

**REGULATORY AMENDMENT**

**TO THE**

**REEF FISH FISHERY MANAGEMENT PLAN**

**TO ADJUST RED SNAPPER SIZE AND BAG**

**LIMITS AND SET STARTING DATE FOR THE**

**1995 RED SNAPPER FISHING SEASON**

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

**OCTOBER 1994**

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## 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
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
SEAMAP	Southeast Area Monitoring and Assessment Program (fishery-independent data program)
SEFC	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. HISTORY OF MANAGEMENT

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

Amendment 1 to the Reef Fish Fishery Management Plan, implemented in 1990, set as a primary objective of the FMP the stabilization of long term population levels of all reef fish species by establishing a survival rate of biomass into the stock of spawning age to achieve at least 20 percent spawning stock biomass per recruit (SSBR), relative to the SSBR that would occur with no fishing. It set a red snapper 7 fish recreational bag limit and 3.1 million pound commercial quota that together were to reduce fishing mortality by 20 percent and begin a rebuilding program for that stock. This amendment also established a 5 fish recreational bag limit and 11.0 million pound commercial quota<sup>1</sup> 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.

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<sup>1</sup> 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.,  $11.0 \div 1.18 \times 1.05 = 9.8$ ). 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.

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<sup>2</sup> million pounds. This action was taken to provide the commercial fishery an opportunity to harvest 0.7 million pounds that went unharvested in 1990 due to an early closure of the fishery in 1990. NMFS had projected the 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

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<sup>2</sup> The corrected 1991 quota, using the revised conversion factor, was 8.8 million pounds. The corrected 1990 actual harvest was 7.6 million pounds.

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 with a commercial quota of 3.06 million pounds and a recreational allocation of 2.94 million pounds (to be implemented by a 7 fish recreational daily bag limit). The amendment also changed the target year to achieve a 20 percent red snapper SPR from 2007 to 2009, based on the Plan provision that the rebuilding period may be for a time span not exceeding 1.5 times the potential generation time of the stock and an 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 its 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.

Proposed Amendment 8 is currently under development. If implemented, it will manage effort in the commercial red snapper fishery by restricting access to the fishery beginning in 1996, either through a license limitation system or an individual transferable quota system. Due to concerns by commercial fishermen about the impact of the proposed measures, the Council has delayed consideration of this amendment until information can 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. The Council is scheduled to receive the results of the data collection in November 1994, at which time consideration of Amendment 8 will be resumed.

## **2. PURPOSE AND NEED FOR ACTION**

In September 1994, the Council reviewed a new stock assessment for red snapper (Goodyear 1994) for purposes of setting the 1995 TAC. The Reef Fish Stock Assessment Panel (RFSAP), upon reviewing the stock assessment and options for a range of TACs up to 8 million pounds, recommended a range of Allowable Biological Catch of up to 6 million pounds (GMFMC 1994b). Based on the results of the stock assessment and recommendation of the RFSAP, the Council chose to retain the status quo TAC of 6 million pounds, allocated 51 percent commercial (3.06 million pounds) and 49 percent recreational (2.94 million pounds). This TAC level has been in place since 1993. Under a constant TAC stock recovery policy and assuming a 50

percent reduction in the shrimp trawl bycatch mortality rate of red snapper is achieved by 1996, continuation of the 6 million pound TAC level is projected to achieve the recovery target of 20 percent SPR by the year 2009.

The 1995 commercial allocation will continue to be implemented through a quota and through the two tier endorsement and trip limit system established in Amendment 6, i.e., commercially permitted reef fish vessels with a red snapper endorsement will be allowed a 2,000 pound trip limit, and permitted vessels without a red snapper endorsement will be allowed a 200 pound trip limit. Under a 1994 regulatory amendment, commercial vessels are limited to landing only one trip limit per day. In 1993, the commercial red snapper season was closed by emergency action from January 1 until February 16 in order to give NMFS time to review red snapper endorsement applications and distribute the endorsements to qualifying permit holders. This closure also allowed fishermen to avoid having to fish during the early weeks of the year, which are frequently periods of bad weather, yet allowed the season to open in time to harvest fish for Lenten season. The 1994 season was also closed by regulatory amendment until February 10 to avoid a derby fishery during a period of frequently bad weather but allow fishing to commence in time for Lent (February 16, 1994). If the opening date is set to accommodate Lenten season, it needs to be set each year because Lent begins on a different date each year. The 1995 season will revert to opening on January 1 unless action is taken to delay the opening. In 1995, Lent begins on March 1.

The red snapper recreational allocation in 1993, the most recent year for which recreational harvest estimates are available, was overharvested by more than 2 million pounds (the recreational allocation was 2.94 million pounds, estimated harvest was 5.1 million pounds). Under the framework procedure for specification of TAC, if harvest by a user group exceeds its allocation in any year, subsequent allocations to that group will be adjusted to assure meeting the specified SPR goal. The SPR goal can still be achieved without the need to reduce the recreational allocation, assuming that a 50 percent reduction in shrimp trawl bycatch is implemented in 1996. However, regulatory measures to reduce the rate of recreational harvest are therefore needed to bring the recreational sector back within its allocation.

### **3. PROPOSED ACTIONS**

The Council proposes to retain the status quo red snapper TAC of 6.0 million in 1995, with 3.06 million pounds allocated to the commercial fishery and 2.94 million pounds allocated to the recreational fishery<sup>3</sup>. The recreational red snapper allocation will be implemented by a reduction in the daily bag limit from 7 fish to 5 fish, an increase in the minimum size limit for recreational harvest from 14 inches to 15 inches, and no retention of recreational catch by captain and crew on recreational charter and headboats.

The commercial red snapper allocation will be implemented by a quota, and the opening of the commercial red snapper season will be delayed until February 24, 1995, which is five days prior to Ash Wednesday.

### **4. MANAGEMENT OBJECTIVE AND OPTIMUM YIELD**

#### **Optimum Yield**

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<sup>3</sup> 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.



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

### **Definition of Overfishing**

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

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

### **5. REEF FISH FRAMEWORK PROCEDURE AS SPECIFIED IN THE FMP**

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

#### **Procedure for Specification of TAC:**

1. Prior to August 1 each year, or such other time as agreed upon by the Council and RD, the Southeast Fisheries Center of NMFS (SEFC) will: a) update or complete biological and economic assessments and analyses of the present and future condition of the stocks for red snapper and other reef fish stock or stock complex; b) assess to the extent possible the current SPR levels for each stock; c) estimate fishing mortality (F) in relation to  $F_{20\text{ percent SPR}}$ ; d) estimate annual surplus production  $F_{\text{max}}$  or other population parameters deemed appropriate; e) summarize statistics on the fishery for each stock or stock complex; f) specify the geographical variations in stock abundance, mortality, recruitment, and age of entry into the fishery for each stock or stock complex; and g) analyze social and economic impacts of any specification demanding adjustments of allocations, quotas, or bag limits.

2. The Council will convene a Scientific Assessment Panel, appointed by the Council, that will, as a working group, review the SEFC assessment(s), current harvest statistics, economic, social, and other relevant data. It will prepare a written report to the Council specifying a range of ABC for each stock or stock complex which is in need of catch restrictions for attaining or maintaining OY. The ABCs are catch ranges that will be calculated for those species in the management unit that have been identified by the Council, NMFS, or the working panel as in need of catch restrictions for attaining or maintaining OY. The range of ABCs shall be calculated so as to achieve reef fish population levels at or above the 20 percent SPR goal by January 1, 2000, for all reef fish except red snapper which has a January 2007 target date, or by a time period (target date), or set of time periods (target dates) specified by the stock assessment panel. Any time period specified by the assessment panels for consideration by the Council under this framework procedure cannot exceed a period equal to 1.5 times the potential generation time of the stock. Generation times are to be specified by the stock assessment panel based on the biological characteristics of the individual stocks. For stock or stock complexes where data in the SEFC reports are inadequate to compute an ABC based on the spawning stock biomass per recruit model, the above working group will use other available information as a guide in providing their best estimate of an ABC range that should result in at least a 20 percent SPR level. The ABC ranges will be established to prevent an overfished stock from further decline. To the extent possible, a risk analysis should be conducted indicating the probabilities of attaining or exceeding the stock goal of 20 percent SPR, the annual transitional yields (i.e., catch streams) calculated for each level of fishing mortality within the ABC range, and the economic and social impacts associated with those levels. The working group report will include recommendations on bag limits, size limits, specific gear limits, season closures, and other restrictions required to attain management goals, along with the economic and social impacts of such restrictions, and the research and data collection necessary to improve the assessments. The working group may also recommend additional species for future analyses.
3. The Council will conduct a public hearing on the working group reports at, or prior, to the time it is considered by the Council for action. Other public hearings may be held also. The Council will request review of the reports by its Reef Fish Advisory Panel and Standing Scientific and Statistical Committees and may convene these groups before taking action.
4. The Council in selecting a TAC level and time period (target date), if necessary, for each stock or stock complex for which an ABC range has been identified will, in addition to taking into consideration the recommendations provided for in (1), (2), and (3), utilize the following criteria:
  - a. Set TAC within or below the ABC range or set a series of annual TACs to obtain the ABC level within three years or less.
  - b. Subdivide the TACs into commercial and recreational allocations which maximize the net benefits of the fishery to the nation. The allocations will be based on historical percentages harvested by each user group during the base period of 1979-1987<sup>4</sup>. However, if the harvest in any year exceeds the TAC due to either the recreational or commercial user group exceeding its allocation, subsequent allocations pertaining to the respective user group will be adjusted to assure meeting the specified target date spawning stock biomass per recruit (SPR) goal.
5. The Council will provide its recommendations to the RD for any specifications in TACs and target dates for each stock or stock complex, quotas, bag limits, trip limits, size limits, closed seasons, and gear

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<sup>4</sup>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.

restrictions necessary to attain the TAC, along with the reports, a regulatory impact review and environmental assessment of impacts, and the proposed regulations before October 15, or such other time as agreed upon by the Council and RD.

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

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. Appropriate regulatory changes that may be implemented by notice action include:
  - a. The TACs for each stock or stock complex that are designed to achieve a specific level of ABC within the first year, or annual levels of TAC designed to achieve the ABC level within three years.
  - b. Bag limits, size limits, vessel trip limits, closed seasons or areas, gear restrictions, and quotas designed to achieve the TAC level.
  - c. The time period (target date) specified for rebuilding an overfished stock with the restriction that a time period specified under this framework procedure cannot exceed a period equal to 1.5 times the generation time of the stock under consideration.
8. If the NMFS decides not to publish the proposed rule of the recommended management measures, or to otherwise hold the measures in abeyance, then the Regional 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.

## **6. SPAWNING POTENTIAL RATIO (SPR)**

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 loses 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.

Calculation of SPR is similar to calculation of YPR, except, instead of attempting to maximize yield from a 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 SPR of a population is then controlled by the fishing mortality exerted on each age class of fish.

## **7. STATUS OF RED SNAPPER STOCK**

This section is taken from the 1994 stock assessment (Goodyear 1994), the 1994 Report of the Reef Fish Stock Assessment Panel (GMFMC 1994a) and the Update to the 1994 Report of the Reef Fish Stock Assessment Panel (GMFMC 1994b). Background information has also been incorporated from the 1993 regulatory amendment for setting red snapper TAC (GMFMC 1992).

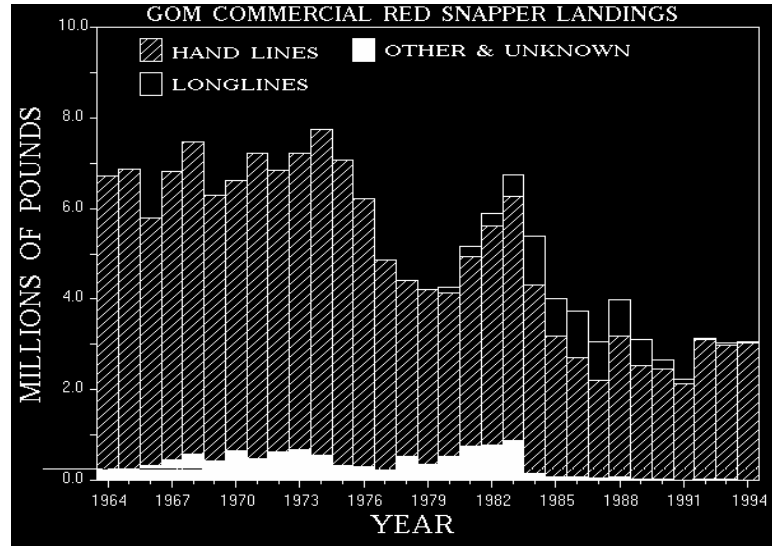
Red snapper within the Gulf of Mexico's Exclusive Economic Zone (EEZ) and adjoining territorial sea are considered to be a single unit stock for management purposes. Although the possibility exists for genetic exchange among red snapper occurring in the southwestern Gulf of Mexico, the Atlantic Ocean, and northern Gulf through larval drift, juvenile and adult red snapper do not migrate long distances once they adopt a benthic life style. It is this nonmigratory behavior of juvenile and adult red snapper that allows for separate management of the red snapper occurring in the U.S. Gulf of Mexico.

### **Harvest Trends**

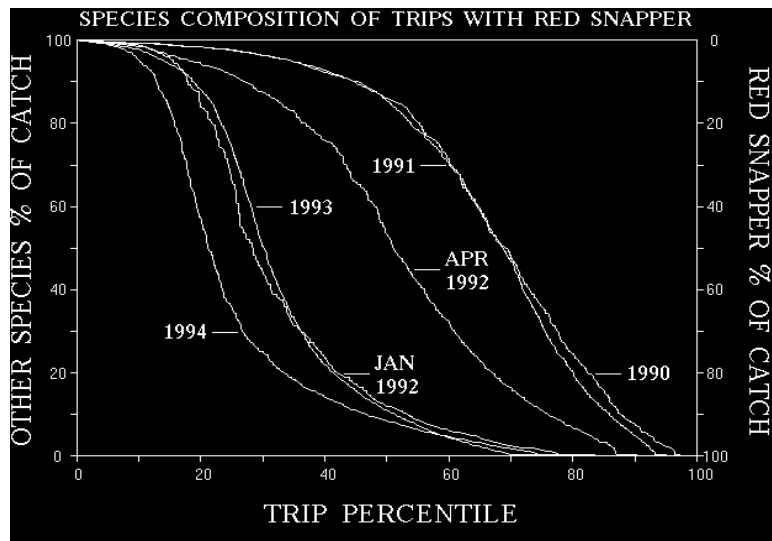
**Commercial:** Gulf of Mexico red snapper harvested by U.S. fishermen are primarily caught in the northern Gulf from Panama City, Florida to Galveston, Texas. The fishery is primarily prosecuted in federal waters, offshore, and outside of state waters. The greatest part of the present commercial and 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 gear types 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.

Total commercial landings of red snapper include fish captured in both U.S. and foreign waters. Landings since 1964 have been separated into the two sources, and analysis was based on domestic landings only. Commercial landings were relatively stable at around 7 million pounds from 1964 until the mid-1970's (Figure 1). They declined to 4.3 million pounds in 1980, recovered to 7.1 million pounds in 1983, and then declined to 2.2 million pounds in 1991. The 1991 to 1993 commercial harvest has been curtailed by quotas to 2.2, 3.1, and 3.0 million pounds respectively. Preliminary estimates indicate the 1994 commercial harvest at about 3.1 million pounds. The 1992 commercial harvest exceeded the quota as a result of an emergency season to alleviate economic hardships after an early quota closure. It was determined at that time that the one-time excess harvest would not adversely affect the rebuilding schedule.

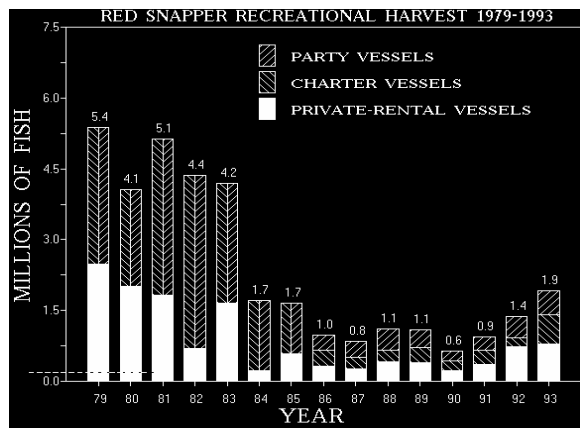


An effect of the commercial quota and the derby fishery that has developed in expectation of the quota being filled is that red snapper is now more of a targeted species than prior to Amendment 1 (Figure 2). In 1990 and 1991 half of the trips which landed red snapper were composed of 85 to 86 percent other species. In January and February, during the regular season for red snapper half of the trips landing red snapper had between 11 and 12 percent other species in the total catch, the remaining trips were almost entirely red snapper. Part of the argument for reopening the season in 1992 with a 1000 pound trip limit



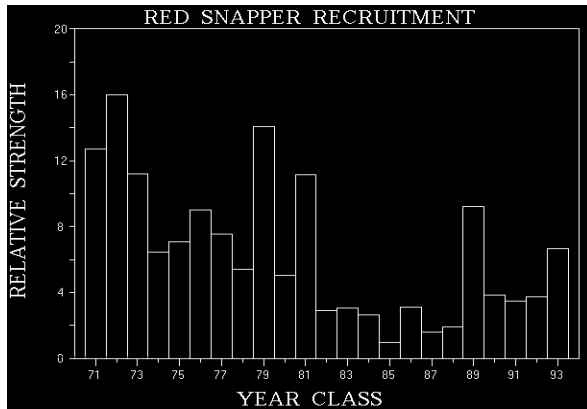
was that the bycatch of red snapper in trips directed at other species would make those trips profitable, and thereby ease the economic hardship caused by the early closure. As can be seen from Figure 2, the species composition of the April-May catch did shift slightly back toward that which had been typical of the 1990 and 1991 fishery. However, 50 percent of the trips landing red snapper had fewer than one third of the catch consisting of other species. Only 40 percent of trips landing any red snapper had more than half of the total catch for the trip made up of other species. The 1993 distribution was almost identical to that in January 1992, but the 1994 distribution was even more focused on red snapper.

**Recreational:** The recreational harvest of red snapper is shown, in numbers of fish, in Figure 4. In recent years the biomass of red snapper recreational landings has increased faster than the numbers of fish landed as the average size of fish caught has increased (Figure 3). Recreational harvest declined from about 5 million fish and 10 million pounds in the early 1980's to about 1 million fish and 2.2 million pounds since about 1986. In 1991 an estimated 0.9 million fish and 2.1 million pounds of were harvested recreationally. In 1992 harvest was estimated at 1.4 million fish and 3.4 million pounds. For 1993, the most recent year for which recreational estimates are available, harvest was estimated at 1.9 million fish and 5.1 million pounds. Since 1990, size and creel limits have resulted in about half the recreational catch being released.



Year	Headboat	Charter	Private	All
1979	1.01	4.09	1.35	2.04
1980	3.33	2.41	2.06	2.83
1981	0.98	1.94	1.69	1.01
1982	0.90	1.71	2.16	0.94
1983	1.25	1.67	1.38	1.31
1984	1.21	3.75	1.85	1.65
1985	1.16	2.48	1.76	1.46
1986	1.37	2.04	1.72	1.44
1987	1.42	2.40	1.82	1.55
1988	1.86	2.10	1.91	1.88
1989	1.59	2.57	1.82	1.63
1990	1.83	2.23	1.84	1.85
1991	1.99	2.07	2.06	2.06
1992	2.39	2.19	2.56	2.27
1993	2.63	2.30	2.86	2.47

**Recruitment Trends**

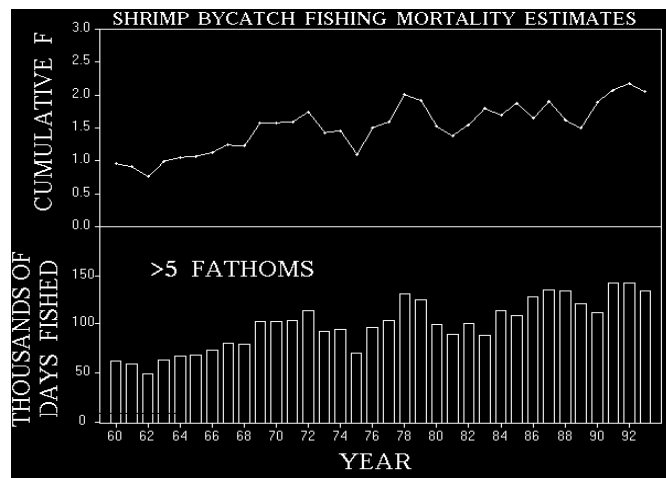


Juvenile abundance indices from the Summer SEAMAP and Fall Groundfish Survey show a general decline between the 1970s and 1980s with the lowest values occurring with the 1985 year class (Figure 5). The Summer SEAMAP red snapper collections are composed almost entirely of age-1 fish while the Fall Groundfish samples have both age-0 and age-1 individuals in abundance. A composite time series was developed to characterize recruitment by year class. The resulting data indicate year class strength has varied by more than 10 fold during the period of record. This time series shows a general decline from

a high age 1 recruitment value of 15.99 for the 1972 year class to a low of 0.97 for the 1985 year class. The strong 1989 year class had a recruitment value of 8.90, and the 1990 year class had a recruitment value of 3.80. 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 three subsequent year classes (1990-1992) averaged about 37 percent of the 1989 year class. Initial estimates of the 1993 year class indicate that it is the strongest year class since 1989, though still below the historical levels of the 1970's.

### Shrimp Trawl Bycatch Mortality

Although the discard mortality associated with shrimp trawls is not a part of the harvest, it is a part of the overall fishing mortality. The age composition and the monthly magnitude of the bycatch is needed to estimate the bycatch mortality by year. Young of the year begin to recruit to the bycatch in June and July, and become the dominant part of the bycatch by August. Age-1 red snapper constitute an important part of the bycatch each month. The cumulative instantaneous mortality estimates from shrimp bycatch are shown in Figure 6. The average value for instantaneous mortality rate for all year classes was  $F=1.79$  implying an average conditional survival probability of 17 percent for the shrimp fishery.



The level of shrimp bycatch mortality must be associated with shrimping effort. Estimates of historical levels were made by applying the ratio of the 1982-1992 average shrimp effort to the average cumulative F for those year classes to historical levels of shrimp effort in waters of 5 fathoms or greater depth (Figure 6).

### 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 1985 the peak was above  $F=0.7$  but declined to a low of  $F=0.3$  by 1992, largely because of conservation actions. Fishing mortality increased in 1993 to about  $F=0.35$  at age 3 coincident with the increased harvest by the recreational fishery.

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  $F_{0.1}=0.18$  per year and  $F_{max}=0.28$  per year, assuming a 33 percent mortality of released fish. The current rate of  $F=0.346$  is much higher than either  $F_{0.1}$  or  $F_{max}$ . Expressed as conditional fishing mortality rates,  $F_{0.1}=0.18=16\%$  of the vulnerable stock,  $F_{max}=0.28=24\%$  of the vulnerable stock, and  $F_{1993, age 3}=0.346=29\%$  of the vulnerable age 3 stock.

### **Spawning Potential Ratio (SPR) Estimates**

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.

The estimate of red snapper SPR for 1984 was about 0.6% of the unfished level. The estimate increased slightly with declining mortality in 1986 and 1987, but then declined somewhat with increased mortality rates in 1988 (Goodyear and Phares 1990). In 1992 it had increased to slightly above 1% (Goodyear 1992). By 1993 it had increased to about 2%, and remained slightly below 2% by 1994 (Goodyear 1994).

The models used to characterize the relative reproductive importance of individual females in this report use the function developed in the previous assessment (Goodyear 1992). However, Collins et al. (ms) analyzed red snapper fecundity from samples from recreational and commercial fisheries, and report that their data suggest increased spawning frequency with age. If so, then it is likely that the function used to estimate fecundity in this assessment underestimates the relative reproductive importance of the older individuals in the population. The consequence of this error is to overestimate SPR.

### **Conclusions**

Red snapper are known to live as long as 42 years (Szedlmayer and Shipp 1992) and probably form a single stock in the northern Gulf of Mexico. Juveniles are often associated with sandy or muddy bottom, but older fish tend to aggregate in areas of hard limestone or other irregular bottom formations. Adults are relatively sedentary. Dispersal of red snapper among different areas occurs primarily by the transport of larvae while they live as plankton in the water column.

The 1990 red snapper assessment (Goodyear and Phares 1990) reinforced earlier conclusions that the red snapper population in the Gulf of Mexico was overfished, with an SPR of 0.6 percent. The 1992 stock assessment (Goodyear 1992) reported a value of SPR for red snapper of about 1 percent, and the current stock assessment (Goodyear 1994) reports an SPR of about 2 percent. While this represents a small improvement, it is still substantially below the 20 percent SPR goal established in Amendment 1. The conservation measures currently in place are enhancing the condition of the stock. The proposed measures will allow the stock to continue to recover. However, without the planned permanent reduction in the shrimp bycatch mortality rate, it will not be possible to attain the spawning stock goals within the one and a half generation times specified by the Plan.



## 8. MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEW

### Introduction

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

The RIR also serves as the basis for determining whether any proposed 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 1995. 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 proposing to begin plan development to consider an amendment to require bycatch reduction devices in shrimp trawls. The succeeding analysis focuses mainly on impacts on the red snapper fishery with general discussions on the consequences of the bycatch reduction on the shrimp 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 Alternative

**Retain the 1994 TAC for red snapper at the status quo of 6.0 million pounds, with 3.06 million pounds allocated to the commercial fishery and 2.94 million pounds allocated to the recreational fishery. The commercial allocation will be implemented by a quota. The recreational allocation will be implemented by an increase in the recreational size limit to 15 inches, a reduction in the recreational daily bag limit from 7 fish to 5 fish, and no retention of recreational catch the captain and crew on recreational charter and headboats.**

**Delay the opening of the 1995 commercial red snapper fishing season until February 24, 1995, which is 5 days prior to Ash Wednesday.**

**Rationale:** Based on biological data and projections presented in the 1994 red snapper stock assessment, the RFSAP initially recommended that directed fishery ABCs of 4 to 6 million pounds would be necessary with a shrimp trawl bycatch mortality reduction of 50 percent beginning in any year from 1994 to 1996 to achieve a 20% SPR by the year 2009 (GMFMC 1994a). After the RFSAP met, new data became available indicating that the 1993 red snapper year class is the strongest since 1989 (figure 5). In light of this new information, the SEFSC conducted new computations to determine whether the TAC could be raised to 7 or 8 million pounds, and the RFSAP reconvened via telephone conference to review the results (GMFMC 1994b). Even with the inclusion of the 1993 year class data, the probability of attaining 20% SPR by the year 2009 was only 35% with a 7 million pound TAC, and only 10% with an 8 million pound TAC. These probabilities are based on achieving a 50% reduction in shrimp trawl bycatch mortality in 1995. If the reduction in shrimp trawl bycatch mortality does not occur until 1996, these probabilities will be even lower. If the TAC is maintained at 6 million pounds, then the probability of meeting the SPR goal is 85% if the reduction in shrimp trawl bycatch mortality occurs in 1995, or 50% if it occurs in 1996. Based on this updated analysis, the RFSAP retained its recommendation of an ABC of up to 6 million pounds. The Council, in accepting the recommendations of the RFSAP, is required to set the TAC within or below the ABC range. The status quo TAC of 6 million pounds is the upper limit of the ABC range established by the Stock Assessment Panel.

In 1991, the recreational sector harvested an estimated 2.1 million pounds of red snapper. The 1991 allocation of 1.96 million pounds was only 4% below the actual harvest. In 1992, the recreational sector harvested an estimated 3.4 million pounds. Although the recreational allocation had been raised to 2.94 million pounds, this was still 14% below the actual harvest. In 1993, the recreational harvest was estimated at 5.1 million pounds. The recreational allocation remained at 2.94 million pounds, or 43% below actual harvest. The increase in pounds of recreationally harvested red snapper is due to both increased numbers of red snapper harvested and increased average weight, as estimated from the MRFSS, the NMFS Headboat survey, and Texas Parks and Wildlife catch estimates. It is still possible to meet the recovery goal with a 6 million pound TAC and 50% reduction in shrimp trawl bycatch mortality by 1996, but only if the recreational sector as well as the commercial sector is constrained to its allocation. Additional management measures are needed to restore the recreational harvest to its allocation under the recovery program. The Council was presented with a series of alternatives for achieving a 43% reduction from 1993 recreational fishing mortality rates for various combinations of size limits, bag limits and closed seasons (Tables 4-7). Based on this analysis, the Council proposes a 15 inch minimum recreational size limit combined with a 5 fish recreational bag limit, which will achieve a reduction in the recreational fishing mortality rate from 1993 levels of between 38% (assuming 33% mortality of released fish) and 57% (assuming 0% release mortality). The commercial minimum size limit will remain at 14 inches in 1995, however, under Amendment 5, the minimum size limit will be 15 inches for all fishermen beginning in 1996. Based on recent studies of grouper survival at various depths (Wilson and Burns, unpublished manuscript), the Council feels that the release mortality of reef fish caught at depths frequently fished by the recreational sector, although greater than 0%, is likely to be less than the 33% that is assumed in the stock assessment analysis and that these measures will approach the needed 43% reduction. To further constrain the recreational harvest, the Council proposes a prohibition on the retention of recreational catch by the captain and crew of recreational charter and headboats. The impact of this additional measure is unknown. However, in 1993 charterboats and party boats accounted for 32% and 25% of recreational red snapper landings. This measure will provide additional reduction in the recreational harvest without impacting the paying customers on for-hire boats or individual fishermen on private and rental boats. Considered together, these measures are expected to achieve the needed reduction in recreational harvest rates.

Winter months are frequently a time of bad weather, which can make fishing hazardous. Because of the expectation that the red snapper quota will be quickly filled, commercial fishermen may feel compelled to fish even under hazardous weather conditions in order to catch their share of the resource. Delaying the opening

of the commercial red snapper season reduces the likelihood of encountering bad weather., and also extends the quota closure date until later in the year. For the last two years, the Council has set the opening of the commercial red snapper season so that it occurs a few days before Lenten season, which is a time of increased demand for seafood. However, Lent occurs on a different day each year. In 1995, Lent begins on March 1. Opening the season on February 24 will allow the industry time to harvest red snapper.

**Biological Impacts:** The management measures currently in place, combined with a strong 1989 year class, are having an impact on the red snapper stocks. The estimate of SPR has increased from 0.6 percent in 1984 to about 2 percent in 1994. Current estimates of SPR are on track with projections, neither higher nor lower than estimated (GMFMC 1994b). Anecdotal information from fishermen is that abundance of red snapper has increased. The average size of red snapper sampled from the recreational fishery has increased every year since 1989. Given the assumption of a 50 percent reduction in shrimp bycatch of red snapper by 1996, a 6 million pound TAC is still projected to achieve a 20 percent SPR by the year 2009.

Recruitment to the age 1 year class is highly variable and not predictable except as a long term underlying stock-recruit function. Recruitment in any given year will almost certainly be either higher or lower than the predicted value. Several strong year classes can accelerate the recovery as can shrimp trawl bycatch mortality rate reductions of more than 50%.. Conversely, several weak year classes or a failure to achieve at least a 50% shrimp trawl bycatch reduction by 1996 can slow down the recovery and require that the TAC be reduced. The stock assessment projections assume that strong year classes and weak year classes will balance each other out over the long term, and that a 50% reduction in shrimp trawl bycatch will be achieved by 1996.

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. Once the 50 percent reduction is achieved and maintained, the pounds or number of red snapper caught will increase as red snapper stock size increases. 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 2009. At low or no bycatch reduction levels, a 20 percent SPR cannot be achieved at any level of TAC.

The commercial allocation of 3.06 million pounds is proposed to be implemented by a quota and a two tier trip limit of 2,000 pounds of red snapper for permitted vessels with a red snapper endorsement and 200 pounds for permitted vessels without a red snapper endorsement. In 1990 the commercial quota was 3.1 million pounds, but only 2.7 million pounds were harvested. The 1995 quota of 3.06 million pounds is almost as high as the 1990 quota. However, the total number of permittees has increased from 1,622 in 1990 to 2,199 in 1992, and subsequently decreased to approximately 1,800 as of February 1994. Red snapper endorsements have been issued to 131 vessel permits. Analysis of logbook data indicates that fishermen changed their behavior since 1990 to more directly target red snapper (Figure 2). In 1990 and 1991 half of the trips which landed red snapper were composed of 85% to 86% other species. During the derby season in January-February 1992 and in 1993 half the trips had only 11% to 12% other species and the remaining trips were almost entirely red snapper. The 1994 season was even more focused on red snapper (Goodyear 1994).

The measures to reduce recreational harvest will reduce the number of fish caught and kept. However, without measures to reduce overall recreational effort, there is likely to be an increase in the number of fish released, along with a corresponding increase in the number of fish that die from release mortality. This has been taken into account in the stock assessment and management analysis by analyzing the impacts of recreational measures with an assumption of 0% release mortality, an assumption of 33% release mortality, and an assumption of 33% release mortality and no fishing after the bag limit is reached. Goodyear (1994)

reviewed several studies of release mortality in reef fish, and the Council reviewed a more recent report on survival of released groupers (Wilson and Burns, unpublished manuscript). Release mortalities in these reports had a very wide range, from 0% to more than 67%. In general, however, release mortality decreased with decreasing depth, and was less than 33% for reef fish caught shallower than 144 feet. Data is not available to determine the average depths at which red snapper are caught. If recreational red snapper fishing occurs primarily in waters shallower than 144 feet, then release mortality is likely to be less than 33% and the impact of the proposed measures to reduce recreational fishing mortality will be greater than what is projected under the assumption of a 33% release mortality. If, on the other hand, recreational red snapper fishing frequently occurs in deeper depths, then the stock assessment's assumption of a 33% overall release mortality and analysis based on that value continues to be the best available scientific information. The Council felt that the recreational fishery is generally conducted in shallower waters than the commercial fishery and that the recreational release mortality was between 0% and 33%.

In 1993 the minimum size limit for red snapper was 13 inches. In 1994 it was increased to 14 inches. The average length of a red snapper reaches 13 inches in November of its age 2 year. An age 3 red snapper averages 14 inches during April and increases to 15 inches by the beginning of June (Table 2). The period from November to May accounts for about 42% of the total recreational harvest, and April and May account for about 14% of the total recreational harvest (Table 3). It is during this period that the size limit increase will have its greatest impact. As a result of the increased size limit, the average weight of a recreationally caught and kept red snapper will increase. The average weight of a 13 inch red snapper is about 1.2 pounds, a 14 inch red snapper - 1.5 pounds, and a 15 inch red snapper - 1.8 pounds. Red snapper of 15 inches or less are the predominant sizes of recreational harvest in all modes and states (Goodyear 1994). To effectively reduce biomass harvested, the decrease in catch of legal sized red snapper will have to be great enough to offset the increase in average weight. The stock assessment's review of, indicating that some of the data probably comes from fishing significant concentrations of red snapper (Goodyear 1994). The impact of increasing the minimum size limit alone on the recreational catch rate will therefore likely be minimal, but in combination with other measures can help to effectively reduce harvest. A secondary benefit of increasing the size limit is to increase the yield per recruit. Under the assumption of a 33% release mortality, yield per recruit will increase with an increasing size limit and is maximized at about 16 inches (GMFMC 1993), and at lower release mortalities the minimum size that results in maximum yield per recruit will be higher.

A decrease in the bag limit is likely to have a significant impact on the rate of numbers of fish harvested since, as previously noted, catch per angler trip data shows high numbers per angler trip at the upper end of the catch distribution. Thus a large portion of the recreational angling effort will be impacted. As with size limits, however, the reduction in numbers of fish harvested will be offset to some extent by an increase in the average weight of the fish caught. Even without a minimum size increase, the average size has been increasing due to increasing abundance of older age groups. During the time when the size limit was held at 13 inches, 1990-1993, the average weight of a red snapper sampled from the recreational fishery increased every year, rising from 1.85 pounds to 2.47 pounds. Both size limit and bag limit changes can have immediate impacts on the rate of biomass harvest, but over time these impacts will be diminished. If these are the only controls applied to the recreational fishery, then further adjustments to bag and size limits will be periodically needed until the stock has recovered and reached equilibrium. A possible secondary impact of reduced bag limits is increased fishing pressure on alternative species as fishermen reach their red snapper limits and turn to targeting other species. According to the NMFS Headboat survey, the top five species, by number of fish caught, from headboats during 1990-1993 (and percent of overall catch composition) were: 1) white grunt (23%); 2) vermilion snapper (21%); 3) red snapper (13%); 4) tomtate (6%); and 5) yellowtail snapper (6%). The top 5 species by number reported in the 1993 Charterboat survey were; 1) red snapper (27%); 2) vermilion snapper (25%); 3) gray triggerfish (17%); 4) porgies (8%); and 5) Spanish mackerel (6%). Of these species, only red snapper, yellowtail snapper and Spanish mackerel are currently subject to bag limits.

The provision for no retention of recreational catch by the captain and crew on recreational charter and headboats will provide an actual reduction in fishing effort since it removes a segment of the recreational fishing population from the consumptive fishery. The impact of this measure is also likely to be persistent over time. The amount of impact of this measure, however, is unknown. Between 1986 and 1993, charterboats have accounted for a cumulative 30% of the recreational harvest and party boats have accounted for 28%. These percentages have been relatively stable since 1986. Charterboats are defined as vessels less than 100 gross tons that meet the requirements of the Coast Guard to carry six or fewer passengers for hire. Assuming that a charter boat crew consists of either the captain alone or captain and one crew, and that the captain and crew fish during a charter trip, and there are from 1 to 6 paying customers, the impacted fishing effort can range from 14% (1 out of 7) to 67% (2 out of three) of that segment's 30% harvest (or 4% to 20% of the overall recreational harvest). Party boats (headboats) are vessels that hold a valid Certificate of Inspection by the Coast Guard to carry passengers for hire. These vessels can and frequently do carry large numbers of customers. Although the crew may also be larger than on charterboats, the relative impact of the captain and crew's catch is likely to be less than that of the charterboats.

**Economic Impacts:** The RFSAP initially recommended an ABC of no more than 6.0 MP (million pounds) and maintained this recommendation even after further examination of higher numbers for the upper range of the ABC (see GMFMC, 1994a and 1994b). In turn the SEP (Socioeconomic Assessment Panel), recommended that a TAC be chosen at the upper bound of the ABC (see GMFMC, 1994c). The proposed TAC of 6.0 MP (million pounds) is the same as that of last year. In fact this is the same TAC since the 1992 fishing season. The commercial/recreational allocation is maintained at its current ratio of 51 percent commercial (3.06 MP) and 49 percent recreational (2.94 MP). In principle then, maintaining the status quo for both the TAC and commercial/recreational allocation would have no short-run economic impacts on fishery participants. The long-term effects depend on such factors as the future status of stock as partly determined by current restrictive TAC and reduction in mortality of juvenile red snapper incidentally caught in shrimp trawls, the market condition for commercially sold red snapper, and the nature and strength of both commercial and recreational demand. While these effects cannot be determined at present, it is reasonable to expect future increases in commercial and recreational benefits if management is successful in fully restoring the red snapper stock.

### Commercial Sector

The commercial fishery will continue to be managed under the endorsement system whereby fishermen with reef fish permits are allowed only one trip a day and subject to a 2,000-pound trip limit with endorsement or 200-pound trip limit without endorsement. The only change proposed for this sector relates to the opening of the red snapper fishing season.

The red snapper fishing season normally starts on January 1st and ends on December 31st of every year. Since 1991 the commercial fishery reached its quota and the fishery closed several months before December. The 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 3 months in 1993 and about 2.5 months in 1994. The commercial fishing the season opened on February 16 in 1993 and February 10 in 1994. These delays in opening the season were intended to minimize fishing during hazardous winter weather and to enable the fishermen to take advantage of higher demand during Lenten season. The proposed opening date of February 24 for the 1995 fishing season is designed to generate the same effects as those of last two years' delayed opening date. While the general conclusion here is that the proposed delay in opening the commercial red snapper season would have similar effects to those of the last two years', it may be instructive to examine the movement of prices in the reef fishery in general and red snapper fishery in particular. The intent here to generate some information on the effects of previous years'

delay in opening the red snapper season at least with respect to the income and ultimately the profitability of the harvest sector.

Waters (1994) recently described the trends in the commercial reef fishery in the U.S. Gulf of Mexico. In 1993, commercial fishermen landed 25.3 MP (whole weight) of reef fish worth \$45.3 million in current prices. Both landings and values are record figures at least since 1965. Red snapper accounted for about 14 percent of both total landings (3.4 MP) and values (\$6.7 million). Groupers accounted for as much as 40 percent of total landings and 50 percent of total values. The rest of the reef fish species, mainly other snappers, accounted for the remaining portion of reef fish landings and values.

The Northern and Western Gulf (Gulf County, FL to Texas) has accounted for most commercial landings (and values) of red snapper in the Gulf. Commercial fishermen in this area received \$6.5 million from red snapper in 1993. This is about 39 percent of all values received by reef fishermen in this area, although it is relatively low compared to red snapper's past contribution to revenues received by fishermen (49% in 1985 and 83% in 1980). The decline in the relative importance of red snapper is due to the long-term decline in landings of red snapper, the increase in landings of other species, and, since 1990, a decline in ex-vessel prices for red snapper.

Red snapper prices generally rose in concert with the general price level prior to the implementation of binding aggregate quotas in 1991. Since then, red snapper prices have declined in both nominal and real (i.e., after adjustment for inflation) terms to their lowest levels during the 1978-1993 period. The implementation of commercial quota and the rapidness with which the quota is filled have led to the volatility of prices for red snapper. Average monthly ex-vessel prices were relatively stable prior to implementation of restrictive quotas because landings occurred relatively uniformly throughout the year. Since 1991, however, average monthly prices have exhibited greater variance in response to the extreme fluctuations in landings. For example, average ex-vessel price for red snapper in the Northern and Western Gulf went down as low as about \$2.00 in 1992 and 1993 in the month fishing started and rose as high as about \$3.25 in 1992 and \$2.75 in 1993 in later months. Certain areas are expected to experience different lower prices for the beginning of the fishing season and different higher prices for later months of the year. In contrast to the situation for red snapper, real average prices for other reef fishes have remained relatively stable.

The Lenten season, which varies from year to year but generally occurs from mid-February to early April, commands relatively higher demand for seafood, including red snapper. Red snapper prices are generally higher during Lent relative to other months of the year. For the period 1985-1990 when regulations were not as restrictive as in later years, average red snapper prices during the months of February to April were about \$2.50 per pound while in other months average prices ranged from \$2.30 to \$2.40. The situation changed in the period 1991-1993 when the derby fishery materialized; that is, prices were higher in other months, particularly during the closure. This signifies that delaying the opening of the red snapper season to take advantage of higher demand during Lent will not fully offset the downward pressure on prices caused by the derby. However, it is very likely that prices would be even lower if the derby took effect in months prior to Lent. In this case, delaying the opening of the season may partially offset the adverse effect of the derby on the income of fishermen.

The other possible effect of delaying the red snapper season is the less risk involved in a more suitable fishing weather. Although it is possible that fishermen may make the same number of trips regardless of the start of the season, a more suitable weather could at least reduce some of the indirect costs that fishing entails. While it is possible that better weather conditions may partially contribute to the heightening of the derby situation in the red snapper fishery, it appears likely that such contribution may not be large enough to negate whatever cost saving generated.

Considering both the revenue and cost effects of the delaying the opening of the red snapper fishing season, it is likely that some net benefits may be generated by this action. Considering further the fact that there is already some experience (1993 and 1994) in delaying the opening of the red snapper season, enforcing this portion of the proposed alternative should not carry additional cost.

### Recreational Sector

While as mentioned earlier the recreational allocation remains the same at 2.94 MP, the proposed alternative would entail three changes in the distribution of the sector's aggregate allocation: 1) increase in recreational size limit from 14 to 15 inches; 2) reduction in bag limit from 7 to 5 fish per day; and, 3) no retention of recreational catch by the captain and crew on recreational charter and headboats. The main intent of these changes is to constrain the harvest of this sector within its allocation.

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, then by about 16 percent in 1992, and finally by about 74 percent in 1993.<sup>5</sup> The need then to impose additional restrictions on the recreational sector becomes 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). 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.

The Biological Impacts section above provides a general idea of the direction and magnitude of catch reduction that may be effected by the proposed management changes. The impact of increasing the minimum size limit alone on the recreational catch rate will likely be minimal. On the other hand, a decrease in bag limit is likely to have a significant impact on the rate of numbers of fish harvested. The proposal to disallow captain and crew on recreational charter and headboats is also expected to reduce recreational catch. While the magnitude of change is not known, it is likely to be a little more than that of the effect of a size limit increase but less than that of the effect of a reduction in bag limit. Together these changes are expected to result in constraining the recreational sector to its allocation, or in reducing recreational catch by about 43 percent relative to the 1993 level. It should be recognized, however, that the expected reduction in recreational catch is based on fishing conditions prevailing in 1993. If certain factors such as recreational fishing effort and successful fishing trips increase, the expected reduction will not materialize.

The economic effects generally directly related to the direction and magnitude of changes in recreational catch. The proposed size and bag limits can then be expected to reduce recreational benefits in the short-run. Anglers in both private/rental boats and in charter/head boats will experience reduction in consumer surpluses. In order to get some insights into the general magnitude of reduction in consumer surplus, we employ here the same estimation technique used in Amendment 1 to FMP (see GMFMC, 1989, for details) and modified by Waters and Platt (1990).

The technique used in Amendment 1 essentially involves translating reduction in harvest to reduction in consumer surplus based on an estimated recreational demand function. The recreational demand used then was that for king mackerel, and this is the same demand estimate used here since there are no existing recreational demand for red snapper. Using consumer surplus estimates from this demand function, a 43

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<sup>5</sup> Using the revised MRFSS estimates, the recreational harvests are calculated to about 28% in 1992 and 88% in 1993 above the recreational allocation (see Holiman, 1994).

percent reduction in recreational catch (assumed to be proportional to catch on a per angler basis) translates to a reduction in consumer surplus of \$4.16 (in 1986 prices) per angler per trip. Multiplying this number by the average number of trips per angler in 1993 of 4.6 results in an annual loss of consumer surplus per angler of \$19.14. The total loss in consumer surplus to the entire recreational sector can be calculated by multiplying the annual loss in consumer surplus per angler by the total number of anglers targeting red snapper. The number of anglers targeting red snapper is roughly calculated by multiplying the total number of anglers by the proportion of trips targeting red snapper to the total number of trips. Using this method the resulting number of anglers targeting red snapper is about 81 thousand in 1993. Thus, the total loss in consumer surplus as a result of the proposed size and bag limit is about \$1.55 million. It needs to be recognized that this loss is premised on, among others, the expectation that the bag and size limit would translate to a 43 percent reduction in recreational catch.

To the extent that the proposed size and bag limits cause recreational fishermen fishing through charter and head boats to reduce their number of trips, a reduction in the revenue of charter and head boat operations may ensue. If the reduction in the number of trips does not cause operators of these boats to reduce the number of boat trips, a reduction in revenue will also result in reduction in profits. Again, we use the same technique employed in Amendment 1, as modified by Waters and Platt (1990), to estimate the reduction in profits to charter and head boats as a result of reduction in catch rates. In the absence of more recent information on the for-hire sector on a Gulfwide basis (e.g., cost, returns, fishing characteristics), we use the same information as in Amendment 1 and Waters and Platt. Reduction in profits is estimated by multiplying the following values: net profits per boat, total number of boats, mean percent of time red snapper is targeted by the boat, and reduction in number of trips.<sup>6</sup> Using the mentioned technique, the reduction in profits to the for-hire sector is about \$4.6 million (in 1988 dollars).

It needs to be recognized that the estimated losses to the recreational sector are premised on, among others, the expectation that the bag and size limit would translate to a 43 percent reduction in recreational catch. It is worth noting that the expected reduction is based on the general conditions prevailing in 1993. To what extent those conditions continue to characterize the fishery in 1995 is not known, but an examination of some factors related to recreational fishing may lend some insights on the likelihood that the proposed changes would be effective in constraining recreational within its allocation.

The increased harvest in poundage by the recreational sector has been attributed to an increase in both the number and average weight of red snapper caught and kept by recreational fishermen. In addition to more restrictive management measures imposed, a relatively robust 1989 year class that comprised a good portion of the larger fish in 1992 and 1993 is one major reason for the increase in average weight of red snapper harvested by recreational fishermen. The increase in the number of red snapper harvested may be attributed to an increase in the number of catch per angler (at least until 1992) and the number of trips taken. Goodyear (1994) reported that median catch (in number of fish) per angler fell to its lowest level in 1989-1990 since 1984, subsequently rose in 1991 and 1992, but declined in 1993, with the drop in 1993 possibly due to decreasing abundance of the 1989 year class. Holiman (1994) reported an increase in the number of trips targeting (primary and secondary) red snapper in 1993. Based on MRFSS data, total trips taken with red snapper as the primary target species were about 132 thousand in 1992 and 180 thousand in 1993. Total trips taken with red snapper as secondary target species were about 10 thousand in 1992 and 23 thousand in 1993. Naturally not all trips targeting red snapper would result in actual red snapper catch. However, the number of unsuccessful trips (i.e., trips in which red snapper is targeted but not caught) fell from about 84 thousand in 1992 to 74 thousand in 1993. Conversely, this indicates an increase in successful trips. Such higher level of successful trips may further invite more trips that target and likely catch red snapper. Such increase in

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<sup>6</sup>The basic source for these data are Holland and Milon (1989) and Ditton et al. (1989).



successful trips may come from current anglers or from recent "entrants." In 1993, MRFSS data shows that there were about 3.5 million saltwater anglers in the Gulf of Mexico region. Recreational demand may also change, and the in the long-run population in the coastal states and real income, both of which are increasing, will define the strength of demand for recreational trips. Saltwater fishing days in the year 2010 have been projected to reach 2.3 million in Alabama, 49 million in Florida (east and west), 3.3 million in Louisiana, 1.4 million in Mississippi, and 20.9 million in Texas (SFI, 1992). Not all days will be spent for red snapper fishing, but the level appears to be relatively high and can be a potential source for a strong fishing pressure on the red snapper stock.

From the foregoing information, it appears that the probability of the proposed measures to effect a recreational harvest in 1995 significantly lower than that in 1993 is relatively low. Over the long-run, there is a possibility that recreational fishing effort may be substantially higher than needed to harvest its allocation even if the red snapper TAC is substantially increased. The SEP noted that changes in both size and bag limits may be a temporary solution (GMFMC, 1994c). Continued expansion of recreational fishing effort would probably lead to additional allocation overruns in the future, with the need to again reduce bag limits. In this light the SEP suggested that the Council consider other alternatives of managing the recreational sector, such as marine reserves, that may provide stock benefits while maintaining a year long fishery with stabilized bag limits.

Disallowing captain and crew of charter and head boats from retaining recreational catch of red snapper is bound to reduce the direct benefits to these individuals, but perhaps more importantly it may raise the indirect cost of operating for-hire vessels. In public testimony during the September 1994 Council meeting, several charter boat captains indicated they use the currently allowed catch for captain and crew to serve as buffer in the event that their customers' catch at the time exceed the bag limit when evenly divided among themselves. Hence, if captain and crew are disallowed to keep and possess recreational catch, the risk of violating the bag limit rules may be relatively higher. To minimize such risk, the operating expense, mainly additional labor expended, of the for-hire boat may have to be increased. The magnitude of this effects is currently unknown.

### **Rejected Alternatives**

**Rejected Alternative 1: Status Quo. Retain the red snapper TAC at 6.0 million pounds with no change in commercial or recreational measures.**

**Rationale:** During Council discussions some Council members pointed out that recently collected data suggests that the maximum age of red snapper may be older than previously thought and that spawning frequency may increase with age. If this is so, then the generation time is longer than the current estimate of 13 years, and the goal of achieving 20% SPR within 1½ generation times can be extended. With a longer recovery period, less restrictive measures would be needed. The Council has asked the SEFSC to recalculate the red snapper generation time using the best and more recent data. However, in the absence of analysis to indicate otherwise, the generation time remains at 13 years and the recovery target date remains at 2009. In order to achieve this recovery goal, the RFSAP recommended an ABC of up to 6 million pounds. Although this alternative retains the maximum TAC that complies with the ABC recommendation, the Council rejected this alternative because the recreational fishing measures currently in place are inadequate to keep the recreational sector within its 2.94 million pound allocation.

**Biological Impacts:** The recreational allocation was exceeded by 0.5 million pounds in 1992 and by 2.2 million pounds in 1993. By failing to constrain the recreational sector to its allocation, this alternative guarantees that the recovery target will not be met. There would be no change in impact to the red snapper resource from release mortality or in the impact on alternative species from a shift in the directed effort. Also,

if older age groups are making a greater contribution to the spawning potential that is currently estimated, one consequence of this error is to overestimate SPR (Goodyear 1994). A lowered estimate of SPR could reduce or cancel any harvest benefits to be gained from a longer generation time and extension of the recovery period.

**Economic Impacts:** In principle, maintaining the status quo does not change the course of economic effects on fishery participants. However, considering that the proposed change affecting commercial fishermen has some positive effects while the proposed changes affecting the recreational sector have negative effects in the short run, maintaining the status quo may also be viewed as foregoing net benefits to the commercial fishery and preventing net loss to the recreational sector over the short run. In the long-run, the relatively high likelihood of recreational harvest consistently exceeding its allocation may partially hinder the achievement of the target recovery of the red snapper stock. It may be noted though that a good part of achieving the target recovery for red snapper depends on the timing and magnitude of reduction of shrimp trawl bycatch of juvenile red snapper.

**Rejected Alternative 2: Establish a red snapper 1995 TAC of 7.0 or 8.0 million pounds, and change the target date to 2012.**

**Rationale:** In light of recent data indicating that the 1993 red snapper year class is the strongest since 1989, the SEFSC evaluated options to raise the TAC to 7.0 or 8.0 million pounds with a 50% reduction in shrimp trawl bycatch in 1995. An increased TAC would result in higher allocations to both the commercial and recreational sectors. This would result in a longer open season for the commercial fishery and either no changes or less restrictive regulatory changes to the recreational sector than in the Proposed Alternative. The RFSAP met by telephone conference to evaluate the results of this analysis (GMFMC 1994b). For both 7 and 8 million pound TACS, the probability of attaining 20% SPR by 2009 remained under 50%. However, a 7 million pound TAC had a 50% probability of reaching 20% SPR by 2010, and an 8 million pound TAC by 2011. If the generation time were extended so that the recovery period could be extended, and there was no significant change to the current SPR estimate or recovery profiles, an increased TAC might be an acceptable alternative. However, generation time currently remains at 13 years and the maximum deadline for recovery at 2009. In addition, the RFSAP felt that achieving a 50% reduction in shrimp trawl bycatch mortality in 1995 was unlikely, and a 1996 implementation of the shrimp trawl bycatch reduction would result in even lower probabilities of recovery success. Consequently, the RFSAP continued to recommend a maximum ABC of 6 million pounds. The Council rejected this alternative because the proposed TACs were outside of the range of recommended ABC, and the target date cannot be extended beyond 2009 by a regulatory amendment unless the biological estimate of the generation time is increased.

**Biological Impacts:** The red snapper recovery program began in 1990 with the implementation of Amendment 1, and is currently scheduled to take 19 years to complete. Over the long term, a one to three year extension of the recovery deadline will have no significant impact on the red snapper resource. In the short term, a higher TAC and extended recovery schedule will result in the stock remaining at low SPR levels for a longer period of time, increasing the risk of recruitment failure. As an example, red pogy stocks in the south Atlantic had a gradual decline in SPR from above 30% to about 10% from 1972 to 1992, and subsequently suffered recruitment failures (personal communication from Gene Huntsman). Although red pogy has a different life history than red snapper (red pogies are protogynous hermaphrodites, red snapper are not), the point is still valid that stocks at low SPR levels are at increased risk of recruitment failure, and the longer they remain at low SPR levels, the longer they are exposed to that risk. A higher TAC would result in a longer commercial red snapper season and reduce fishing pressure on alternate species. Although increased recreational measures might still be needed to constrain the recreational sector to its allocation, they would not initially need to be as strong as in the Proposed Alternative. However, this relief would only be

temporary. If the recreational allocation continues to be managed solely through size and bag limits, then as red snapper increase in abundance and average size, more restrictive size and bag limits would eventually be needed.

**Economic Impacts:** An increase in TAC may generally be expected to generate more benefits to the commercial sector of the fishery. However, the accompanying increase in commercial quota can be expected to be relatively minimal to substantially dampen the derby-like nature in the fishery. The endorsement system imposed since 1993 and the one-trip-a-day limitation imposed in 1994 have not really made any substantial effect on extending the fishery. In fact under the same quota, the 1994 season turned out to be shorter than the previous year so that prices throughout the open season were still relatively low. At any rate an increase in quota may benefit certain participants in the fishery. Considering the one-trip-a-day limitation, there is good possibility that the increase in quota may attract "new" participants to the fishery, i.e. those that have not very active in the fishery but are eligible to fish most likely under the 200-pound trip limit.

As with the commercial sector, an increase in TAC may be expected to increase the benefits derived by this sector from red snapper fishing. Noting, however, that the recreational harvest is already currently at high level, the increase in TAC ( and recreational allocation) will not directly translate in an increase in benefits for this sector. There are, nonetheless, certain indirect benefits from an increase in recreational allocation. For one, the recreational sector may not face any threat of bag limit reductions in order to stay within its allocation. Second, an increase in recreational allocation may be perceived by anglers as an indication of more potentially successful fishing trips due to stock abundance or to less intense competition from the commercial sector particularly in certain fishing areas. Another benefit, particularly for the for-hire sector, would be in terms of maintaining a more stable environment for recreational fishing. These benefits would come in as increased consumer surplus to anglers and higher profits to the for-hire vessels.

While there are accompanying increases in commercial and recreational benefits from an increase in TAC, the long-term scenario may not be beneficial to both sectors if the recovery of the stock is stunted due to such TAC increase. Biological simulation runs of a 7 MP and 8 MP TAC yield relatively low probability of reaching the target SPR goal by 2009. However, the probability of reaching the target SPR is higher when the recovery period is extended to 2010 or 2011.

**Rejected Alternative 3: Retain the red snapper TAC at 6.0 million pounds, increase the recreational size limit to 15 inches, and keep the recreational bag limit at 7 fish.**

**Rationale:** If a 0% release mortality of red snapper is assumed, staff analysis of size limit, bag limit and closed season combinations indicate that with a 6 million pound TAC, a size limit increase to 15 inches will achieve the needed 43% reduction from 1993 fishing levels without the need for any other measures (Table 6). However, at a 33% release mortality the 15 inch size limit alone would not be sufficient to meet the recreational allocation (Table 4). The Council felt that the recreational fishery is generally conducted in shallower waters than the commercial fishery, and that recreational release mortality is probably less than 33% but greater than 0%. The Council rejected this option because they felt it would not be sufficient to keep the recreational fishery within its allocation.

**Biological Impacts:** The discussion under the Proposed Alternative regarding size limits is also applicable to this alternative. Since there is no decrease in the bag limit under this alternative, the impact from directed effort shifting to alternate species would not change from the status quo.

**Economic Impacts:** Since in itself an increase in the size limit from 14 to 15 inches is expected to have a minimal effect in reducing recreational harvest, the consequent economic effects would also tend to be minimal.

**Rejected Alternative 4: Retain the red snapper TAC at 6.0 million pounds, increase the recreational size limit to 16 inches, and reduce the recreational bag limit to 6 fish.**

**Rationale:** If a 33% release mortality of red snapper is assumed, staff analysis of size limit, bag limit and closed season combinations indicate that with a 6 million pound TAC, a size limit increase to 16 inches and a bag limit of 6 fish will achieve the needed 43% reduction from 1993 fishing levels (Table 4). However, at a 0% release mortality these measures would produce an initial reduction in recreational fishing mortality far in excess of what is needed (Table 6). The Council felt that the recreational fishery is generally conducted in shallower waters than the commercial fishery, and that recreational release mortality is probably less than 33% but greater than 0%. The Council rejected this option because they felt that the measures were more restrictive than needed to keep the recreational fishery within its allocation.

**Biological Impacts:** The discussions under the Proposed Alternative regarding size limits and bag limits are also applicable to this alternative.

**Economic Impacts:** Under the scenario of a 33% release mortality, this alternative has the same economic impacts as the Proposed Alternative, and thus discussions therein are applicable here. If a much lower release mortality rate holds, this alternative would result in larger economic impacts than the Proposed Alternative. The direction of effects, however, for both alternatives would be the same.

### **Additional Measures Not Considered**

**Closed Seasons:** The Council was provided with staff analysis for including a recreational closed season in combination with size and bag limits. A closed season would reduce overall recreational effort by eliminating harvest of red snapper for a set period of time. There would still be release mortality during the closed season from fishermen targeting red snapper for catch and release and from fishermen incidentally catching red snapper while targeting other species. Many charter and headboat operators are heavily dependent on red snapper fishing to attract paying customers year round, and they felt that any closed season would be a hardship on the recreational fishing industry. As a result, the Council did not consider any alternatives that included closed seasons.

**TACs Less Than 6 Million Pounds:** The RFSAP's recommended ABC range of up to 6 million pounds allows the Council to set the TAC at any level below 6 million pounds. A lower TAC would improve the probability of achieving the recovery goal. A reduction in TAC may be needed in the future if the 50% shrimp trawl bycatch reduction is not implemented by 1996, or if sector allocations and TAC continue to be exceeded, or if there is a series of weak year classes. However, a lower TAC would require more restrictive measures on the recreational fishery than in the Proposed Alternative, and the commercial season would be even shorter than the current brief season. At its September 1994 meeting, the Council voted to begin plan development for an amendment to require shrimp trawl bycatch reduction devices. Current projections indicate that if a 50% shrimp trawl bycatch reduction is achieved in 1996, the recovery goal can be met with a 6 million pound TAC. Since a reduced TAC would be disruptive to both the commercial and recreational sectors and is not needed according to current projections, the Council did not consider lowering the TAC.

Adoption of a Fixed F Instead of a Fixed TAC Strategy: The current management strategy calls for maintaining a constant TAC until the recovery goal is reached. A fixed F (Fishing Mortality) strategy would keep the rate of fishing mortality proportional to stock size so that, as the stock recovers, TAC would increase proportionately. The fixed TAC strategy allows a higher TAC at the beginning of the recovery process, but as the stock recovers, shorter commercial seasons result and more restrictive recreational measures are needed to maintain the recreational allocation. In light of the increasing difficulties of managing the red snapper recovery on a fixed TAC strategy, the Council has asked NMFS to look at a transition from a fixed TAC to a fixed F strategy, and to give the Council some idea of how and when this could be accomplished. Until this analysis is available, however, the Council cannot consider a change in strategy.

Limited Entry in the Recreational For-Hire Industry: In previous public hearings the Council has received suggestions that a limited entry system be implemented in the recreational charter and/or headboat industry as a means to control recreational effort. Whether such a system would be effective depends on the amount of excess capacity currently in the for-hire industry and the ability of recreational fishermen to shift to private and rental boats or shore based fishing. A limited entry system cannot be implemented through a regulatory amendment, but requires a full plan amendment. The Council is in the process of developing a limited entry system for the commercial red snapper fishery (Reef Fish Amendment 8) but has no plans at present to develop a recreational limited entry system.

### **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.....	\$15,000
NMFS administrative costs of document preparation, meetings and review.....	\$ 6,000
Law enforcement costs.....	\$ none
Public burden associated with permits.....	\$ none
NMFS costs associated with permits.....	\$ none
TOTAL.....	\$21,000

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 options.

The Proposed Alternative contains several features that have varying effects on the commercial and recreational sectors of the red snapper fishery. The feature that maintains the TAC and commercial/recreational allocation of the TAC has no short-run economic effects. Its long-run effects depend on such varied factors as the future status of the stock as partly determined by current restrictive TAC and future reduction in shrimp trawl bycatch of juvenile snappers, and the nature and strength of both commercial and recreational demand for red snapper. Delaying the opening of the commercial red snapper season is expected to result in relatively higher revenues and lesser costs for fishing vessels, although it may not substantially offset the downward pressure on ex-vessel prices due to the derby. The reduction in bag limit coupled with an increase in size limit to the recreational sector is estimated to result in a reduction of consumer surplus of roughly \$1.55 million and of profits of for hire vessels of roughly \$4.6 million. Disallowing captain and crew of for-hire vessels to retain recreational catch will directly reduce the benefits to these individuals and raise the indirect cost of fishing operation.

The no action alternative (Rejected Alternative 1) has, in principle, no short-run impacts on fishery participants. Relative, however, to the Proposed Alternative, it may be viewed as forgoing the benefits to the commercial sector but at the same time forestalling losses on the recreational sector, including captain and crew of for-hire vessels. Over the long-run, maintaining the status may hinder the achievement of the target recovery of the red snapper stock as the harvest of the recreational continues to increase above its allocation.

Raising the TAC and extending the recovery period (Rejected Alternative 2) are expected to increase benefits to the commercial sector considering that this sector is relatively effectively constrained to its current allocation. The direct effects on the recreational sector is minimal since this sector is already catching even more than the amount of increase in recreational allocation under this alternative. However, indirect recreational benefits may arise in terms of not being subjected to lower bag limits and of maintaining a more stable environment for recreational fishing. Extending the recovery period raises the probability of reaching the target SPR at higher TACs under this alternative.

Since in itself an increase in the size limit from 14 to 15 (Rejected Alternative 3) results in minimal reduction to recreational catch, the accompanying economic effects also tend to be minimal.

Rejected Alternative 4 has the same effects as the Proposed Alternative under a 33% release mortality scenario. The negative effects on the recreational sector would be larger than those under the Proposed Alternative under the condition of 0% release mortality rate.

The proposed regulatory action is estimated to cost the Federal government \$21,000. 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 \$6.7 million. 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 status quo for the TAC level is maintained and the only major action affecting the commercial sector is the delay in opening the red snapper season, there is expected to be no major increases in prices to consumers or cost of fishing operation to the commercial sector. The recreational fishery may suffer losses in consumer surplus and for-hire boat profits, but these losses if at all they materialize may be deemed not major relative to the size of the recreational fishery. 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 sector, any of the sub-items under item (c) above would not apply. Despite potential losses in consumer surplus recreational anglers are not likely to incur significant changes with respect to any of the sub-items under item (c) above. The for-hire sector may incur reduction in profits, but how such reduction in profits translate to effects on competition, employment, investment, productivity, or innovation cannot be determined.

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

## **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. As of October 21, 1994, there are 1,592 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 \$3.5 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 will be 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 would 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, 2 percent of small business entities being forced to cease business operations (NMFS, 1992).

Since there is no change in TAC and therefore in commercial quota, no attendant reduction in gross revenues to commercial red snapper vessels may ensue. Charter and head boat operators may incur reduction in gross revenues resulting from the proposed changes in size and bag limits. However, the losses estimated in the RIR refer to the entire for-hire sector, and it is not known what those losses are as a percent of each vessel's gross revenues. If the expected reduction in recreational catch does not materialize, the estimated revenue losses will also not occur. 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). There is some possibility that some smaller for-hire vessels may be substantially affected by the change in size and bag limits, but it appears unlikely that such management changes would force any of those vessels to cease operation.

## Conclusion

Based on the foregoing discussion, the proposed measures in this regulatory amendment may be regarded as not effecting a significant economic impact on a substantial number of small entities.



## 9. ENVIRONMENTAL ASSESSMENT

### Environmental Consequences

Physical and Human Environment: To the extent that can be ascertained, the action proposed in this amendment will have no impact on the physical environment. The increase in the recreational size limit and decrease in the bag limit for red snapper and the prohibition on retention of recreationally caught red snapper by the captain and crew of charter and headboats will allow continuation of a year round directed recreational fishery while rebuilding the overfished stock to optimum yield and thus be beneficial to the fishing industry.

Fishery Resource: The TAC proposed in this amendment with a concomitant regulatory measures to constrain the recreational fishery to its allocation is consistent with the Council's objective of rebuilding the overfished red snapper stock within one and a half generation times. Measures to decrease recreational harvest of red snapper may result in increased pressure in alternate species. Of the top alternate species listed in the discussion under Proposed Alternative, only Spanish mackerel is considered overfished. That species is on a recovery program and is subject to minimum size and bag limits.

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 ir retrievable 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

## **10. SCIENTIFIC RESEARCH AND DATA NEEDS**

The following scientific research and data needs have been identified with assistance from the scientific and industry advisory panels.

### **Biological Needs**

- differential release mortality rates for recreational vs. commercial fisheries.
- development of unbiased age-length keys
- analysis of fecundity at age, maximum age and generation time

### **Socioeconomic Needs**

- estimation of commercial demand and supply for red snapper and reef fish
- estimation of recreational demand for red snapper and reef fish
- cost and returns estimate for the commercial red snapper and reef fish industry
- cost and returns estimate for the for-hire sector in red snapper and reef fish fishery
- social impact assessment of the red snapper and reef fish fishery
- bioeconomic modeling and estimation of the red snapper and reef fish fishery

## 11. REFERENCES

- Ditton, Robert B., J.R. Stoll, and D.A. Gill. 1989. The social structure and economics of the charter and party boat fishing fleets in Alabama, Mississippi, Louisiana, and Texas. Final report for MARFIN award NA86WC-H-06133 submitted to the National Marine Fisheries Service, Southeast Regional Office, 9450 Koger Boulevard, St. Petersburg, Florida 33702.
- 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., and P. Phares. 1990. Status of red snapper stocks of the Gulf of Mexico: Report for 1990. Report CRD 89/90-05. Available from National Marine Fisheries Service, Southeast Fisheries Center, Miami Laboratory, Coastal Resources Division, 75 Virginia Beach Drive, Miami, Florida 33149.
- Gulf and South Atlantic Fisheries Development Foundation, Inc. (GSAFDF). 1991. A research plan addressing incidental harvest in the Gulf of Mexico and South Atlantic shrimp fisheries. Edited by Peter Hoar, John Hoey, Chris Nelson, and Jim Nance. 78 p.
- GMFMC. 1992. Regulatory amendment to the Reef Fish Fishery Management Plan for setting the 1993 red snapper total allowable catch. Gulf of Mexico Fishery Management Council, Tampa, Florida. 29 p.
- GMFMC. 1993. Supplemental environmental impact statement for the reef fish fishery of the Gulf of Mexico (including measures of amendment 5) and amendment 5 to the reef fish fishery management plan for the reef fish resources of the Gulf of Mexico (including regulatory impact review and initial regulatory flexibility analysis). Gulf of Mexico Fishery Management Council, Tampa, Florida. 84 p. + append.
- GMFMC. 1994a. 1994 report of the Reef Fish Stock Assessment Panel. Gulf of Mexico Fishery Management Council, Tampa, Florida. 22 p.
- GMFMC. 1994b. Update to the 1994 report of the Reef Fish Stock Assessment Panel. Gulf of Mexico Fishery Management Council, Tampa, Florida. 7 p.
- Holland, Stephen M. and J.W. Milon. 1989. The structure and economics of the charter and party boat fishing fleet of the Gulf coast of Florida. Final report for MARFIN award NA87WC-H-06141 submitted to the National Marine Fisheries Service, Southeast Regional Office, 9450 Koger Boulevard, St. Petersburg, Florida 33702.
- Milon, J. Walter. 1989. Estimating recreational angler participation and economic impact in the Gulf of Mexico mackerel fishery. Final report for MARFIN award NA86WC-H-06116 submitted to the National Marine Fisheries Service, Southeast Regional Office, 9450 Koger Boulevard, St. Petersburg, Florida 33707.

National Marine Fisheries Service. 1991. Marine recreational fishery statistics survey, Atlantic and Gulf coasts, 1987-1989. Current fishery statistics number 8904. NMFS/NOAA. Silver Spring, MD.

Poffenberger, J.R. 1992. Letter to Steven Atran, Gulf of Mexico Fishery Management Council, dated May 28, 1992.

Riechers, R. (Chairman). 1992. Report of the 1992 Socioeconomic Panel meeting on red snapper. Gulf of Mexico Fishery Management Council, Tampa, Florida. 10 p.

Sport Fishing Institute (SFI). 1992. Compendium of sport fishing statistics. Sport Fishing Institute, Washington, DC.

Szedlmayer, S.T. and R.L. Shipp. 1992. Production of a large artificial reef area in the northeastern Gulf of Mexico. Final report for Cooperative Agreement #NA90AAHMF733 Marine Fisheries Initiative (MARFIN) Program. Coastal Research and Development Institute, University of South Alabama, Mobile, AL.

Waters, J. R. 1992a. Graphical depiction of seasonal distributions for commercial landings and ex-vessel value of reef fish in the Gulf of Mexico. SERO/NMFS, NOAA. 9450 Koger Boulevard, St. Petersburg, Florida 33702.

Waters, J. R. 1992b. Economic assessment of the commercial reef fishery in the U.S. Gulf of Mexico. SERO/NMFS, NOAA. 9450 Koger Boulevard, St. Petersburg, Florida 33702.

Waters, J. and J. Platt. 1990. Economic analyses of alternative management options for the red snapper fishery in the Gulf of Mexico. Workshop held at Gulf of Mexico Fishery Management Council office, June 5-6, 1990. Report available from the Gulf of Mexico Fishery Management Council, Suite 881, Lincoln Center, 5401 West Kennedy Boulevard, Tampa, Florida 33609.

Wilson, R.R. Jr. and K.M. Burns. unpublished manuscript (1994). Potential survival of released groupers caught deeper than 40 m based on shipboard and in-situ observations and tag-recapture data. Available from the Gulf of Mexico Fishery Management Council, Tampa, Florida 33609. 35 p.

## **12. PUBLIC REVIEW**

A public hearing to obtain public comments on this regulatory amendment was held during the Gulf Council meeting in September 1994 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  
-Scientific and Statistical Committee  
-Reef Fish Advisory Panel  
-Ad Hoc Red Snapper Advisory Panel  
-Reef Fish Stock Assessment Panel  
-Socioeconomic Panel

National Marine Fisheries Service  
-Southeast Regional Office  
-Southeast Fisheries Science Center

RESPONSIBLE AGENCY:

Gulf of Mexico Fishery Management Council  
Lincoln Center, Suite 331  
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(813)228-2815

LIST OF PREPARERS

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

Table 1. Estimated probability distributions of SPR in the year 2009 for Gulf of Mexico red snapper for several management alternatives (Table 93 in GMFMC 1994b).

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CASE											
P	A	B	C	D	E	F	G	H	I	J	
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0.99	0.043	0.162	0.245	0.197	0.176	0.159	0.145	0.163	0.132	0.118	
0.98	0.047	0.162	0.247	<b>0.200</b>	0.181	0.168	0.149	0.168	0.151	0.121	
0.97	0.049	0.162	0.251	0.201	0.184	0.169	0.152	0.170	0.153	0.124	
0.96	0.050	0.162	0.252	0.203	0.185	0.172	0.154	0.173	0.155	0.132	
0.95	0.051	0.162	0.253	0.206	0.188	0.175	0.155	0.176	0.159	0.138	
0.90	0.055	0.162	0.256	0.210	0.195	0.180	0.161	0.182	0.164	0.146	
0.85	0.058	0.162	0.259	0.215	<b>0.200</b>	0.184	0.164	0.185	0.171	0.152	
0.80	0.060	0.162	0.261	0.217	0.202	0.187	0.167	0.189	0.176	0.156	
0.75	0.061	0.162	0.263	0.220	0.206	0.189	0.169	0.192	0.180	0.159	
0.70	0.063	0.162	0.264	0.223	0.209	0.192	0.172	0.194	0.183	0.162	
0.65	0.065	0.162	0.266	0.225	0.211	0.193	0.173	0.196	0.186	0.166	
0.60	0.066	0.162	0.267	0.227	0.213	0.194	0.176	0.198	0.188	0.169	
0.55	0.067	0.162	0.268	0.230	0.216	0.197	0.177	<b>0.200</b>	0.190	0.171	
0.50	0.069	0.162	0.270	0.232	0.217	<b>0.199</b>	0.179	0.202	0.192	0.173	
0.45	0.070	0.162	0.271	0.234	0.218	<b>0.200</b>	0.181	0.203	0.193	0.176	
0.40	0.071	0.162	0.272	0.237	0.221	0.202	0.184	0.205	0.195	0.178	
0.35	0.072	0.162	0.274	0.240	0.223	0.204	0.185	0.207	<b>0.199</b>	0.181	
0.30	0.074	0.162	0.275	0.242	0.225	0.206	0.187	0.209	<b>0.201</b>	0.184	
0.25	0.076	0.162	0.277	0.244	0.227	0.208	0.189	0.212	0.204	0.188	
0.20	0.077	0.162	0.279	0.246	0.229	0.210	0.192	0.214	0.207	0.191	
0.15	0.079	0.162	0.281	0.249	0.232	0.214	0.194	0.217	0.210	0.195	
0.10	0.081	0.162	0.283	0.252	0.236	0.218	0.197	0.219	0.215	<b>0.200</b>	
0.05	0.086	0.162	0.286	0.256	0.241	0.222	<b>0.200</b>	0.223	0.222	0.206	
0.04	0.086	0.162	0.287	0.257	0.241	0.224	0.202	0.225	0.224	0.208	
0.03	0.088	0.162	0.288	0.258	0.243	0.225	0.203	0.227	0.226	0.210	
0.02	0.089	0.162	0.291	0.259	0.245	0.227	0.205	0.228	0.228	0.212	
0.01	0.090	0.162	0.292	0.261	0.248	0.230	0.208	0.231	0.231	0.216	

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Definitions of Cases

- A 6 million pound TAC, no reduction in shrimp bycatch.
  - B No harvest, no reduction in shrimp bycatch.
  - C 4 million pound TAC, 50% reduction in shrimp bycatch in 1994.
  - D 6 million pound TAC, 50% reduction in shrimp bycatch in 1994.
  - E 6 million pound TAC, 50% reduction in shrimp bycatch in 1995.
  - F 6 million pound TAC, 50% reduction in shrimp bycatch in 1996.
  - G 6 million pound TAC, 50% reduction in shrimp bycatch in 1997.
  - H 6 million pound TAC, 50% reduction, 12.5% each year from 1995 to 1998.
  - I 7 million pound TAC, 50% reduction in shrimp bycatch in 1995
  - J 8 million pound TAC, 50% reduction in shrimp bycatch in 1995
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Table 2. Expected mean total lengths (inches) of red snapper at the beginning of month by model age (Table 3 in Goodyear 1994).

Age	Month											
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
0	-	-	-	-	-	1.0	2.0	2.5	3.0	3.5	4.0	4.6
1	4.8	4.9	5.2	5.5	6.0	7.0	7.9	8.4	8.7	8.9	9.0	9.2
2	9.2	9.3	9.6	9.9	10.4	11.3	12.1	12.5	12.7	12.9	13.0	13.1
3	13.1	13.3	13.5	13.8	14.3	15.1	15.7	16.1	16.3	16.5	16.6	16.7
4	16.7	16.8	17.0	17.3	17.7	18.5	19.0	19.4	19.5	19.7	19.8	19.8
5	19.8	20.0	20.2	20.4	20.8	21.5	22.0	22.3	22.4	22.5	22.6	22.7
6	22.7	22.8	23.0	23.2	23.5	24.2	24.6	24.9	25.0	25.1	25.2	25.2
7	25.2	25.3	25.5	25.7	26.0	26.5	26.9	27.2	27.3	27.4	27.4	27.5
8	27.5	27.6	27.7	27.9	28.2	28.7	29.0	29.3	29.4	29.4	29.5	29.5
9	29.5	29.6	29.8	29.9	30.2	30.6	30.9	31.1	31.2	31.3	31.3	31.4
10	31.4	31.4	31.6	31.7	31.9	32.3	32.6	32.8	32.9	32.9	33.0	33.0
11	33.0	33.1	33.2	33.3	33.5	33.9	34.1	34.3	34.3	34.4	34.4	34.5
12	34.5	34.5	34.6	34.7	34.9	35.2	35.5	35.6	35.7	35.7	35.8	35.8
13	35.8	35.8	35.9	36.0	36.2	36.5	36.7	36.8	36.9	36.9	36.9	37.0
14	37.0	37.0	37.1	37.2	37.3	37.6	37.8	37.9	37.9	38.0	38.0	38.0
15	38.0	38.1	38.1	38.2	38.4	38.6	38.7	38.8	38.9	38.9	38.9	39.0
16	39.0	39.0	39.1	39.1	39.3	39.5	39.6	39.7	39.7	39.8	39.8	39.8
17	39.8	39.9	39.9	40.0	40.1	40.3	40.4	40.5	40.5	40.5	40.6	40.6
18	40.6	40.6	40.7	40.7	40.8	41.0	41.1	41.2	41.2	41.2	41.2	41.3
19	41.3	41.3	41.3	41.4	41.5	41.6	41.7	41.8	41.8	41.8	41.8	41.9
20	41.9	41.9	41.9	42.0	42.1	42.2	42.3	42.3	42.4	42.4	42.4	42.4
21	42.4	42.4	42.5	42.5	42.6	42.7	42.8	42.8	42.9	42.9	42.9	42.9
22	42.9	42.9	43.0	43.0	43.0	43.2	43.2	43.3	43.3	43.3	43.3	43.3
23	43.3	43.4	43.4	43.4	43.5	43.6	43.6	43.7	43.7	43.7	43.7	43.7
24	43.7	43.7	43.8	43.8	43.8	43.9	44.0	44.0	44.0	44.1	44.1	44.1
25	44.1	44.1	44.1	44.1	44.2	44.3	44.3	44.4	44.4	44.4	44.4	44.4
26	44.4	44.4	44.4	44.5	44.5	44.6	44.6	44.6	44.7	44.7	44.7	44.7
27	44.7	44.7	44.7	44.7	44.8	44.8	44.9	44.9	44.9	44.9	44.9	44.9
28	44.9	44.9	45.0	45.0	45.0	45.1	45.1	45.1	45.1	45.1	45.1	45.2
29	45.2	45.2	45.2	45.2	45.2	45.3	45.3	45.3	45.3	45.3	45.4	45.4
30	45.4	45.4	45.4	45.4	45.4	45.5	45.5	45.5	45.5	45.5	45.5	45.5



Table 3. Mean 1984-1993 monthly distribution of red snapper recreational harvest from the Gulf of Mexico by mode based on MRFSS, the NMFS Headboat Survey, and the Texas Parks and Wildlife Coastal Sportfishing Survey (Table 48 in Goodyear 1994).

Month	Percentage of Annual Harvest			
	Headboat	Charter	Private	Total
Jan	5.714	1.982	3.445	3.779
Feb	5.693	1.982	3.445	3.772
Mar	5.694	5.250	5.320	5.423
Apr	5.703	5.250	5.320	5.426
May	5.711	9.646	9.466	8.287
Jun	9.989	9.646	9.466	9.687
Jul	14.141	10.968	13.783	13.115
Aug	14.826	10.968	13.783	13.339
Sep	8.132	15.477	10.601	11.154
Oct	8.130	15.477	10.601	11.153
Nov	8.129	6.677	7.384	7.430
Dec	8.138	6.677	7.384	7.433
All	100.000	100.000	100.000	100.000

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