps between January 1, 1991 and November 19, 1992, created a special management zone (SMZ) with gear restrictions off the Alabama coast, created a framework procedure for establishing future SMZ's, required that all finfish except for oceanic migratory species be landed with head and fins attached, established a schedule to gradually raise the minimum size limit for red snapper to 16 inches over a period of five years, and closed the region of Riley's Hump (near Dry Tortugas, Florida) to all fishing during May and June to protect mutton snapper spawning aggregations.

A 1992 Regulatory Amendment set the 1993 red snapper TAC at 6.0 million pounds to be allocated as 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

be for a time span not exceeding 1.5 times the potential generation time of the stock and an estimated red snapper generation time of 13 years (Goodyear 1992).

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. *Note: A legal challenge to the red snapper endorsement emergency rule was filed in U.S. District Court, Corpus Christi, Texas on January 21, 1993. The outcome of this challenge has not been determined as of the writing of this draft.*

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.

A proposed 1993 Regulatory Amendment that would have moved the longline and buoy gear restricted area boundary off central and south-central Florida inshore from the 20 fathom isobath to the 15 fathom isobath for a one-year period beginning January 1, 1994 was withdrawn by the Council in January 1994. This regulatory amendment had been proposed as an experimental fishery during which time studies would be carried out to examine the biological, social and economic impacts of the action. The action was proposed in response to requests from longline fishermen for increased access to areas with suitable grouper habitat, and in consideration of a red grouper stock assessment which indicated that species was not overfished and that the commercial quota had never been filled. The Council withdrew the proposal amid concerns that it would lead to a quota closure and a concern by the NMFS Southeast Fisheries Science Center that there were inadequate experimental controls to properly evaluate the impact of the action.

A 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. The shallow water grouper was also evaluated and was retained at it's status quo level of 15.1 million pounds (9.8 million pound commercial quota) and 20 inch total length size limit for gag, red, Nassau, yellowfin and black grouper.

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

Amendment 8 has been approved for implementation in 1996. It will manage effort in the commercial red snapper fishery by restricting access to the fishery through an individual transferable quota system. Due to concerns by commercial fishermen about the impact of the proposed measures, the Council delayed consideration of this amendment until information could be collected (under Amendment 9) to determine eligibility and initial allocations to individual fishermen.

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 is 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 as late as December 31, 1995, in order to continue the existing interim management regime until longer term measures can be implemented.

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

An October 1994 proposed 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.

Amendment 11 has been partially approved by NMFS for implementation in 1996. This amendment establishes allowable sales provisions for reef fish harvested in the EEZ, provides additional transferability for permits and endorsements, continues the reef fish vessel permit moratorium for up to an additional five years, allows reef fish vessel permits to be transferred between vessel owners under the moratorium without requiring the transfer of the permitted vessel, and establishes a permit for vessels to operate as reef fish charter or head boats in the EEZ. Disapproved measures included a new definition of Optimum Yield based on the $F_{0.1}$ fishing mortality rate, an allowance for the Council to set TAC in excess of ABC for species that are not overfished, and an extension of the recovery period for red snapper from 1½ to 2 generation times. The Council, upon review of the disapproved measures, voted to resubmit an Optimum Yield definition based on 30 percent SPR, and resubmit an allowance for TAC to exceed ABC subject to a 10 percent maximum excess harvest and two year maximum duration limitation. Resubmission of the disapproved measures is currently in preparation.

Amendment 12 has been approved by the Council and is currently in preparation for submission to NMFS. This amendment proposes to combine greater amberjack, lesser amberjack and banded rudderfish into an aggregate 1 fish bag limit and 28 inch fork length recreational size limit while retaining a commercial 36 inch

fork length size limit for greater amberjack only, remove the provisions for automatic increases in the red snapper commercial size limit to 15 inches in 1996 and 16 inches in 1998, and establish an aggregate daily bag and possession limit of 20 reef fish per person for all reef fish species not having a bag limit.

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 November 1995, the Council reviewed a new stock assessment for red snapper (Goodyear 1995) for purposes of setting the 1996 TAC. The 1995 stock assessment incorporated new information about red snapper life history (which is reviewed later in this document) that substantially changed the estimates of current status of stock, recovery projections and Allowable Biological Catch (ABC). Briefly, these changes were 1) red snapper are longer lived than previously thought so that 1½ generation times now corresponds to a maximum recovery date of the year 2019 rather than 2010, 2) some reduction in shrimp trawl bycatch mortality is now assumed to have occurred since 1993 and has been incorporated into the stock assessment, 3) because of their increased longevity, the recovery will be more gradual than previously projected, and 4) the current status of stock is now estimated to be 0.6 percent SPR rather than 4 percent (this last item is merely a rescaling of the stock condition given the new life history information, it does not represent any decrease in the perceived health of the stock).

The Reef Fish Stock Assessment Panel (RFSAP), upon reviewing the stock assessment and options for a range of TACs up to 14 million pounds, recommended a range of Allowable Biological Catch of 6 to 10 million pounds with a recovery target date of 2019 (GMFMC 1995). This is considerably higher than the previous ABC range of 4 to 6 million pounds with a recovery target date of 2009, and is the result of incorporating the new information about red snapper life history into the stock assessment. However, the RFSAP also warned that this ABC range was based on the validity of a number of assumptions, particularly achieving a 50 percent shrimp bycatch mortality reduction by May, 1997 (start of shrimp season). The Socioeconomic Assessment Panel (SEP), concerned about achievability of the assumed 50 percent shrimp bycatch reduction and stability to the fishery if a TAC at the upper end of ABC were selected but subsequently had to be reduced, recommended that the TAC be set at an intermediate level of 8 million pounds in 1996, with an increase to 10 million pounds in 1997 contingent upon achieving a 50 percent reduction in shrimp bycatch. This strategy was endorsed by the Red Snapper Advisory Panel (RSAP). The Scientific and Statistical Committee (SSC) accepted the reports of the RFSAP and SEP, and advised the Council that the consequences of selecting a TAC at the upper end of ABC were that there would have to be an earlier and larger reduction in shrimp bycatch mortality (relative to selecting a lower TAC), whereas the consequences of selecting a TAC at the lower end of ABC were that there would need to be a reduction in the recreational red snapper harvest from recent levels.

A bag and size limit analysis prepared by NMFS projected that, if recreational bag and size limits were left unchanged, the 1996 recreational harvest would be 4.47 million pounds, corresponding to a TAC of 9.12 million pounds. Based on the results of the stock assessment recommendations of the RFSAP, SEP, RSAP, SSC, and bag and size limit projections, the Council chose to extend the recovery target date to the new 1½ generation time estimate of 2019, and to set the 1996 TAC at 9.12 million pounds, allocated 51 percent commercial (4.65 million pounds) and 49 percent recreational (4.47 million pounds). This is a 52 percent increase over the TAC level has been in place since 1993. It is more conservative than the upper end of ABC

range, yet it avoids the need to implement potentially destabilizing increases in recreational harvest restrictions.

The commercial red snapper allocation is controlled by a quota, with an individual transferable quota (ITQ) system scheduled to be put in place during 1996. For the commercial sector, red snapper size limits are used not to control rate of fishing, but to optimize biological and economic benefits at a given TAC. In 1994 a series of biennial 1 inch increases to an eventual 16 inch minimum size limit (in 1998) was established. A 16 inch size limit was determined to maximize yield per recruit and SPR recovery rate, assuming a 33 percent release mortality. The stock assessment has noted that scientific evidence for 33 percent release mortality is imprecise. Many commercial fishermen have argued that the actual mortality rate is higher, resulting in dead fish being discarded and wasted. In addition, commercial fishermen have argued that the 14 inch fish have a higher value during parts of the season. As a result, the Council proposed, through Amendment 12, to eliminate the 1996 and 1998 automatic increases in the commercial size limit, and to leave the size limit at 14 inches unless a specific decision was made to change it. Amendment 12 has not yet been reviewed by NMFS and cannot be implemented in time to prevent the 1996 15 inch size limit increase from taking place. Therefore, action is needed through this regulatory amendment to eliminate the automatic increases and restore the 14 inch commercial size limit as part of the 1996 implementation of TAC, which was the Council's original intent in Amendment 12.

4. PROPOSED ACTIONS

The Council proposes to increase the red snapper TAC for 1996 to 9.12 million pounds, with 4.47 million pounds allocated to the recreational sector and 4.65 million pounds allocated to the commercial sector[3].

The recreational allocation will be implemented by retaining the current 5 fish daily bag limit and 15 inch minimum size limit. The commercial allocation will be implemented by a quota. (Note: Through previous action, 1 million pounds of the quota is to be implemented through an extension of the red snapper endorsement system and associated trip limits, and the remainder through an individual transferable quota system.)

The Council also extends the recovery target date to the year 2019. This is within the allowable recovery period of 1½ generation times from 1990, based on the Reef Fish Stock Assessment Panel's recommendations that the natural mortality rate estimate be lowered to M=0.10 resulting in an extension of the generation time estimate to 19.6 years. (If M had remained at 0.20, the maximum target date would have been 2010. However, because of the faster recovery rate projection under M=0.20, the proposed TAC and 50 percent shrimp bycatch reduction by 1997 would still result in a recovery by the target date.)

The Council also proposes to repeal, for the commercial sector, the automatic increase in red snapper size limit to 15 inches on January 1, 1996 and 16 inches on January 1, 1998 that were implemented through Amendment 5, and restore the 14 inch commercial minimum size limit.

---

[3] This 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.

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 submitted to 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.e A reef fish stock or stock complex is overfished when it is below the level of 20 percente SPR.e

2.e When a reef fish stock or stock complex is overfished, overfishing is defined as harvestinge at a rate that is not consistent with a program that has been established to rebuild the stocke or stock complex to the 20 percent SPR level.e

3.e When a reef fish stock or stock complex is not overfished, overfishing is defined as ae harvesting rate that, if continued, would lead to a state of the stock or stock complex thate would not at least allow a harvest of optimum yield on a continuing basis.e

6. REEF FISH FRAMEWORK PROCEDURE AS SPECIFIED IN THE FMP

(Note: Under Amendment 11, which will be implemented in January 1996, there will be a number of revisions to the framework procedure. These revisions are either editorial in nature or only affect management of stocks that are not overfished, and do not affect red snapper. The following is the framework procedure under which this regulatory amendment was developed.)

Optimum Yield (OY) can be achieved with annual total allowable catch (TAC) specifications for each spe or species group. The Council has established a framework procedure where, on an annual basis, a scien working group will establish a range of Allowable Biological Catch (ABC), and the Council will set a T and prescribe fishing restrictions to attain the management goal of OY for implementation by the Reg Director (RD) of NMFS prior to the beginning of a fishing year.

Procedure for Specification of TAC:

1.o Prior to August 1 each year, or such other time as agreed upon by the Council and RD, the Southeasto Fisheries Center of NMFS (SEFC) will: a) update or complete biological and economic assessmentso and analyses of the present and future condition of the stocks for red snapper and other reef fish stocko or stock complex; b) assess to the extent possible the current SPR levels for each stock; c) estimateo fishing mortality (F) in relation to $F_{30 \text{ percent SPR}}$; d) estimate annual surplus production F_{max} or othero population parameters deemed appropriate; e) summarize statistics on the fishery for each stock or stocko complex; f) specify the geographical variations in stock abundance, mortality, recruitment, and age oto entry into the fishery for each stock or stock complex; and g) analyze social and economic impacts oto any specification demanding adjustments of allocations, quotas, or bag limits.o

2.o The Council will convene a Scientific Assessment Panel, appointed by the Council, that will, as ao working group, review the SEFC assessment(s), current harvest statistics, economic, social, and othero relevant data. It will prepare a written report to the Council specifying a range of ABC for each stocko or stock complex which is in need of catch restrictions for attaining or maintaining OY. The ABCs areo catch ranges that will be calculated for those species in the management unit that have been identifiedo by the Council, NMFS, or the working panel as in need of catch restrictions for attaining or maintainingo OY. The range of ABCs shall be calculated so as to achieve reef fish population levels at or above theo 20 percent SPR goal by January 1, 2000, for all reef fish except red snapper which has a January 2007o target date, or by a time period (target date), or set of time periods (target dates) specified by the stocko assessment panel. Any time period specified by the assessment panels for consideration by the Councilo under this framework procedure cannot exceed a period equal to 1.5 times the potential generation timeo of the stock. Generation times are to be specified by the stock assessment panel based on the biologicalo characteristics of the individual stocks. For stock or stock complexes where data in the SEFC reporto are inadequate to compute an ABC based on the spawning stock biomass per recruit model, the aboveo working group will use other available information as a guide in providing their best estimate of an ABCo range that should result in at least a 20 percent SPR level. The ABC ranges will be established too prevent an overfished stock from further decline. To the extent possible, a risk analysis should beo conducted indicating the probabilities of attaining or exceeding the stock goal of 20 percent SPR, theo annual transitional yields (i.e., catch streams) calculated for each level of fishing mortality within the ABC range, and the economic and social impacts associated with those levels. The working groupo report will include recommendations on bag limits, size limits, specific gear limits, season closures, ando other restrictions required to attain management goals, along with the economic and social impacts oto such restrictions, and the research and data collection necessary to improve the assessments. Theo working group may also recommend additional species for future analyses.o

3.o The Council will conduct a public hearing on the working group reports at, or prior, to the time it iso considered by the Council for action. Other public hearings may be held also. The Council will requesto review of the reports by its Reef Fish Advisory Panel and Standing Scientific and Statistical Committeeso and may convene these groups before taking action.o

4.o The Council in selecting a TAC level and time period (target date), if necessary, for each stock or stocko complex for which an ABC range has been identified will, in addition to taking into consideration theo recommendations provided for in (1), (2), and (3), utilize the following criteria:o

a.o Set TAC within or below the ABC range or set a series of annual TACs to obtain the ABC levelo within three years or less.o

b.c Subdivide the TACs into commercial and recreational allocations which maximize the net benefitsc of the fishery to the nation. The allocations will be based on historical percentages harvested byc each user group during the base period of 1979-1987[4]. However, if the harvest in any year exceedsc the TAC due to either the recreational or commercial user group exceeding its allocation.c subsequent allocations pertaining to the respective user group will be adjusted to assure meeting thec specified target date spawning stock biomass per recruit (SPR) goal.c

5. The Council will provide its recommendations to the RD for any specifications in TACs and target datesc for each stock or stock complex, quotas, bag limits, trip limits, size limits, closed seasons, and gearc 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 timec as agreed upon by the Council and RD.c

6.c Prior to each fishing year, or other such time as agreed upon by the RD and Council, the RD will reviewc the Council's recommendations and supporting information; and, if he concurs that the recommendationsc are consistent with the objectives of the FMP, the National Standards, and other applicable law, he shallc forward for publication notice of proposed TACs and associated harvest restrictions by November 1, orc such other time as agreed upon by the Council and RD (providing up to 30 days for additional publicc comment). The RD will take into consideration all information received and will forward for publicationc in the Federal Register the notice of final rule by December 1, or such other time as agreed upon by thec Council and RD.c

If NMFS decides not to publish the proposed rule of the recommended management measures, or to otherwise hold the measures in abeyance, then the Regional Director must notify the Council of his intended action within 15 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.c Appropriate regulatory changes that may be implemented by notice action include:c

a.c The TACs for each stock or stock complex that are designed to achieve a specific level of ABCc within the first year, or annual levels of TAC designed to achieve the ABC level within three years.c

b.c Bag limits, size limits, vessel trip limits, closed seasons or areas, gear restrictions, and quotasc designed to achieve the TAC level.c

c.c The time period (target date) specified for rebuilding an overfished stock with the restriction thatc a time period specified under this framework procedure cannot exceed a period equal to 1.5 timesc the generation time of the stock under consideration.c

8.c If the NMFS decides not to publish the proposed rule of the recommended management measures, or toc otherwise hold the measures in abeyance, then the Regional Director must notify the Council of hisc intended action within 15 days of receipt of the Council's proposal and the reasons for NMFS concernc

[4] This 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

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 thee Council to conform the amendment to the requirements of applicable law.e

7.e WHAT IS SPAWNING POTENTIAL RATIO (SPR)?e

Spawning potential ratio is an index of a population's health as measured by the biological ability of the adult fish to produce spawn or eggs. A particular estimated level of SPR is directly dependent on the estimated number of living adult fish (or females), and their longevity or number at age, which is controlled by the prevailing fishing mortality exerted on the population. This biological spawning ability can be measured in terms of total adult fish biomass (number alive x average weight), gonad biomass (number alive x average gonad weight), or eggs produced (number alive x average number of eggs spawned) for each age class of fish.

A generation of fish in a population must on average produce the same number of adult fish in the next generation for a population to persist without decline or, in other words, be in equilibrium. All populations of animals attempt to attain levels of equilibrium, however environmental fluctuations prevent this from happening in most cases. Fishing reduces the number of adults surviving from a given number of recruits by reducing their life expectancy. To prevent population collapse the egg to recruit survival probability and/or the fecundities of the survivors must rise in response to the fishing induced lowered abundance of adults (Goodyear 1989). Clearly, the above population mechanisms allow a population to be harvested without damaging its biological potential. However, as harvest pressure grows (fishing mortality increases), a point is reached where the population looses more fish through harvesting than it can replenish, and overfishing occurs. A population can also exist at an equilibrium level below its optimum level and can increase in size if fishing mortality is reduced.

Various measures of optimal fishing have been defined whereby fishing greater than the optimal level results in overfishing. The concepts of maximum sustainable yield (MSY) and maximum yield per recruit (YPR) are the two most common measures of optimal fishing. For reasons set forth in Amendment 1, the measure of optimal fishing for reef fish was chosen to be 20 percent SPR, which in a YPR context results in management advice similar to that needed to achieve maximum YPR.e

Calculation of SPR is similar to calculation of YPR, except, instead of attempting to maximize yield from ae year class of fish, achieving a certain level of spawning potential is attempted. This spawning potential is estimated as the fraction or ratio of spawning ability of the species when being fished divided by the spawning ability of the species under conditions of no fishing mortality; i.e., only natural mortality occurs. The SPRe of a population is then controlled by the fishing mortality exerted on each age class of fish.e

8.e STATUS OF RED SNAPPER STOCKe

This section is based on the 1995 Report of the Reef Fish Stock Assessment Panel (GMFMC 1995), and the 1995 red snapper stock assessment (Goodyear 1995). Comparisons to previous stock assessments are based on information contained in the 1994 red snapper stock assessment (Goodyear 1994).

New Information

A number of new findings have been incorporated into the 1995 stock assessment, which alter the current estimate of status of stock and recovery projections. These include:

Reduced growth rate estimate: An improved growth rate estimate was derived by incorporating new data obtained from a number of studies that assigned ages from examination of scales, otoliths or length frequencies for the youngest fish. Incorporation of this new data into a pooled growth model resulted in assigning much older ages to some fish than were seen in earlier studies, and a reduction in the asymptotic maximum length from 45.9 inches in the 1994 assessment, which was based primarily on scale data (Goodyear 1994, Figure 10) to 34.5 inches in the current stock assessment. The new pooled data model is shown in Figure 1, and is based on the following von Bertalanffy growth equation:

$$L_t = 87.75(1-e^{(-0.16(t + 0.452))})$$

where t = age in years, and L_t = total length in centimeters.

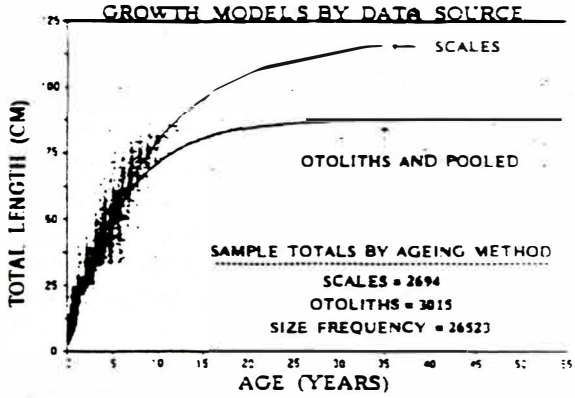


Figure 1. Age-length scattergram and von-Bertalanffy equations fitted to three data groupings. Each included the length-frequency ages; SCALE added scale ages; Otolith added otolith ages; Pooled included all data except scale ages > 7.

Reduced natural mortality rate and increased longevity estimates: Previous stock assessments assumed a natural mortality rate of M=0.20. However, estimates of longevity and natural mortality have changed as a result of the new age and growth data, which includes fish that have been aged to as old as 53 years (the previous oldest aged fish had been 42 years), and historical records, which indicate that large (and presumably old) red snapper were once relatively common. Calculations of natural mortality from a variety of data sources and analytical methods produced estimates of natural mortality ranging from M=0.12 to 0.38 with 95 percent confidence bounds ranging from M=0.02 to over 1.00. Despite the large range of mortality estimates and uncertainty about their robustness when derived from fished stocks with variable recruitment, the apparent longevity of this species argues that natural mortality must be relatively low. Consequently, the RFSAP recommended adoption of a natural mortality rate of M=0.10 for this and subsequent analysis of red snapper stocks. As a result of this lower mortality rate, the natural lifespan of red snapper is longer than previously estimated, and the estimate of generation time has increased from 13.6 years to 19.6 years.

Incorporation of reductions in shrimp trawl bycatch mortality for 1993 and 1994: Earlier stock assessments assumed that no previous reduction in shrimp trawl bycatch mortality has yet occurred. For the 1995 stock assessment, shrimp trawl bycatch estimates were available at a resolution of 4-month intervals rather than annual intervals. This allowed incorporation of the effect of temporal changes in the age-class distribution of the shrimp trawl bycatch into the bycatch mortality estimates. Consequently, analysis of management options were able to include already achieved shrimp trawl bycatch reductions of 5.8% in 1993 and 10% in 1994. However, even with inclusion of the 1993 and 1994 bycatch reduction estimates, it remains that only 12 percent of the population ultimately escapes capture by the shrimp fishery to become part of the directed fishery and spawning stock.

Reduced estimate of recreational release mortality: Previous red snapper stock assessments assumed a release mortality of 33 percent for all red snapper fishing. The mortality of released fish is an important consideration

in evaluating the conservation effects of regulations that set minimum sizes and total allowable catch. Data from an ongoing mark-recapture study suggests that mortality increases from 20 to 30 meters (66 to 98 feet). About 14 percent of fish at 30 meters showed signs of stress upon release. In addition to the hooking and handling mortality, predation of released fish caught and released may be exacerbated in areas with significant concentrations of large predators. Analyses in the current stock assessment assume release mortality of 20 percent for the recreational and 33 percent for commercial fisheries based on the depth distribution of their respective effort.

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. The greatest part of the present commercial and recreational harvest is directly south and to the west of the Mississippi River.

In the commercial red snapper fishery the primary gear types used are manually operated handlines or power assisted lines (bandit rigs). Landings from these gears are reported under a single gear code for handlines. Other gear types used to harvest red snapper include bottom longlines, buoy lines and fish traps, although total landings of red snapper from fish traps have been small.

The commercial harvest since 1990 is shown in the table below and by gear type in Figure 2 (handlines includes power reels and bandit rigs). The commercial quota was initially 3.1 MP in 1990 and was subsequently set at 51 percent of TAC when adjustments were made. For 1995, the commercial harvest was estimated to be slightly below the 3.06 million pound quota as of the close of the fishing season on April 14. However, at the Council's request, the commercial season was reopened for 36 hours on November 1-2, 1995 to allow the commercial sector an opportunity to harvest the remaining 0.16 MP of the 1995 3.06 MP quota. Preliminary estimates are that, with inclusion of the November mini-season, the commerciale sector will have met or slightly exceeded its allocation.

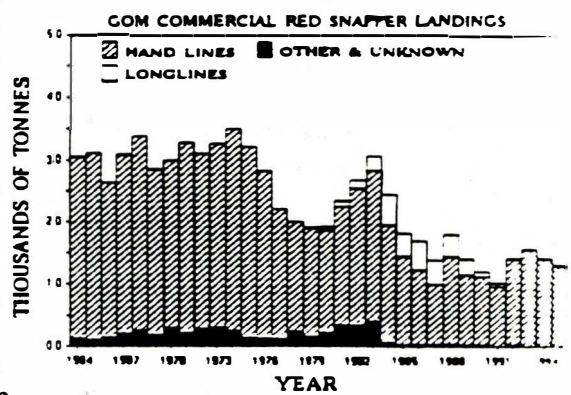


Figure 2. Commercial landings of red snapper from [illegible] waters of the Gulf of Mexico.

COMMERCIAL RED SNAPPER HARVEST

Year	Commercial Quota	Commercial Harvest
1990	3.1 MP	2.6 MP (1.2 thousand MT)
1991	2.04 MP	2.2 MP (1.0 thousand MT)
1992	2.04 MP plus emergency season	3.1 MP (1.4 thousand MT)
1993	3.06 MP	3.4 MP (1.6 thousand MT)
1994	3.06 MP	3.1 MP (1.4 thousand MT)
1995	3.06 MP	2.9 MP (1.3 thousand MT) - preliminary

The first quota closure of the commercial red snapper fishery occurred on August 24, 1991. In subsequent years, a derby fishery developed, and the quota was filled in increasingly shorter time periods. As shown in Figure 3, maximum catch per day accrued to those fishermen who departed the last week of December 1991 for the start of the 1992 season. Catch per day decayed rapidly from the peak observed in the early part of the 1992 season and by the last month of the season was comparable to that at the end of the 1991 season. Catch per day during the 1,000 pound trip limit in 1992 averaged about 240 pounds and was similar to the same time period the previous year. In 1993 and 1994 catch per trip was obviously constrained by the trip limit and the fleet was capable of much higher total catches. Annual mean catch per day for the directed fishermen also increased by more than 3-fold in the six year period since the logbook program was implemented. In addition to increased catch rates, red snapper has become more of a targeted species (i.e., it comprises a greater proportion of an average red snapper vessel's total landings) than it was prior to Amendment 1.

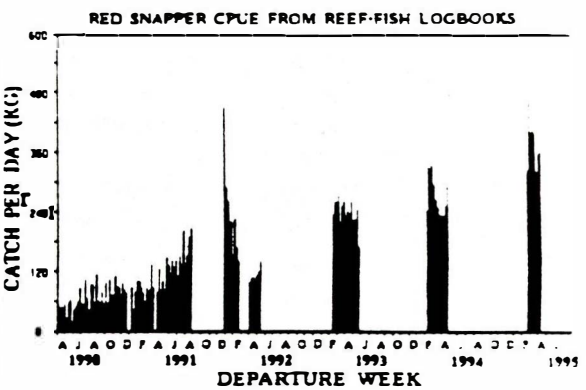


Figure 3. Red snapper catch per day fished by week for trips where red snapper exceeded half the total finfish landings.

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, and 2.94 MP since 1993. 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	1.3 MP (0.579 thousand MT)
1991	1.96 MP	2.1 MP (0.937 thousand MT)a
1992	1.96 MP	3.8 MP (1.726 thousand MT)a
1993	2.94 MP	5.4 MP (2.429 thousand MT)a
1994	2.94 MP	4.7 MP (2.125 thousand MT)a
1995	2.94 MP	not available

Recreational red snapper harvest in numbers of fish is shown in Figure 4. 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.

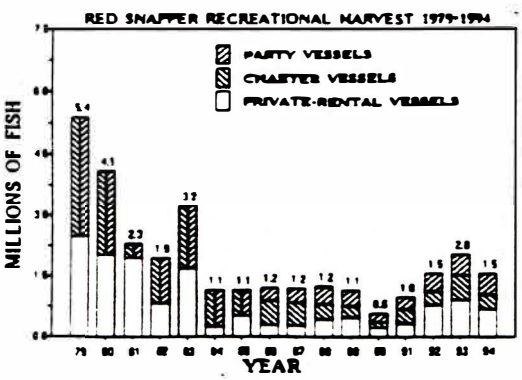


Figure 4. Estimated numbers of red snapper harvested by recreational fishermen by mode, 1979 to 1994.

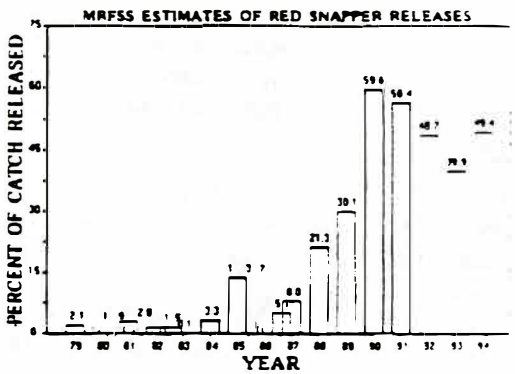


Figure 5. Estimated fractions of red snapper caught and released by recreational fishermen 1979-1994

The MRFSS, in addition to harvest, estimates the number of fish that are caught and released (Figure 5). Red snapper were rarely released in the early years of the survey but more than half of those caught were being released by 1990, and the proportion released declined thereafter. This pattern reflects changes in the length frequency of the red snapper harvested and is likely due to minimum size limits as well as the growth of the 1989 year class.

Overall Harvest: The Council established TAC levels of 4 MP in 1991 and 1992, and 6 million pounds since 1993. Total directed fishery harvests during 1990 through 1994 are listed in the table below and in Figure 6 (with metric tonnes converted to millions of pounds).

OVERALL RED SNAPPER HARVEST

Year	TAC	Total Directed Harvest
1990	No TAC was explicitly specified	4.0 MP (1.8 thousand MT)
1991	4.0 MP	4.4 MP (2.0 thousand MT)
1992	4.0 MP plus emergency season	6.8 MP (3.1 thousand MT)
1993	6.0 MP	8.8 MP (4.0 thousand MT)
1994	6.0 MP	7.7 MP (3.5 thousand MT)

These harvest levels reflect adjustments that have been made to the MRFSS recreational estimates.

The Council intended that management measures would control the harvest of red snapper. However, the total harvest by the directed fishery has exceeded the TAC every year since 1991. The overruns in 1992 and 1993 were each 2.8 million pounds over their respective TACs.

Recreational red snapper harvest allocations since 1991 have been set at 49 percent of the TAC, or 1.96 MP in 1991 and 1992, and 2.94 MP since 1993.

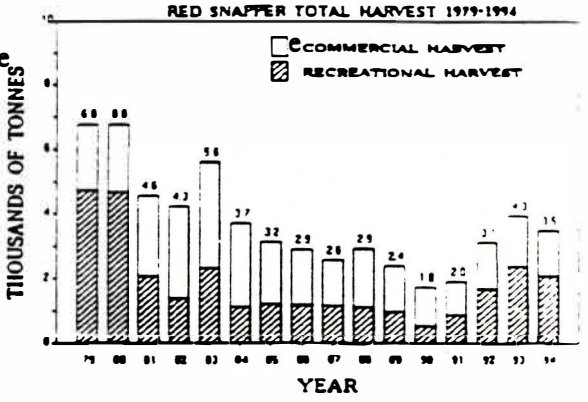


Figure 6. Estimated biomass of the combined commercial and recreational harvest of Gulf of Mexico red snapperse (1979-1994).

Recruitment Trends

Trend vs. Time: Juvenile abundance indices from the Summer SEAMAP Survey and Fall Groundfish Survey show a general decline between the 1970s and 1980s with the lowest values occurring with the 1985 year class (Figure 7). The Summer SEAMAP red snapper collections are composed almost entirely of age-1 fish while the Fall Groundfish samples contain both age-0 and age-1 individuals. A composite time series was developed to characterize recruitment by year class. Year class strengths have varied more than 10-fold during the period of record. Most recent years have had poor recruitment compared to the 1970s. However, the 1989 year class was the strongest seen in 8 years and more than 4.4 times greater than the average of the previous 5 years. Members of this year class began to recruit to the fishery late in 1991 and most were of legal size by January 1992. The five subsequent year classes (1990-1994) averaged only about 40 percent of the 1989 year class, but 1.8 times higher than the five years preceding 1989.

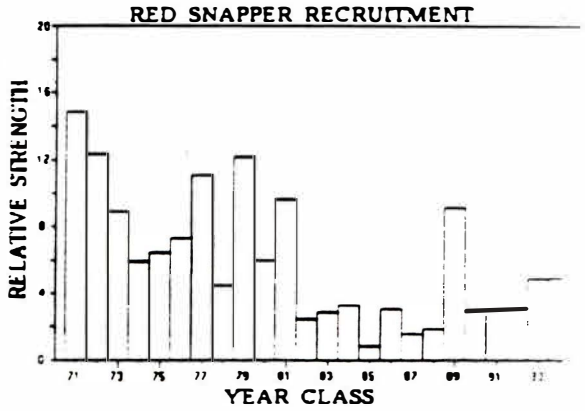


Figure 7. Year class strength estimate for red snapper 1971-1994.

Trend vs. Spawning Stock: Recruitment closely follows the spawning stock (Figure 8) indicating that this fishery is recruitment over-fished. This figure illustrates that spawning stock, measured as population fecundity, has increased since regulations were implemented in 1990. However, the figure also illustrates how close this fishery came to recruitment failure in 1985. This trend indicates there is a spawning stock threshold below which recruitment declines precipitously. The red snapper population has been reduced to a level that any decrease in stock size would have a direct negative effect on recruitment.

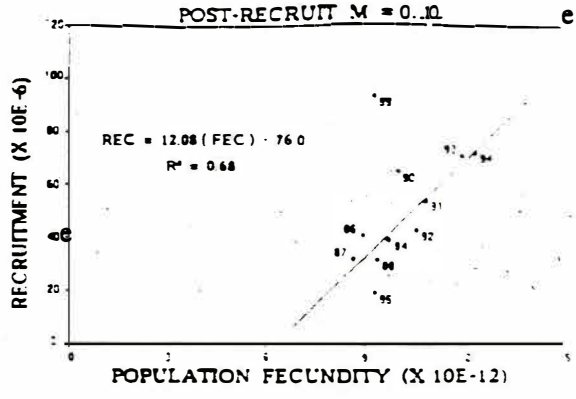


Figure 8. Scattergram of recruitment and population fecundity for M=0.10. The 1989 point was omitted from the regression.

Generation Time and Recovery Target Date

Generation time is defined as the mean age of the mothers of the young comprising a year class (Goodyear 1994). It is a function of the mean fecundity of females at each age and the number of females alive at each age. The number of females at each age in an unfished population is dependent upon the natural mortality rate estimate. The management plan specifies that the recovery schedule for overfished stocks is to be no greater than 1.5 times the unfished generation time. Estimated generation times and the corresponding recovery target dates (based on a starting date of 1990 and a 1½ generation time multiplier) for the previous natural mortality rate estimate of M=0.20 and the current estimate of M=0.10 are presented below.

Natural Mortality Rate	Generation Time	Recovery Target Date
0.10	19.6 years	2019
0.20	13.6 years	2010

Fishing Mortality Rates

VPA estimates of fishing mortality rates within the directed fishery have been very high. Data were sufficient to estimate the mortality only beginning in 1984. The fishing mortality rates rise rapidly with age after the juvenile red snapper enter the fishery reaching a maximum at age 3. In previous stock assessments, the 1985 the peak was above F=0.7 but declined to a low of F=0.3 by 1992. Fishing mortality increased in 1993 to

about F=0.35 at age 3 coincident with the increased harvest by the recreational fishery. In the current stock assessment, average fishing mortality in 1994 in the directed fishery was estimated to be F=0.30 per year.

For comparison the red snapper yield per recruit analyses provided estimates of $F_{0.1}$ and F_{max}, two management benchmarks typically used to determine overfishing. At M=0.10, $F_{0.1}$=0.076 per year or 0.073 per year for discard mortality levels of 20 percent or 33 percent respectively. The level for F_{max} is 0.13 per year. The current fishing mortality level of F=0.30 is approximately four times higher than $F_{0.1}$ and more than twice as high as F_{max}.

Spawning Potential Ratio (SPR) Estimates and ABC Range

The terms spawning stock biomass per recruit (SSBR) used in Amendment 1 and spawning potential ratio (SPR) used in the stock assessments both refer to the same index of population status. This regulatory amendment follows the terminology of the stock assessments by using SPR because it is technically a more correct reference to spawning stock index.

In previous stock assessments, red snapper SPR was estimated to have been about 0.6% of the unfished level in 1984, increasing to slightly below 2% by 1994 (Goodyear 1994). When the new biological information previously discussed in this document was incorporated into the SPR model, but natural mortality was kept at the old estimate of M=0.20, the 1984 estimate of SPR increased to 4 percent, but with very little improvement in subsequent years (Figure 9), partly because year classes partly protected by recent conservation actions have not yet become important contributors to the spawning stock (Goodyear 1995).

Under the new natural mortality estimate of M=0.10, the new current SPR estimate is about 0.6 percent, essentially unchanged from 1984 (Figure 9). The RFSAP noted that this change in SPR (relative to the estimates under M=0.20) is simply a rescaling of the recovery parameters along with extension of the target date to 2019, and does not represent a dramatic decrease in the perceived health of the stock. Under the assumptions that 1) actual shrimp trawl bycatch mortalities are not higher in 1995 and 1996 that projected, 2) the recreational sector stays within its allocation, 3) a 50 percent reduction in shrimp trawl bycatch mortality is implemented in 1997, and 4) projected increases in recruitment are realized, the RFSAP recommended an ABC range of 6 million to 10 million pounds of red snapper. However, the RFSAP also warned that failure to meet these conditions can result in possibly dramatic reductions in future ABC ranges.

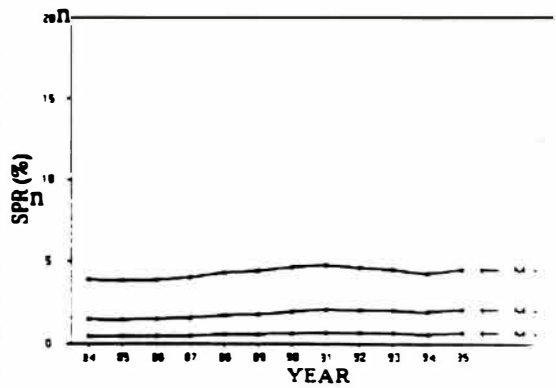


Figure 9. Estimates of dynamic SPR for 1984-1994 three levels of post-bycatch natural mortality.

9.n CHARACTERIZATION OF THE FISHERY AND PARTICIPANT GROUPSn

General Description

The fishery for red snapper is composed of a shrimp trawl bycatch of age-0 and age-1 fish, a commercial fishery managed by quota since 1990, a for hire recreational fishery and private recreational anglers the advent of TAC and allocations in the fishery, its history can be described as one of attenuated season

depressed prices for the food commercial sector and overruns of allocation 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 accelerated implementation of increased minimum sizes on red snapper for the anglers.

As mentioned elsewhere, the statutory allocation of TAC is 51 percent commercial and 49 percent recreational, but the actual landing percentages in the directed fishery over the last three years averaged at 41 percent commercial and 59 percent recreational.

Recreational and For-Hire Sectors

Recreational landings have been identified from three survey sources: Texas Parks and Wildlife, NMFS-Headboat and NMFS-MRFSS. All three surveys reflect an increasing trend in landings over the years. Figure 10 displays the relative contribution to recreational catch by state using these sources. Another perspective is to view the landings on a state by state basis. Even during this short time frame the shift in state shares of the recreational landings, notably the recovery of landings by Florida and the growth of Louisiana and Alabama is evident.

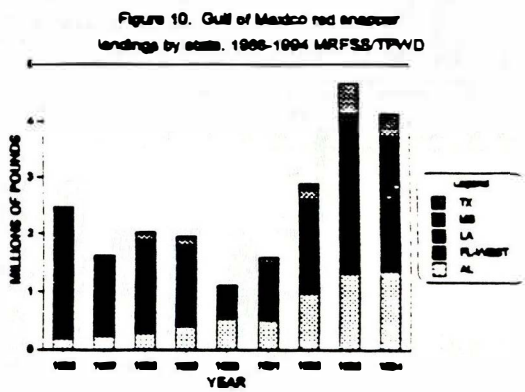


Figure 10. Gulf of Mexico red snapper landings by state, 1986-1994 MRFSS/TPWD

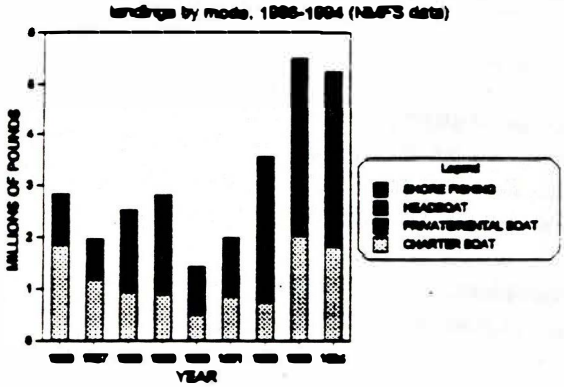
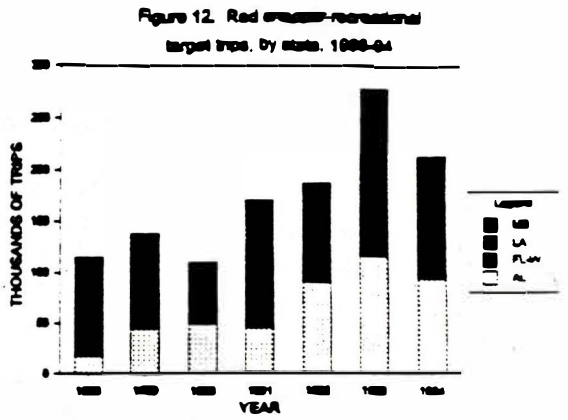


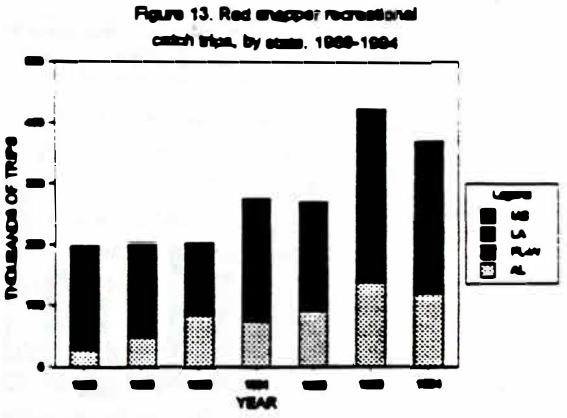
Figure 11. Gulf of Mexico recreational landings by mode, 1986-1994 (NMFS data)

Figure 11 displays landings by mode for the period 1986 to 1994. The landings in the charter mode have a bimodal distribution with highs during 1986 and 1993; the private boat and headboat modes suggest a trend of growing catches. 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. The figure reflects a 5.7 MP catch in 1994 for example. 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 for a 1994 estimate of 4.7 MP. It should also be noted that preliminary partial-year landings data received by the Council indicated 1995 landings from MRFSS were 24 percent lower than those in 1994 and 1995 headboat landings 16 to 32 percent lower than those in 1994 (Holiman and Dixon, pers. comm. 1995).

Estimation of recreational overruns is further complicated by the increased minimum size limit that went into effect during 1995 and the lack of 1995 data to evaluate the accuracy of the earlier reduction estimates. Some public testimony to the Council suggested that landings were down as a result of the size limit and bad weather

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 12 through 15 present some information on angler trips in which red snapper was targeted (target trips) or caught (catch trips). In Figure 12, note the trends in red snapper target trips by state between 1988 and 1994: 1) there was little perceptible effect on target trips after the implementation of Amendment 1 to the reef fish

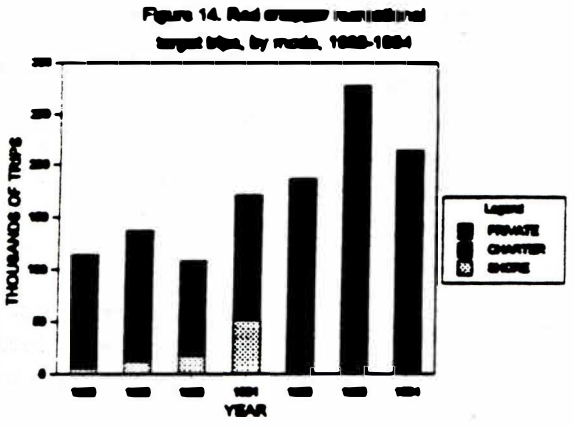


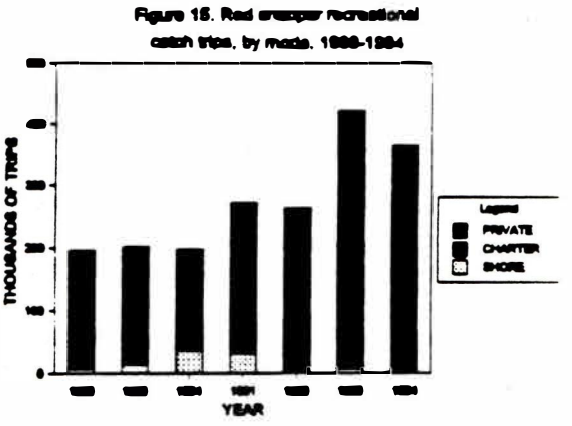


FMP; 2) Louisiana anglers increased trips by roughly 20 percent when the last two years are compared to the prior five years; 3) Alabama anglers experienced a doubling of trips between 1991 and 1992 which has persisted and increased; 4) Mississippi anglers mimicked the trend in Alabama.

Figure 13 displays angler trips in which red snapper was caught, whether or not red snapper was targeted. The catch trips correlated well with the target trips, although not so much in terms of magnitudes of changes. In Alabama, for example, the catch trips increased and decreased in the same direction as the target trips. But the doubling of target trips between 1991 and 1992 was accompanied by only a slight increase in catch trips. Catch trips in this state nonetheless picked up in later years. Florida's proportion of catch trips is larger than the state's proportion in target trips while the opposite seems to be the case for Mississippi.

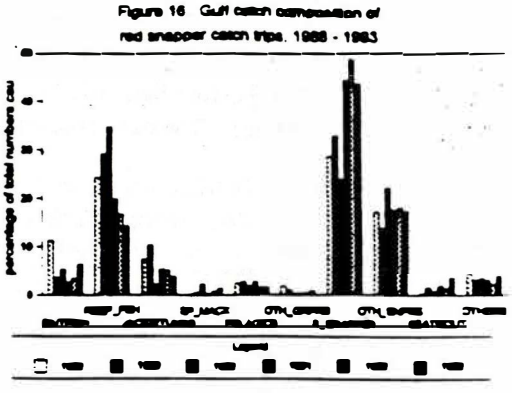
Figures 14 and 15 break down the recreational target and catch trips into shore, charter and private boat trips. The shore mode comprises a minimal portion of both total target and catch trips. The charter boat mode





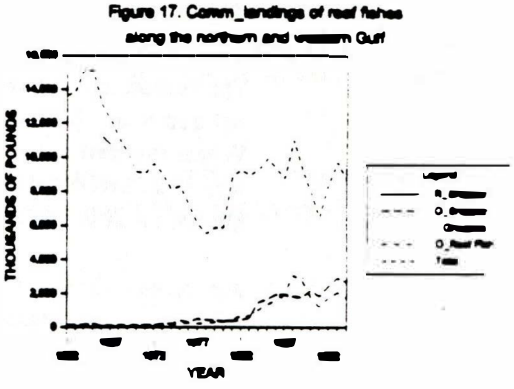
indicates a steady increasing trend in both target trips (Figure 14) and catch trips (Figure 15). The private mode has dominated the target trips. The same can be said of the catch trips, except in 1993 and 1994 when the charter boat mode had higher proportional share of total catch trips. Figure 15 appears to bear out the growing importance of the charter boat mode in accounting for recreational catches of red snapper.

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 16 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.



Commercial Sector

Red snappers are mainly caught and landed in the northern and western Gulf (including Texas to Bay County, Florida). Commercial landings of reef fishes in this area declined from over 15 MP in 1964 (a good portion of which was from Mexican waters) to a low of 5.5 MP in 1978. Landings recovered during the late 1970s, and have averaged 9.0 million pounds (whole weight) per year between 1981 and 1994 with a range of 6.5 million pounds (in 1991) to 11.0 million pounds (in 1988) (Figure 17). However, the species composition of the catch changed markedly. Landingse 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. Red snapper represented 35% of the total commercial catch of reef fishes in 1994 compared with 72% of the catch in 1980 and 85% in 1970.

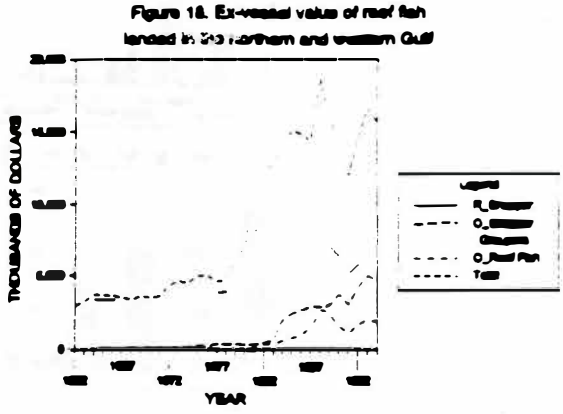


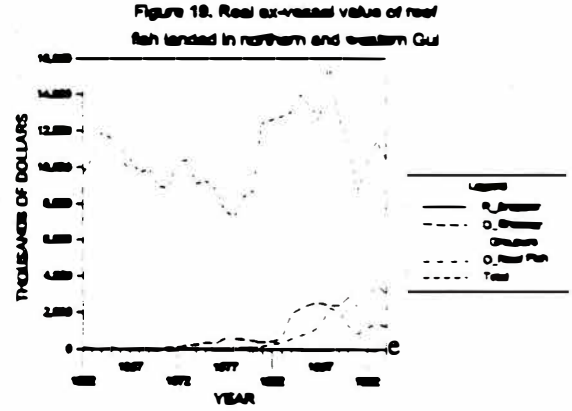
Ex-vessel value received by commercial reef fishermen in the northern and western Gulf of Mexico increased from $2.9 million in 1962 to $18.6 million in 1988, declined to $11.9 million in 1991, and then increased to $15.5 million in 1994 (Figure 18). Much of the increase prior to 1988 was due to inflation, 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 17 and 19). Real ex-vessel value remained relatively constant from 1981 through 1987, peaked in 1988, and then declined. The real ex-vessel revenues received in 1991 and 1992 were the lowest since 1980 (Figure 19)

Commercial fishermen in the northern and western Gulf received $6.2 million from red snapper in 1994. Historically, red snapper has been the most valuable species in the fishery, but its relative importance has declined (Figures 17 and 19). In 1994, red snapper contributed 40% 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.

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 2,000 in January, 1993, to about 1,532 in July, 1995.





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 red snapper fishermen were allowed a 200 pound limit per day trip.

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.

10.e MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEWe

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 regulations are a "significant regulatory action" under certain criteria provided in Executive Order 12866 and whether the proposed regulations 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 recordkeeping requirements. The RFA requires that if regulatory and recordkeeping 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 commercial and recreational directed 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 in half in 1997. 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, the Council is developing an amendment to the shrimp FMP that would require bycatch reduction devices in shrimp trawls. The succeeding analysis focuses mainly on impacts on the red snapper fishery.

In this document, the "Economic Impacts" statements under each of the management options comprise the bulk of the RIR. The problems and objectives are described in previous sections of this regulatory document as a part of the RIR by reference.

Proposed Alternatives

Proposed Alternative 1. Set the 1996 TAC for red snapper at 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. Implemented the recreational allocation by retaining the status quo of a recreational size limit of 15 inches and a recreational daily bag limit of 5 fish.

Proposed Alternative 3. Extend the red snapper recovery target date to the year 2019, based on a new natural mortality estimate of M=0.10 and a new generation time estimate of 19.6 years.

Proposed Alternative 4. Remove the provision, for the commercial sector, for automatic red snapper minimum size limit increases to 15 inches total length in 1996 and 16 inches total length in 1998 that was

implemented through Amendment 5, and retain the 14 inch total length size limit for red snapper for the commercial sector.

Note: The above Proposed Alternatives are inter-related and have therefore been listed and discussed together in this section. In particular, any changes to Proposed Alternative 1 would force changes to Proposed Alternative 2, and changes to Proposed Alternative 3 would force changes to both Proposed Alternatives 1 and 2.

Rationale: The proposed TAC is within the 6 to 10 million pound ABC range recommended by the RFSAP, and is more conservative than the maximum allowed under the ABC recommendation. This is the first time since 1991 that the Council has proposed a TAC at less than the upper limit of ABC[5], and reflects the concerns expressed by the RFSAP, SEP and RSAP about achievability of a 50 percent shrimp bycatch reduction in 1997. The proposed TAC has a better than 50 percent probability of achieving the recovery target even under the more conservative assumption of only a 37 percent shrimp trawl bycatch reduction in 1997 and a 50 percent reduction in 1998. The technology to achieve this reduction currently exists, and the Council is in the process of preparing an amendment to the Shrimp FMP to implement the reduction. Therefore, achieving the bycatch reduction goal appears reasonable.

There is a 54 percent probability of achieving the 20 percent SPR target by 2019 with a 9.12 million pound TAC. This is based on a linear interpolation in Table 118 of the stock assessment (appended to this amendment), between the probabilities of achieving 20 percent under an 8 million pound TAC (90% probability - column C) and a 10 million pound TAC (25% probability - column D). This is also based on the more restrictive assumption that there will only be a 37 percent reduction in shrimp trawl bycatch in 1997 and a 50% reduction in 1998. If the full 50% shrimp trawl bycatch reduction can be achieved in 1997, these probability levels will be even higher.

Bag and size limit analysis by NMFS (Holiman 1995a, Table 1 - appended to this amendment) projects that recreational harvest under the existing 5 fish and 15 inch recreational limits will result in a recreational red snapper harvest of 4.47 million pounds. This is exactly the recreational allocation under a 9.12 million pound TAC, making additional recreational harvest restrictions unnecessary. Anecdotal information from fishermen suggests that recreational harvest may be even lower than projected due to the increasing frequency of storms in the Gulf of Mexico and a corresponding decrease in recreational effort, which has not yet been reflected in the recreational survey data. In addition, since we do not currently have a full year of recreational fishing under the existing bag and size limits, the actual impact of the existing size and bag limits is not yet known. Maintaining status quo for an additional season will allow time for the necessary data to be collected to fully assess the impact of the existing regulations before deciding whether changes are needed. Status quo will also promote stability in the recreational for-hire industry. Charterboat operators have suggested that their ability to attract paying customers would be severely impacted if the bag limit were to be further reduced.

Extension of the recovery target date to the year 2019 is a result of improved biological data for red snapper. New age and growth data indicates that red snapper are much longer lived and have a longer generation time than previously thought. The 2019 target date is 1½ times the new generation time. As stated in the RFSAP report, this is simply a rescaling of biological parameters which has no effect on recommended ABC ranges nor does it represent a dramatic decrease in the perceived health of the stock.

---

[5] In the 1991 Regulatory Amendment for Setting the 1991 Red Snapper Total Allowable Catch, the Council considered TACs ranging from 3 to 5 million pounds, and adopted a 4 million pound TAC. For 1992, TAC was not respecified and remained at 4 million pounds. For the 1993, 1994, and 1995 seasons, TAC was set and maintained at the upper ABC limit of 6 million pounds

Restoration of the 14 inch commercial size limit and removal of the automatic 15 inch and 16 inch increases in 1996 and 1998 are technical adjustments made necessary by delays in the processing of proposed Amendment 12, which contains similar provisions. It had been the Council's intent that the commercial 15 inch size limit not be implemented on January 1, 1996. Since Amendment 12 will not be in effect on January 1, the 15 inch commercial size limit will take effect, and this regulatory amendment is needed to restore the original size limit. The 1995 stock assessment notes that, in addition to hooking and handling mortality, predation of released fish may be important in areas with significant concentrations of large predators. The assessment further notes that the precise extant of release mortality is not clear. Because of this uncertainty about the level of release mortality and the potential wastage of economically valuable fish if the size limit has been set incorrectly, the Council feels that changes to the commercial size limit should not be made at this time. Further rationale for retaining a 14 inch commercial size limit comes from Amendment 12 as follows:

> Amendment 5 created a series of biennial size limit increases that will raise the minimum size limit for red snapper to an eventual 16 inches total length This is the size that will maximize yield per recruit and biomass yield from the stock, assuming a 33 percent release mortality, thereby benefiting the restoration program. The commercial red snapper industry feels, however, that NMFS has underestimated the release mortality from the commercial sector. The commercial fishery may fish further offshore than the recreational sector. Fast retrieval and sudden decompression associated with the use of power reels may also contribute to a higher mortality for commercially caught fish. Also, a 13 inch fish is a more desirable size for the market. The Ad Hoc Red Snapper AP recommended that the 13 inch size limit be restored. However, in the absence of positive information that release mortality is higher than assumed, there may be a greater benefit to the commercial fishery from keeping the size limit regulation stable at 14 inches. If release mortality is higher than assumed, then the minimum size limit that produces maximum yield per recruit will be smaller.

Biological Impacts: The 9.12 million pound TAC represents a 52 percent increase over the 6 million pound TAC that has been in effect since 1993, but only an 18 percent increase over the actual 7.7 million pound total harvest in 1994, and less than a 4 percent increase over the peak harvest (since TACs were implemented) of 8.8 million pounds in 1993.

Virtually all of the additional actual harvest will accrue to the commercial sector, which has been effectively constrained in recent years by quota closures. For 1996, the Council has proposed, through previous action, that one million pounds of the commercial quota be harvested under a short-term extension of the red snapper endorsement system and trip limits beginning February 1, 1996. The remainder of the quota (3.65 million pounds under the proposed TAC) is to be taken through an ITQ system beginning in April. In the wreckfish ITQ on the Atlantic coast, some holders of small share amounts have not used their shares, resulting in underharvest of the quota. It is therefore possible that in 1996 the commercial sector will not exceed and may underharvest their quota.

The recreational sector, in contrast to the commercial sector, has not been effectively constrained in the past. It has exceeded its allocation in every year that there has been a recreational allocation, in some years taking nearly double its allotted poundage. In previous years recreational harvest proposals have been based partly on assumed but undocumented factors, such as a reduction in angler participation resulting from increased harvest restrictions, or on additional measures that were subsequently disapproved, e.g., exclusion of charter/headboat captains and crew from retaining a bag limit. For 1996, the Council has proposed a combination of TAC and bag/size limits that precisely matches the projected recreational harvest to the recreational allocation, without any additional assumptions.

The bag and size limit analysis does not take into account possible increases in average size of fish caught or increased success rate of anglers, which could result in recreational harvest being greater than projected. In addition, NMFS has made a preliminary projection that the 1995 recreational harvest will be 5 million pounds under the current size and bag limits. This estimate is based on partial 1995 MRFSS survey data, expanded using historical MRFSS effort estimates and ratios between Texas and headboat data and MRFSS data. However, the NMFS analysis uses uncorrected MRFSS charterboat effort data from recent years which has been called into question by the Council. The red snapper stock assessment uses a 5 year running average to estimate MRFSS charterboat effort in 1993 and 1994, resulting in reduced effort and landings estimates for those years. Had the same correction been applied to the preliminary NMFS 1995 recreational harvest projection, it would have resulted in a lower estimate. Prilimianry 1995 landings data for part of that year indicated landing levels 24 percent and 16 to 32 percent below comparable periods in 1994 for the MRFSS and Headboat survey respectively (personnel communications, Holiman and Dixon). NMFS has suggested that problems with the MRFSS effort data may stem not from overestimating recent years, but from underestimating earlier years. If true, a future stock assessment will need to incorporate revised landings estimates which may result in a change in future ABC ranges. In the absence of that determination, the lower effort estimates used by the stock assessment have been accepted by the SSC as the best available scientific information. Consequently, with the information available, the presumption that the status quo size and bag limits will constrain recreational harvest at or near its 4.47 million pound proposed allocation appears to be reasonable.

The assumption of a 50 percent reduction in shrimp trawl bycatch of red snapper is very important to achieving the 20 percent SPR goal. This does not mean a 50 percent reduction in the absolute pounds or numbers of red snapper caught but rather a reduction in the instantaneous mortality rate associated with shrimp trawl bycatch. As such, the actual pounds or number of red snapper caught is proportional to the red snapper stock size. However, the achievability of the 20 percent SPR goal is very sensitive to achieving a shrimp bycatch reduction. A lower percentage of bycatch reduction or a delay in implementation will require reduced TAC's to achieve a 20 percent SPR by 2019. At low or no bycatch reduction levels, a 20 percent SPR cannot be achieved at any level of TAC.

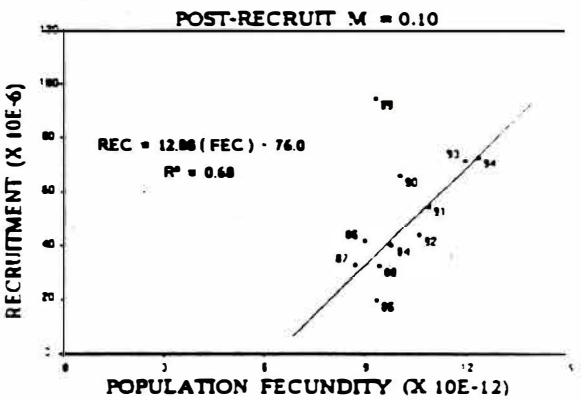


Figure 20. Scattergram of recruitment and population fecundity for M=0.10. The 1989 point was omitted from the regression.

Extending the recovery period to the year 2019 is the result of new data indicating that red snapper are longer lived and have a longer generation time than previously thought. In general, the longer lived a species is, the longer a recovery will take. In this regard, an extension of the recovery period is not unreasonable provided it remains within the 1½ generation time limit as specified in the FMP. As shown in Figure 20, population fecundity and year-class recruitment in recent years has been consistently higher than in the mid-1980's, suggesting that there is a trend for increased recruitment and a reduced chance of recruitment failure over time as the stock recovers. However, a stock that is below the overfishing threshold is by definition vulnerable to recruitment failure, and is in danger of not being able to sustain itself. The high volatility of recruitment success is vividly illustrated in Figure 20, by examining at the large difference in recruitment between 1985 and 1989, two years with nearly identical population fecundities. These two years are certainly extremes within the dataset, and probably represent rare events. However, the probability of either rare event (extreme success or extreme failure) reoccuring increases as a result of increasing the time

that the stock is allowed to remain in an overfished condition. Since each of these rare events has only occurred once within the eleven years of available data, it is impossible to quantitatively determine the level of potential risk (or reward). Achieving projected recruitment levels is an assumption of the model. If the projected levels are not achieved, future reductions in TAC may be necessary. Conversely, if projected levels are exceeded, future increases in TAC may be possible.

The following analysis of the 14 inch commercial red snapper size limit is taken from Amendment 12. Note that the analysis is based on the old natural mortality rate estimate of M=0.20. Under the new estimate of M=0.10 the sizes corresponding to a given SPR and yield will be higher (see discussion later in this section).

Amendment 5 established a schedule of biennial one-inch size limit increases to raise the red snapper minimum size limit from 13 inches to 14 inches in 1994, 15 inches in 1996, and 16 inches in 1998. The 15 inch size limit for the recreational fishery was implemented in 1995, ahead of schedule, as part of a regulatory change to keep the recreational sector within its 2.94 million pound allocation.

The 16 inch size limit is within the range of sizes determined to achieve 99 percent of the maximum yield per recruit, assuming a 33 percent release mortality of undersized fish (the size range, from figure 69 of Goodyear 1992, was about 15-19 inches). This yield per recruit was also dependent on reducing fishing mortality to a rate of about F=0.2. At the 1994 fishing mortality rate of F=0.346 for the most heavily exploited age 3 age group (from table 90 of Goodyear 1994), neither 99 percent nor 95 percent of maximum yield per recruit can be achieved at any size limit. A 90 percent yield per recruit can be achieved with sizes ranging from about 14-21 inches, but 20 percent SPR can be achieved only at the upper end of that range (Figure 21).

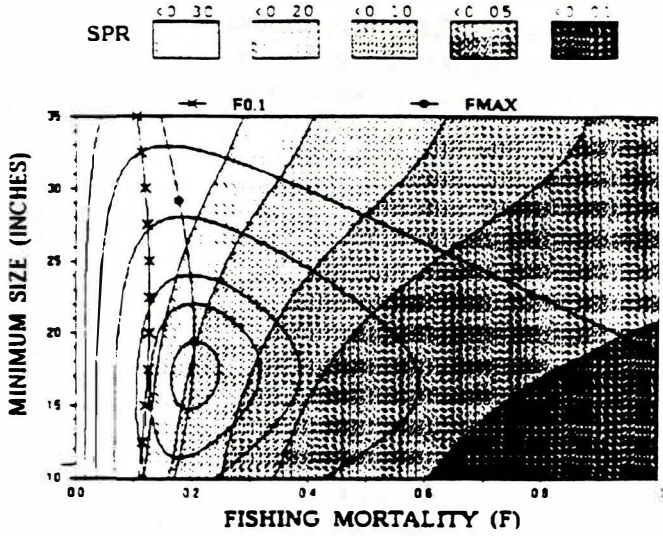


Figure 21. Yield and SPR for red snapper in the absence of any shrimp trawl discard mortality as a function of minimum size and F for a release mortality of 0.33. Yield isopleths represent 99%, 95%, 90%, 75%, 50% and 25% of maximum yield per recruit (from figure 69 in Goodyear 1994).

Testimony from commercial fishermen suggests that release mortality may be higher than 33 percent. One person's testimony stated that historical documents from as far back as the 1870's noted that snapper caught deeper than 10 fathoms could not be kept alive in the live wells that were used during that time period. If release mortality is higher than assumed, then the minimum size for maximum yield per recruit will be smaller. Conversely, if release mortality is lower (or the maximum age is higher than in the current assessment), the minimum size will be larger. Based on the above yield curve, a 20 percent SPR can be achieved with a 14 inch size limit provided the fishing mortality rate is reduced to between F=0.21 to 0.28. However, when the new biological data and natural mortality estimates are factored in, the stock assessment estimate for the minimum size limit corresponding to maximum YPR increases from 16 to 18 inches. The RFSAP report states that the 1994 directed fishing mortality rate is estimated to be F=0.30. Thus, maintaining a 14 inch size limit could necessitate a reduction in TAC to achieve the recovery target.

It must be noted that the above yield curve (Figure 21) is from the 1994 stock assessment, since there was no corresponding analysis in the 1995 assessment. Under the 1995 assumption of a lower natural mortality rate and reduced growth rate model, a red snapper at any given size is older than previously thought (comparison of Table 3 in Goodyear 1994 with the equivalent Table 5 in Goodyear 1995). However, the relative reproductive importance of older age classes also increases, as seen in Figure 22. The RFSAP concluded that adoption of a lower natural mortality rate simply rescaled some aspects of the assessment and did not affect ABC ranges or represent a dramatic decrease in the perceived health of the stock.

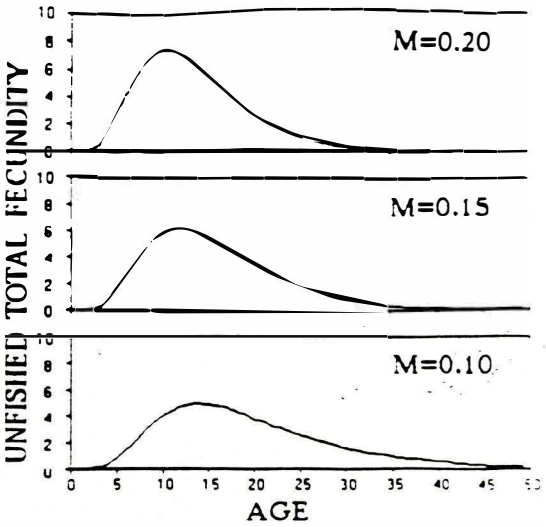


Figure 22. Relative reproductive importance of female red snapper by age in the unfished condition for natural mortality rates of 0.10, 0.15, and 0.20.

Economic Impacts: Ever since the advent of more restrictive management on the red snapper fishery, the upper bound of ABC recommended by the RFSAP has never gone above 6.0 MP. The current RFSAP recommendation of an upper limit of 10 MP is 67 percent above the past upper ABC bound. In the past, the SEP consistently recommended that a TAC be chosen at the upper bound of the ABC (see GMFMC 1992,1993,1994). For the current assessment, the SEP proposed a graduated TAC of 8.0 MP for 1996 and 10.0 MP for 1997. The two-year TAC is based on the fact that no comprehensive stock assessment will be conducted in 1996 and on the likelihood of achieving a level of shrimp trawl bycatch reduction in 1997 that is required to successfully progress along the recovery plan for the red snapper stock. The RSAP proposed a TAC similar to that proposed by the SEP and a retention of the recreational limits of 5 fish and 15 inches. The SSC advised the Council that a selection of TAC at the upper end of ABC would require earlier (by 1997) and larger (at least 50 percent) reductions in shrimp bycatch and selection of TAC at the lower end of ABC would require a reduction of the recreational harvest from levels observed in recent years. The Council is proposing a 9.12 MP TAC for 1996, with the poundage allocation to the commercial and recreational sectors determined by the prevailing 51/49 commercial/recreational allocation ratio.

The proposed increase in TAC, retention of the recreational limits of 5 fish and 15 inches, retention of commercial size limit of 14 inches, and the extension of the recovery target date would obviously result in an increase in short-term net benefits to red snapper fishery participants. The long-term effects depend, among others, such factors as the future status of stock as partly determined by current regulations on directed fishery and reduction in mortality of juvenile red snapper incidentally caught in shrimp trawls, market condition for commercially sold red snapper, and the nature and strength of both commercial and recreational demand.

Commercial Sector

The red snapper fishing season normally starts on January 1 and ends on December 31 of every year. In 1991 the commercial fishery reached its quota and the fishery closed several months before December. In year 1992 marked the onset of a derby in the red snapper fishery when the regular season started on January 1st and ended 53 days later. The derby continued the following years, with the fishery open for about 2 months in 1993, 2.5 months in 1994, and 1.5 months in 1995. The 1995 season was prematurely closed but was reopened for 36 hours the first week of November. Since 1993, the commercial fishery season on

has been delayed through regulatory amendments. It opened on February 16, 1993, February 10, 1994, and February 24, 1994. These delays were intended to minimize fishing during hazardous winter weather and to enable the fishermen to take advantage of higher demand during Lent.

Since 1993, commercial harvest of red snapper has been governed by a species endorsement system. Vessels fishing with endorsement can harvest up to 2,000 pounds per day trip; the rest are limited to 200 pounds per day trip. The endorsement system was partly intended to slow down the derby fishery, but with little effect as borne out by attenuated seasons over the last three years. Fishing year 1996 marks a different management regime for the commercial sector. If a proposed emergency action is approved, the season will commence on February 1, 1996 under a 1.0 MP quota. Harvest will still be governed by the endorsement system. This season closes when the quota is reached. Starting April 1, 1996, an ITQ system will take effect unless forestalled by Congressional action. The commercial fishery will then reopen with the remaining 1996 quota distributed as ITQ coupons to participating fishermen. The fishery remains open to the extent that there are unused ITQ coupons. Unless specified, the implementation of an ITQ system in 1996 is presupposed in the ensuing discussion of impacts on the commercial sector.

Proposed Alternatives 1, 3, and 4 have direct effects on the commercial sector. Proposed Alternative 3 would enable larger short-term benefits in the sense that a longer recovery period would entail less restrictive regulations, including quotas, over the entire recovery period. The long-term prospects of this alternative depend heavily on the rapidity of stock recovery. We may expect a longer recovery period with less restrictive management to slow down the stock's recovery, and a shorter period to speed up such recovery. In either situation, the economic issue involves determining the net benefits over time, and it is possible that the net benefits to the commercial sector over the same period may turn out to be same for both situations. We may note at this stage that the rapidity of stock recovery also depends on shrimp trawl bycatch reduction and future recruitment. Both these aspects have been discussed in the Biological Impacts section. The important issue here is that these two factors appear to be relatively extraneous to the management of the directed fishery. If nothing is done on bycatch reduction, even closure of the directed fishery would not enable the stock to recover beyond the overfishing level. It appears from this angle that an extension of the recovery period with concomitant less restrictive regulations may result in an increase in net benefits to the commercial fishery over the long run.

An increase in quota from 3.06 MP to 4.65 MP would undoubtedly result in an increase in short-run producer and consumer surpluses to the commercial sector. Granting the same assumptions on, among others, bycatch reduction and recruitment levels as those of the stock assessment model, the economic implications (at the harvest level) of the proposed increase in commercial quota, assumed to be held constant over the proposed recovery period, may be quantified. Waters (1995) developed a simple economic model to calculate the present value of alternative commercial quotas. This analysis was presented to the SEP, and is the basis for the ensuing discussion.

From an economic perspective, an evaluation of alternative commercial quotas entails maximization of the present value of catches over a fairly long time horizon. For regulation to be effective, catches must be reduced in the short-term, and later may be increased when the fish population increases in size. A smaller commercial quota would yield smaller revenues 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 quota would generate larger short-term benefits at the expense of a slower stock recovery. Thus, the economic problem is characterized as a tradeoff in catches over time. However, the biological model for red snapper was concerned only with catches during the recovery period and did not offer projections of the possibilities for larger catches after the biological goals had been met.

The RFSAP's recommended ABC of 6 to 10 MP corresponds to a commercial quota of 3.06 to 5.1 MP. Projections of annual industry catches of red snapper were provided by Dr. Goodyear for the 1996-2020 period. A simple economic model was developed to calculate the present value of alternative commercial quotas. Industry-wide catches were obtained from the biological simulation model. A regression analysis of real (after adjustment for inflation), average annual ex-vessel prices against annual landings of red snapper for the 1962-1994 period generated predictions of ex-vessel prices for each quota. An estimate of the average catch of red snapper per trip (approximately 1,550 pounds for high-volume, hook-and-line fishermen with red snapper endorsements in the northern Gulf) was obtained from the economic survey. However, as the red snapper resource recovers and becomes more abundant over time, it is expected that catch per trip would increase. The economic model increases catch per trip in proportion to the relative increase in the lagged young-of-the-year index as predicted from the biological simulation model. The total number of trips for red snapper was calculated as the ratio of the total commercial quota and catch per trip. Harvesting costs were calculated as the product of numbers of trips for red snapper and average variable costs per trip. Average trip costs were $800 for high-volume, hook-and-line fishermen with red snapper endorsements. Net benefits were calculated as gross revenues minus trip costs, and did not subtract fixed costs or payments for labor. Projected net present values under different scenarios are:

Projected net return to vessel owner, captain and crew.
Assumptions: Bycatch reduction: 5.8% in 1993, 10% in 1994, 1995, 1996, and 50% in 1997
Natural mortality rate: 0.10
Discount rate: 7%

Period	3.06 MP Quota	4.08 MP Quota	4.65 MP Quota	5.1 MP Quota
1996-2000	$30.2 million	$36.1 million	$37.8 million	$38.6 million
1996-2020	$92.5 million	$112.0 million	$117.9 million	$120.7 million

Several points need to be raised regarding the above figures. First, Waters (1995) provided net present values corresponding to TACs of 8.0 MP and 10.0 MP. Net present values for a 9.12 MP TAC were interpolated. Second, the projections assume that an ITQ system is in effect throughout the projection period. Both revenues and costs were adjusted to reflect one possible configuration of prices, consolidation of ITQs, and number of trips under an ITQ system. That is, prices would be relatively stable throughout the year so as to be about similar to the price configuration before the onset of more restrictive management since 1990. The high volume producers would harvest most of the quotas and would increase their number of trips.

It is not a surprise that the economic model indicated that larger, constant quotas would generate a higher net present value than would smaller, constant quotas. Thus, the present value of a 5.1 MP quota exceeded the present values of both the 4.08 and 4.65 MP quotas. Because the biological goal of a 20% ratio of spawning potential would not be achieved until shortly before 2020, the long-term benefits of larger future catches were not predicted. The model predicted a relatively large increase in net present value if the quota were increased from 3.06 to 4.08 MP, and another but lesser increase if the quota were increased from 4.08 to 4.65 or 5.1 MP. By the assumptions of the model, each increment in the commercial quota would cause ex-vessel prices to decline and would increase the number of trips, and hence trip costs, required to harvest the quota.

While the effects of an increase in quota would likely be the dominant source of increases in benefits to the commercial sector, Proposed Alternative 4 would also "contribute" to an increase in benefits. This contribution appears more in terms of preventing a reduction in benefits attributable to an increase in quota and not in the sense of adding benefits. The reason for this is that this alternative would merely prevent an increase in size limit from the current 14 inches to 15 inches in 1996 and 16 inches in 1998. Such successive

increases in size limit would potentially reduce revenues since the 1 to 2 pound market size category would be lost to the fishermen. Antozzi (1993) reported prices for the 1 to 2 pound category were higher than some other market sizes. In this event, revenues from larger sizes would not compensate entirely the revenue losses from the smaller size fish. In addition, the increase in size limit may increase production cost in terms of longer travel time and more labor to select legal size fish.

We may conclude from the foregoing discussion that the proposed measures would result in an increase of both short and long-term net benefits to the commercial sector.

Recreational Sector

Unlike its commercial counterpart, the recreational red snapper fishery is not closed once its allocation is reached. Bag and size limits have been the major tools used to keep this sector within its allocation. Since 1991, the recreational sector has been exceeding its allocation, initially by about 7 percent in 1991, 16 percent in 1992, 84 percent in 1993, 60 percent in 1994, and a projected 70 percent in 1995. It may pointed out here that the 1993 and 1994 recreational harvest estimates have been questioned as to their accuracy, and preliminary data suggest 1995 landings may be lower than those in 1994. At any rate, the need then to impose additional restrictions on the recreational sector has become necessary as its allocation is increasingly exceeded every year. This need was echoed by the SEP in its 1993 report when it became known that the recreational sector did not appear to be constrained enough by the bag and size limit (see GMFMC, 1993). A year later the Council decided to reduce the recreational bag limit from 7 to 5 fish and increase the size limit from 14 to 15 inches for the 1995 season. It may be noted, however, that constraining the recreational sector within its allocation (and the commercial sector within its quota) presupposes that the long-term benefits from restrictive management could outweigh short-run losses or short-run forgone benefits.

Holiman (1995b) conducted a size and bag limit analysis on the recreational sector. His projections indicate that the current limits of 5 fish and 15 inches would result in a 4.47 MP harvest in 1996. Given this scenario, the proposed increase in recreational allocation via an increase in TAC (Proposed Alternative 1) and the retention of current limits (Proposed Alternative 2) would have practically minimal effects on the recreational sector. Previous discussion regarding the extension of the recovery period also applies here.

While recreational bag and size limits are currently adequate to constrain the recreational catch to its increased allocation, these measures may not be sufficient to address potential increases in recreational effort over the long run unless its allocation is also increased over time. Along this line, the SEP (GMFMC, 1994) suggested that a long run approach, other than bag and size limits, may need to be developed. Noting also the trend in catches by anglers in private and charter boat mode that indicates the growing importance of the charter boat mode, the SEP (GMFMC, 1995) recommended that the Council formally recognize the reef fishery in general and red snapper in particular as being composed of three distinct sectors: commercial for food, for-hire recreational and private recreational. This recommendation was based on the observation that the three sectors are motivated by different sets of economic and social factors and that different management regimes for the three sectors should result in a higher level of economic and social benefits for any particular level of total harvest. Specific additional recommendations related to this general recommendation include: 1) setting a control date for entry to the for-hire sector, 2) formulating specific options to control overall effort in the for-hire and private recreational sectors, and 3) requesting that the Regional Director of NMFS begin an economic and social research program that will provide information for Council decisions regarding effective management of the recreational sectors.

Rejected Alternatives

RED SNAPPER TAC

Rejected Alternative 1: **Status Quo. Retain the red snapper TAC at 6.0 million pounds.**

Rejected Alternative 2: **Set the red snapper TAC at some level higher than 6.0 million pounds but less than 9.12 million pounds.**

Rejected Alternative 3: **Set the red snapper TAC at 10.0 million pounds.**

RECREATIONAL BAG AND SIZE LIMITS

Rejected Alternative 4: **Set recreational bag and size limits at a more restrictive level than status quo.**

Rejected Alternative 5: **Set recreational bag and size limits at a less restrictive level than status quo.**

RECOVERY TARGET DATE

Rejected Alternative 6: **Status Quo. Retain the 2009 target for recovery of red snapper stocks to 20 percent SPR.**

COMMERCIAL MINIMUM SIZE LIMIT

Rejected Alternative 7: **Status Quo. Do not restore the commercial red snapper minimum size limit to 14 inches (size limit would increase to 15 inches and remain at 15 inches if Amendment 12 is approved, or increase again to 16 inches in 1998 if Amendment 12 is disapproved).**

Rationale: Because all of the rejected alternatives are inter-related, they are presented and discussed in a single section. Given the current knowledge of red snapper life history and generation time, selection of a recovery target date must first be made. This target date determines the range of allowable TAC. Selection of the TAC then determines the recreational allocation and commercial quota. Finally, once the recreational and commercial allocations have been set, appropriate regulations to implement those allocations can be considered.

Recovery Target Date: New biological information indicates that red snapper are longer lived than previously thought, resulting in a substantial increase in the generation time estimate, from 13.6 years to 19.6 years, and also a slower recovery rate than previously projected. Extending the recovery date to 2019 retains the previously established 1½ generation time recovery time frame. As stated in the RFSAP report, this is simply a rescaling of some of the stock assessment parameters. Retaining the status quo target date of 2009 would reduce the recovery time frame to approximately 1 generation time. As shown in the stock assessment's Table 119 (appended to this report), because of the slower projected recovery rate resulting from the new biological parameters, none of the TAC alternatives in the stock assessment could produce 20 percent SPR by 2009. Maintaining the 2009 target date would therefore have required a decrease in TAC and possibly even a total closure of the fishery (see biological impacts discussion), resulting in economic and social disruptions to both the commercial and recreational sectors. For this reason, the status quo target date (Rejected Alternative 6) was rejected.

Red Snapper TAC: Under the new life history parameters and target date, a 6 million pound TAC is more restrictive than necessary to achieve 20 percent SPR. Higher TAC levels can be implemented and still provide a greater than 50 percent probability of reaching the target (see Tables 118 and 119 from Goodyear 1995, appended to this report) while providing increased social and economic benefits to the commercial and recreational sectors. For this reason, the status quo TAC (Rejected Alternative 1) was rejected in favor of increasing the TAC.

If TAC were increased to a level higher than 6 million pounds but less than 9.12 million pounds, increased harvest restrictions would continue to be needed on the recreational sector to constrain it to it's allocation. In public testimony from charter and headboat operators, the Council was told that additional recreational restrictions, particularly reductions in bag limits, would make it difficult to attract paying customers and would be detrimental to the recreational fishing industry, particularly those vessels that principally target red snapper. Under a 9.12 million pound TAC, the NMFS bag and size limit analysis projects that the recreational sector will exactly fill its allocation with no changes needed to existing bag and size limits (see Holiman 1995a, table 1, appended to this amendment). In order to avoid these negative impacts, increasing the TAC to a level below 9.12 million pounds (Rejected Alternative 2) was rejected.

The upper limit of the ABC range recommended by the RFSAP is 10 million pounds. At this level, the RFSAP concluded that the target 20 percent SPR could still be achieved by 2019 provided that a 50 percent shrimp trawl bycatch reduction is achieved in 1997. However, under the more conservative bycatch reduction assumptions used in the stock assessment (37 percent reduction in 1997 and 50 percent in 1998), there is only a 25 percent probability of achieving the target with a 10 million pound TAC (Table 118). The Council is currently developing an amendment to the Shrimp FMP to require bycatch reduction devices, but there is uncertainty whether a full 50 percent reduction will be achieved in 1997. A 9.12 million pound TAC provides a substantial increase in quota to the commercial sector, no need to change recreational restrictions, and a better than 50 percent probability of achieving the SPR target even under the more conservative bycatch reduction assumptions. Because substantial social and economic benefits can be accorded to both sectors at a 9.12 million pound TAC while avoiding the uncertainty associated with a 10 million pound TAC, the Council chose to set TAC at the more conservative 9.12 million pounds, and rejected Alternative 3.

Recreational Bag and Size Limits: The 9.12 million pound TAC has a recreational allocation of 4.47 million pounds. This is precisely the recreational harvest that is projected by NMFS. Since there is neither need nor justification to increase or reduce recreational harvest restrictions under this TAC, and since maintaining status quo bag and size limits would provide stability in the recreational sector, the Council rejected both Rejected Alternative 4 and Rejected Alternative 5 in favor of the status quo.

Commercial Minimum Size Limit: Under Amendment 12, which was approved by the Council but not submitted to NMFS, it was the intent of the Council that the commercial red snapper size limit remain at the 1994 limit of 14 inches unless a decision is made to change the limit in the future. Due to administrative delays, Amendment 12 cannot be implemented before the January 1, 1996 automatic size limit increase to 15 inches takes effect. If the size limit provision of Amendment 12 is approved, it will remove automatic size increases, but leave the limit at the size in effect at the time of implementation. Under the status quo alternative, this would be 15 inches. The Council believes, based on testimony provided by commercial fishermen, that release mortality in the commercial sector is higher than the 33 percent level used in the stock assessment. If this is true, the increased release mortality resulting from an increase in the size limit would result in a lower SPR or slower recovery rate than what is indicated by the assessment. Furthermore, increased release mortality wastes an economically valuable component of the resource. The stock assessment itself noted that the release mortality estimates are not precise. The Council felt that it is important, no

to eliminate the future automatic increases, but also to restore the previous 14 inch size limit, and therefore rejected the status quo (Rejected Alternative 6).

Biological Impacts: The RFSAP report emphasized four major assumptions on which their recommendation of ABC range was based: 1) actual shrimp trawl bycatch mortalities are not higher in 1995 and 1996 than the projected estimates, 2) the recreational sector stays within its allocation, 3) the 50 percent bycatch reduction is implemented in 1997, and 4) projected increases in recruitment are realized. Failure to meet the assumptions could result in a slower than projected recovery and future decreases in ABC range.

The impacts of the rejected alternatives depends upon the validity of these assumptions. Assumption 1 is based on the best available scientific information, which suggests that shrimp bycatch reductions of 5.8 percent in 1993 and 10 percent in 1994 have occurred. Shrimp fishermen have suggested that higher bycatch reductions may have already been achieved as a result of changes in shrimping effort and area fished. Assumption 2 validity is dependent on the combination of recreational allocation level and recreational measures to achieve that level, and is discussed in greater detail in the following paragraphs. In previous years the recreational harvest assumption has not been valid. Assumption 3 has previously been incorporated as an explicit part of the red snapper recovery program. The technology exists to achieve a 50 percent bycatch reduction and the Council is developing a Shrimp FMP amendment to implement that reduction. Assumption 4 is based on the validity of the stock-recruitment relationship used in the stock assessment model. The model uses a Beverton-Holt function. This stock-recruit function was developed in the 1950's and has long been used to model recruitment of marine fish populations. However, the red snapper parameters of the Beverton-Holt function were derived from a narrow range of relatively low stock sizes. The stock assessment noted that (Goodyear 1995), "The applicability of the Beverton-Holt model, and the accuracy of its parameter estimates are uncertain, and recruitment predicted from the relation at stock sizes much different than the current size of the stock should be viewed with skepticism".

At TACs below the proposed alternative (Rejected Alternatives 1 and 2) there would be a faster rate of recovery or an increased probability of achieving the recovery by the target date. However, a lower TAC would require a reduction in recreational harvest and would need to be accompanied by more restrictive recreational measures (Rejected Alternative 4). Given the failure of the recreational sector to stay within its allocation in previous years, it is likely that, at TACs lower than the Proposed Alternative, the assumption that the recreational sector stays within its allocation would fail to be met. If this were to occur, improvements in SPR would fail to occur as projected, which would lead to lower ABC ranges in future years.

Conversely, a higher TAC (Rejected Alternative 3) would have a reduced probability of attaining the recovery target even if all assumptions are met. However, a higher TAC would create a recreational allocation higher than the projected harvest under current bag and size limits, and would increase the probability of the recreational harvest assumption being valid.

In previous regulatory amendments to set red snapper TAC, impacts of the TAC on the commercial "derby" type fishery and effort shifting to alternative species during closures has been discussed. 1996 is a transitional year during which the commercial harvest management strategy will switch from an open access fishery to an ITQ system. The impact of the ITQ system rather than the level of TAC will be the driving force in 1996 on patterns of effort toward red snapper and alternative species.

Retaining the 2009 target date for red snapper recovery (Rejected Alternative 6) would necessitate reductions in TAC because of the slower recovery rate associated lower natural mortality rate and increased longevity over previous stock assessments. Appended Table 119 shows that, with a 6 million pound TAC, there is only a 50 percent probability of the stock reaching even 9.6 percent SPR by 2009. Even under a constant fishing

mortality rate scenario column H in table 119), which calls for an initial reduction in TAC to 1 million pounds, the 50 percent probablity level for SPR in 2009 is only 11.3 percent. Although options for a 2009 recovery target using the new life history parameters were not examined in the stock assessment, it is likely that retaining the 2009 target date would force a substantial reduction in TAC or even a total closure of all red snapper harvest.

The impact of allowing the commercial size limit to increase to 15 inches (Rejected Alternative 7) depends upon the true level of red snapper release mortality. During 1995, under a 14 inch size limit, observer data indicated that 40.7 percent of the red snapper caught by number (18.6 percent by weight) were released in the commercial fishery. Fishermen's logbook data indicated a lower release rate of 30 percent in 1995. Under the new natural mortality rate estimate of M=0.10, the 1995 stock assessment calculates that, at 33 percent release mortality, the minimum size limit that produces maximum yield per recruit is 18 inches. This is an increase over the previous estimate of 16 inches, which was based on a natural mortality rate of M=0.20. Note also that for the recreational fishery, which now has an assumed release mortality of 20 percent and M=0.10, maximum yield per recruit occurs at a minimum size limit of 21 inches. Lower size limits reduce both yield per recruit and spawning potential relative to the stock assessment projections. If commercial fishing release mortality is higher than 33 percent, as many fishermen suggest, the optimum size to maximize yield per recruit is less than 18 inches. However, the SPR projection model assumes that the size limit for all fishermen will increase to 16 inches in 1998. The proposed lower size limits and/or a determination that commercial release mortality is greater than 33 percent will require that the projections be reevaluated with the new parameters, and may result in reduced future ABC ranges.

Economic Impacts: The relative impacts of alternative TAC levels on the commercial sector were discussed in conjunction with impact analysis for the Proposed Alternative. The table of net present values presented above summarizes these impacts. One observation worth reiterating here is that while an increase in TAC from 6.0 MP to 8.0 MP resulted in relatively significant increase in producer surplus, an increase from 8.0 MP to 9.12 MP or 10.0 MP resulted in relatively smaller increase in benefits.

Since the only binding restraints on the recreational sector are bag and size limits, the choice of TAC will have no direct effects on the recreational sector unless the limits are adjusted to ensure that this sector's harvest matches with its allocation. In this sense, the choice of a TAC affects the recreational sector only through concomitant adjustments in the recreational limits. Of course, a TAC level imposes a pressure on the Council to adjust recreational limits. The following discussion on impacts on the recreational sector considers various TAC choices and corresponding recreational limits.

Maintaining the TAC at 6.0 MP would require more restrictions on the recreational sector, if that sector is constrained to its allocation. Holiman's (1995b) analysis shows that this TAC requires limits of 2 fish and 15 inches or 3 fish and 16 inches. This would severely constrain the recreational sector, resulting in significant reductions in angler consumer surplus and for-hire vessel profits. It is likely in this scenario that some for-hire businesses, particularly in areas where red snapper is either highly targeted or caught, may cease operation entirely. In terms of target trips, these limits would have greater impacts on the private recreational than for-hire recreational anglers; in terms of catch trips, most of the impacts of these limits would befall on anglers fishing through charter boat mode (see Figures 14 and 15 for frequency distribution of trips). Reduction in catch would have the tendency to reduce trips taken by anglers so that charter boats would suffer the loss of many customer trips as a consequence. The growing trend in both catch and target trips in Alabama implies that anglers and for-hire boats in this state would receive a greater portion of the adverse effects resulting from reductions in recreational limits. The extent would there be species substitution resulting from these very restrictive limits depends on the availability of other species. As can be gleaned from Figure 16 above, there appears to be no perceptible change in species caught together with red snapper as more regulations have been

imposed on the fishery. It is likely then under this situation, the losses in benefits due to more restrictive management may be mostly borne by participants in the red snapper fishery.

A TAC level of 8 MP, which is between 6.0 and 9.12 MP, requires limits of 4 fish and 15 inches or 5 fish and 16 inches. The nature of this adverse effects may be expected to be similar to that of a 6.0 MP TAC, although smaller in magnitude. We may note, though, that while this adverse impact may not be as large as that with a 6.0 MP TAC, only recently were recreational limits changed. For the 1995 season the bag limit was reduced from 7 to 5 fish and the size limit was increased from 14 to 15 inches. The absence of data has precluded any assessment of the effects of these changes. We may expect, nonetheless, that a further restriction on the fishery could become substantial when viewed with respect to the pre-1995 recreational limits.

According to NMFS analysis, a 10.0 MP TAC would allow limits of 5 fish and 15 inches or 6 fish and 16 inches. The required limits are practically the same as that required under the proposed TAC of 9.12 MP. A 430 thousand pound difference in recreational allocation would not allow a higher bag limit, unless accompanied by a larger size limit, considering the recreational effort in the fishery. In this sense, the effects on the recreational sector of a 10.0 MP TAC may not significantly differ from that of a 9.12 MP TAC.

An increase in commercial size limit would mean a loss in the market for smaller size fish. To the extent that smaller fish command relatively higher prices than some larger size fish, revenues to fishermen may slightly decrease. In addition, a larger size limit may impose a relatively higher fishing cost as travel farther offshore and more labor for discarding fish may be necessitated. Considering, however, that the commercial fishery may be under an ITQ system starting April 1, 1996, the increase in size limit may have its impact more on the revenue than on the cost side of fishing operation.

Maintenance of the current recovery period entails more restrictive management measures, even more restrictive than current ones. In this event, the short-term adverse consequences on both the commercial and recreational sectors would be significant. 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. One key factor in this recovery is the achievement of a required bycatch reduction. While a short recovery period necessitates a more immediate achievement of bycatch reduction and probably even at higher level of reduction, the achievement of the required level of bycatch is dependent on factors more important than the recovery period. Given this scenario, there appears to be less economic risk involved with a longer recovery period and less restrictive management than with short recovery period and more restrictive management.e

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.....	$25,000
NMFS administrative costs of document preparation, meetings and review.....	$ 16,000
Law enforcement costs.....	$ none

Public burden associated with permits	$ none
NMFS costs associated with permits	$ none
TOTAL	$41,000

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 and Net Impact of Proposed Action

The proposed regulatory action constitutes changes in management for red snapper in the EEZ under the jurisdiction of the Gulf Council. The emphasis of the summary is on the expected economic impact of the various proposed alternatives.

The proposed alternative to increase TAC from 6.0 MP to 9.12 MP is expected to result in minimal impacts on the recreational sector and significant impacts on the commercial sector. Since the selected TAC allows recreational limits to be maintained at current levels without substantially exceeding the sector's allocation, the proposed TAC alternative coupled with the proposed alternative to retain recreational limits would have practically no impacts on this sector. Because the commercial sector has been effectively constrained to its allocation under the 6.0 MP TAC, an increase in TAC to 9.12 MP and consequently the commercial quota to 4.65 MP would directly translate to an increase in benefits to this sector. Assuming the higher quota is maintained throughout the recovery period, the commercial sector is expected to generate producer surpluses totalling $37 million over five years or $117.9 million over the recovery period. The proposed extension of the recovery period would maintain the estimated impacts of a higher TAC on both the commercial and recreational sectors. The proposed alternative to maintain a 14-inch size limit for the commercial sector would prevent a potential reduction in revenues and very likely profits that would be generated due to an increase in quota.

The proposed regulatory action is estimated to cost the Federal government $41,000. The proposed measures are not expected to incur additional enforcement cost and permit cost to either the public or NMFS.

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; or 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.

The entire commercial red snapper fishery had an ex-vessel value of about $6.2 million in 1994. There is currently no adequate measure of the recreational red snapper fishery impacted by the proposed regulation but the estimated impacts of the proposed regulation are relatively small relative to the $100 million a year benchmark. Thus, given the size of the fishery and the segment of the fishery directly affected by the proposed regulation, it is concluded that any revenue or cost impacts on the fishery would be significantly less than $100 million annually.

Since the TAC level is proposed to be increase by 52 percent, there is expected to be major increases in revenues and profits to the commercial sector. Commercial cost of fishing operation remains largely unaffected especially if the ITQ system is implemented in 1996. Prices to consumers may slightly decrease as a result of an increase in quota. The recreational for-hire sector remains unaffected by the increase in recreational allocation and retention of size and bag limits. 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 cost 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, any of the sub-items under item (c) above would not apply.n

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

Initial Regulatory Flexibility Analysis

Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to relieve small businesses, small organizations, and small governmental entities from burdensome regulations and record keeping requirements. The category of small entities likely to be affected by the proposed plan amendment is that of commercial and for-hire businesses currently engaged in the reef fish fishery. The impacts of the proposed action on these entities have been discussed above. The following discussion of impacts focuses specifically on the consequences of the proposed action on the mentioned business entities. An Initial Regulatory Flexibility Analysis (IRFA) is conducted to primarily 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.

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. Others are in the process of being renewed. The Small Business Administration (SBA) defines a small business in the commercial fishing activity as a firm with receipts of up to $2.0 million annually. SBA also defines a small business in the charter boat activity as a firm with receipts up to $3 million per year. There are about 838 charter boats and 92 party boats operating in the Gulf. Practically all current participants of the reef fish fishery readily fall within such definition of small business. Since the proposed action will affect practically all the current participants, the "substantial number" criterion is met. This particular conclusion abstracts from any other measures to be adopted for the reef fish fishery.

Economic impacts on small business entities are considered to be "significant" if the proposed action can result in any of the following: a) reduction in annual gross revenues by more than 5 percent; b) increase in total costs of production by more than 5 percent as a result of an increase in compliance costs; c) 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; d) capital costs of compliance represent a significant portion of capital available to small entities, considering internal cash flow and external financing capabilities; or e) as a rule of thumb 20 percent of small business entities being forced to cease business operations (NMFS, 1992).

The increase in TAC and therefore in commercial quota will increase gross revenues to commercial red snapper vessels by more than 5 percent. Charter and head boat operators may not experience increases in gross revenues. Under the proposed regulation, both the commercial and recreational sector will not incur increases in production cost (item b) or increases in cost to comply with the regulation (items c and d). Considering that the impacts of the proposed regulation are determined to be positive, none of the existing businesses may cease operation as a result of the regulation.

Based mainly on the impacts on gross revenues on commercial fishermen, the proposed measures in this regulatory amendment may be regarded as effecting a significant economic impact on a substantial number of small entities. An IRFA is required and the following sections comprise the remainder of this IRFA.

Explanation of Why the Action is Being Considered

Refer to the section on Purpose and Need for Action.

Objectives and Legal Basis for the Rule

Refer to the section on Management Objective and Optimum Yield. The Magnuson Fishery Conservation and Management Act of 1976 provides the legal basis for the rule.

Demographic Analysis

Refer to the Reef Fish Fishery Management Plan, as amended particularly by Amendments 1, 5, and 8.

Cost Analysis

Refer to the Economic Impacts section of the RIR.

Competitive Effects Analysis

The industry is composed entirely of small businesses (harvesters and charter boats operations). Since no large businesses are involved, there are no disproportional small versus large business effects.

Identification of Overlapping Regulations

The proposed action does not create overlapping regulations with any state regulations or other federal laws.

Conclusion

It has been determined that this regulation, if enacted, results in significant economic impacts on a substantial number of small entities, mainly because of the increase in gross revenues to the commercial harvest sector. The foregoing information and pertinent portions of the RIR are deemed to satisfy the analysis required under the RFA.

11. ENVIRONMENTAL ASSESSMENT

Environmental Consequences

Physical and Human Environment: The actions proposed in this amendment will have no impact on the physical environment. The increase in the TAC will allow a 52 percent increase in the commercial quota for 1996, which will benefit the initial recipients of red snapper ITQ shares under the proposed ITQ program. The proposed TAC will also establish a recreational allocation at a level that is consistent with the projected harvest under the existing recreational bag and size limits, making increased restrictions on the recreational sector unnecessary. Had increased restrictions been needed, there would have been a decreased ability of recreational for-hire boats to attract customers. The proposed actions avoid this negative impact , and furthermore, provides stability in the recreational red snapper regulations for at least one more year.

Fishery Resource: 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 more conservative than the 10 million pound upper limit of the ABC range recommended by the RFSAP, reflecting a risk averse approach by the Council in the face of uncertainty about implementation of shrimp bycatch reduction. Detailed analysis on the impacts of the proposed and rejected alternatives can be found in the biological impacts discussion under the alternatives and is included herein by reference.

Effect on Endangered Species and Marine Mammals: The NOAA will conduct a consultation under Section 7 of the Endangered Species Act. A consultation was previously conducted regarding the impact of Amendment 1 which included the framework measures under which this action is being taken. A biological opinion resulting from that consultation found that neither the directed fisheries nor the proposed action 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 action are necessary because there are no harmful impacts to the environment.

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

Irreversible and irretrievable commitments of resources: There are no irreversible commitments of resources caused by implementation of this 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 action is an adjustment of the original regulations of the FMP under the framework procedure set forth in Amendment 1 to rebuild overfished reef fish stocks. The proposed action 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

12.e OTHER APPLICABLE LAWe

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.

Coastal Zone Consistency

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all federal activities which directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The proposed changes in federal regulations governing red snapper in the EEZ of the Gulf of Mexico will make no changes in federal regulations that are inconsistent with 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.

This regulatory amendment is consistent with the Coastal Zone Management programs of the states of Alabama, Florida, Louisiana, and Mississippi to the maximum extent possible; Texas does not have an approved Coastal Zone Management program. 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, and Louisiana.

Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the Federal Government. The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and record keeping requirements is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The Council does not propose, through this regulatory amendment, to establish any 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.

13. SCIENTIFIC RESEARCH AND DATA NEEDS

Biological Needs

The following scientific research and data needs have been identified by the Reef Fish Stock Assessment Panel.

1.e Foremost, age studies need to be conducted both for evaluating growth rate of red snapper and to develope age-length keys for analyzing catch distributions by age. It is of paramount importance that representativee samples of catches are aged on an ongoing basis to calculate growth rates and age-length keys. Stocke assessment using VPA techniques is very sensitive to accurate estimates of catch-at-age.e

2.e The next stock assessment for red snapper should include analysis of how to make the transition from a constant TAC policy to a constant F policy without having to reduce current harvest levels.e

3.e Determination of the age-specific rate of natural mortality of the red snapper population.e

In addition to the above recommendations of the RFSAP, it should be noted that the new biological parameters for red snapper resulted in a stock assessment that shows the recovery to be slower than previously projected. This conflicts with anecdotal information from fishermen, which suggests that the recovery is occurring faster than projected. Reasons for this discrepancy should be evaluated. Some possible hypothesis are:

1) The amount of shrimp bycatch reduction that has already been achieved may be higher than currentive estimated.e

2)e Fishermen have noted small groups of large red snapper on the mud flats. The number of fish at eache location is too small for commercial vessels to go after, leading some fishermen to suggest that these may constitute a population of larger and older fish that are unavailable to the fishery and have been anaccountede for in the stock assessment, but contribute to the spawning population.e

3)e The stock assessment noted that the validity of the Beverton-Holt stock-recruit function and its calculatede parameters must be viewed with skepticism outside of the range of observed stock abundance.e

4) The ability and ease of fishermen to locate and harvest red snapper may be a poor indicator of the healthe of the stock due to technological improvements in fish finding and navigation gear. Furthermore, the increasede restrictions on red snapper harvest may be discouraging new entrants into the commercial fishery, resulte in the average fisherman having a greater level of experience than in earlier years.e

Socioeconomic Needs

The following scientific research and data needs have been identified by the Socioeconomic Assessment Panel.

1.e Demand models associated with this fishery should be estimated using more recent monthly timee-datae

2.e Supply models should be estimated using the results of the completed survey of the commercede fishery.e

3. Modeling results based on the survey of the commercial reef fishery should be presented at the SEP's next meeting on reef fish.

4. The SEP recommends that an attempt be made to look at species substitution in both the commercial and recreational fisheries.

5. New York wholesale price information should be examined to further investigate price fluctuations and price by market size categories.

6. Social and demographic information on the participants of Gulf of Mexico reef fish fishery.

7. Estimate separate demand models private recreational and for-hire sector.

14.0 REFERENCES

Antozzi, William. 1993. Memorandum for Richard Raulerson on the subject of red snapper price system. SERO/NMFS. 9450 Koger Boulevard, St. Petersburg, Florida 33702.

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. 1989. Spawning stock biomass per recruit: The biological basis for a fisheries management tool. ICCAT working document: SCRS /89 /82. Available from National Marine Fisheries Service. Southeast Fisheries Center, Miami Laboratory, Coastal Resources Division, 75 Virginia Beach Drive, Miami. Florida 33149.

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.

Holiman, S.G. 1995a. Reef fish economic assessment for the Gulf of Mexico recreational fishery. NMFS/SERO, St. Petersburg, FL. 12 p.

Holiman, S.G. 1995b. Recreational catch and effort for red snapper and other reef fish species. Staff Report, Division of Economic Trade Analysis, NOAA, NMFS, Southeast Regional Office, 9450 Koger Boulevard, St. Petersburg, FL 33702.

Waters, J. R. 1995. Economic assessment of the commercial reef fishery in the U.S. Gulf of Mexico. SERO/NMFS, NOAA. 9450 Koger Boulevard, St. Petersburg, Florida 33702.

15.0 PUBLIC REVIEW

A public hearing to obtain public comments on this regulatory amendment was held during the Gulf Council meeting in November 1995 in New Orleans, Louisiana. Copies of this document may be obtained from the Gulf of Mexico Fishery Management Council office, 5401 West Kennedy Boulevard, Suite 331, Tampa. Florida 33609, (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
Lincoln Center, Suite 331
5401 West Kennedy Boulevard
Tampa, Florida 33609
(813)228-2815

LIST OF PREPARERS

Gulf of Mexico Fishery Management Council
- Steven Atran, Population Dynamics Statistician
- Antonio Lamberte, Economist

Table 118. Estimated probability distributions of SPR in the year 2019 for Gulf of Mexico red snapper for several management alternatives for a post-bycatch natural mortality rate of 0.10 (from Goodyear 1995).

	CASE							
P	A	B	C	D	E	F	G	H
0.99	0.122	0.084	0.211	0.195	0.179	0.144	0.105	0.205
0.98	0.122	0.085	0.213	0.197	0.182	0.150	0.112	0.205
0.97	0.122	0.085	0.213	0.198	0.184	0.152	0.119	0.205
0.96	0.122	0.086	0.213	0.198	0.184	0.154	0.120	0.205
0.95	0.122	0.086	0.214	0.198	0.184	0.154	0.122	0.205
0.90	0.122	0.087	0.215	0.200	0.187	0.158	0.127	0.205
0.85	0.122	0.088	0.216	0.201	0.188	0.161	0.132	0.205
0.80	0.122	0.088	0.216	0.202	0.190	0.163	0.136	0.205
0.75	0.122	0.089	0.217	0.203	0.191	0.166	0.140	0.205
0.70	0.122	0.089	0.218	0.204	0.192	0.168	0.143	0.205
0.65	0.122	0.090	0.218	0.205	0.193	0.169	0.145	0.205
0.60	0.122	0.090	0.218	0.205	0.194	0.171	0.147	0.205
0.55	0.122	0.090	0.219	0.206	0.195	0.172	0.150	0.205
0.50	0.122	0.091	0.219	0.207	0.196	0.174	0.152	0.205
0.45	0.122	0.091	0.220	0.207	0.196	0.175	0.154	0.205
0.40	0.122	0.092	0.220	0.208	0.197	0.177	0.156	0.205
0.35	0.122	0.092	0.220	0.209	0.198	0.178	0.157	0.205
0.30	0.122	0.092	0.221	0.209	0.199	0.179	0.160	0.205
0.25	0.122	0.092	0.221	0.210	0.200	0.181	0.162	0.205
0.20	0.122	0.093	0.222	0.210	0.201	0.182	0.163	0.205
0.15	0.122	0.093	0.222	0.211	0.201	0.183	0.166	0.205
0.10	0.122	0.094	0.223	0.212	0.203	0.185	0.168	0.205
0.05	0.122	0.095	0.224	0.213	0.204	0.188	0.173	0.205
0.04	0.122	0.095	0.224	0.214	0.205	0.189	0.174	0.205
0.03	0.122	0.096	0.224	0.214	0.206	0.190	0.175	0.205
0.02	0.122	0.096	0.225	0.215	0.207	0.191	0.177	0.205
0.01	0.122	0.096	0.225	0.216	0.207	0.193	0.179	0.205

Definitions of Cases

A No harvest, no reduction in shrimp bycatch.

B 2722 tonne (6 million pound) TAC, no reduction in shrimp bycatch.

C 2722 (6 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

D 3629 (8 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

E 4536 (10 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

F 5453 (12 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

G 6359 (14 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

H Constant F, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998.

Table 119. Estimated 50th percentile of the probability distribution of SPR by year for Gulf of Mexico red snapper for several management alternatives for a post-bycatch natural mortality rate of 0.10 (from Goodyear 1995).

	CASE							
Year	A	B	C	D	E	F	G	H
1995	0.006	0.006	0.006	0.006	0.006	0.006	0.006	0.006
1996	0.008	0.006	0.006	0.006	0.006	0.006	0.006	0.007
1997	0.011	0.007	0.007	0.006	0.006	0.005	0.005	0.010
1998	0.014	0.008	0.008	0.007	0.007	0.005	0.005	0.012
1999	0.018	0.010	0.010	0.009	0.007	0.006	0.005	0.016
2000	0.023	0.012	0.013	0.011	0.009	0.006	0.005	0.021
2001	0.028	0.015	0.017	0.014	0.011	0.008	0.006	0.027
2002	0.03-	0.018	0.022	0.018	0.015	0.010	0.007	0.034
2003	0.041	0.021	0.029	0.024	0.020	0.014	0.009	0.043
2004	0.047	0.025	0.037	0.031	0.026	0.018	0.013	0.053
2005	0.054	0.029	0.047	0.039	0.033	0.024	0.017	0.064
2006	0.060	0.033	0.058	0.049	0.042	0.030	0.022	0.076
2007	0.067	0.037	0.070	0.060	0.052	0.038	0.028	0.088
2008	0.073	0.042	0.083	0.072	0.063	0.048	0.035	0.100
2009	0.079	0.047	0.096	0.084	0.075	0.058	0.043	0.113
2010	0.085	0.051	0.110	0.097	0.087	0.068	0.052	0.125
2011	0.091	0.056	0.123	0.111	0.100	0.080	0.062	0.136
2012	0.096	0.061	0.137	0.124	0.113	0.091	0.072	0.148
2013	0.100	0.066	0.150	0.137	0.125	0.103	0.083	0.158
2014	0.105	0.070	0.163	0.150	0.138	0.116	0.094	0.168
2015	0.109	0.075	0.175	0.162	0.150	0.128	0.106	0.177
2016	0.113	0.079	0.187	0.174	0.162	0.140	0.117	0.185
2017	0.116	0.083	0.199	0.186	0.174	0.151	0.129	0.192
2018	0.119	0.087	0.209	0.197	0.185	0.163	0.140	0.199
2019	0.122	0.091	0.219	0.207	0.196	0.174	0.152	0.205
2020	0.125	0.094	0.229	0.216	0.206	0.184	0.163	0.211

Definitions of Cases

A No harvest, no reduction in shrimp bycatch.

B 2722 tonne (6 million pound) TAC, no reduction in shrimp bycatch.

C 2722 (6 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

D 3629 (8 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

E 4536 (10 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

F 5453 (12 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

G 6359 (14 million pound) TAC, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998

H Constant F, 5.8% reduction in shrimp bycatch in 1993, 10% in 1994, 24% in 1996, 37% in 1997 and 50% in 1998.

Source: Table 1 from Holiman 1995

ESTIMATED 1996 GULF OF MEXICO RED SNAPPER LANDINGS (MILLIONS OF POUNDS) UNDER DIFFERENTIAL BAG AND SIZE LIMITS.				
HEADBOAT/CHARTERBOAT		PRIVATE/RENTAL		
BAG LIMIT	SIZE LIMIT	BAG LIMIT	SIZE LIMIT	LANDINGS
5	15	5	15	4.469
4	15	4	15	4.014
2	15	5	15	3.691
5	15	2	15	3.624
3	15	3	15	3.463
2	15	4	15	3.426
4	15	2	15	3.329
2	15	3	15	3.120
3	15	2	15	3.069
2	15	2	15	2.737
5	16	5	16	4.009
5	16	4	16	3.780
4	16	4	16	3.600
3	16	5	16	3.600
5	16	3	16	3.509
2	16	5	16	3.300
5	16	2	16	3.164
3	16	3	16	3.098
2	16	4	16	3.072
4	16	2	16	2.984
2	16	3	16	2.800
3	16	2	16	2.753
2	16	2	16	2.456
5	15	5	16	4.226
4	15	4	16	3.798
5	15	3	16	3.727
5	15	2	16	3.382
3	15	3	16	3.269
2	15	4	16	3.211
4	15	2	16	3.182
2	15	3	16	2.939
3	15	2	16	2.925
5	17	5	17	3.392
5	17	4	17	3.211
5	17	3	17	2.973
4	17	3	17	2.819