REGULATORY AMENDMENT

TO THE

REEF FISH FISHERY MANAGEMENT PLAN

FOR SETTING THE

1991 RED SNAPPER TOTAL ALLOWABLE CATCH

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

MARCH 1991

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1. HISTORY OF MANAGEMENT

The Reef Fish Fishery Management Plan was implemented in November 1984. The implementing 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 1950s, recreational harvest data since 1979, and in 1984 initiated a dockside interview program to collect more detailed data on commercial harvest. Consequently, just recently has quantitative assessment of the population levels of major reef fish species been possible. 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.

The Council, through Amendment 1 to the Reef Fish Fishery Management Plan, implemented in 1990 a 7 fish recreational bag limit and a 3.1 million pound commercial quota for red snapper that together were to reduce fishing mortality by 20 percent and begin rebuilding the population. However, analyses available to the Council during development of Amendment 1 indicated that additional red snapper harvest restrictions would be necessary in the future to rebuild to 20 percent SPR by the target year of 2000. The Council also implemented a framework procedure (described in Section 4) to allow for annual management changes; this regulatory amendment is the first such change proposed under the Amendment 1 framework procedure.

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 Acceptable Biological Catch (ABC) was being harvested as bycatch of the shrimp trawl fishery. At the April 1990 Council meeting it was determined that, in conjunction with NMFS, a series of scientific meetings be held to review available data more thoroughly to determine alternatives to complete closure of the directed fishery. The Council convened a joint Reef Fish and Shrimp Advisory Panel meeting, a biological workshop to review bycatch estimates and explore management alternatives for both the directed and bycatch fisheries, and an economic workshop to review methodologies and to prepare economic evaluations of management alternatives for review by the RFSAP. 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 currently exist for reducing trawl bycatch.

Public hearings were also held at twelve locations throughout the Gulf of Mexico in August 1990 in addition to public hearings held during the September 1990, November 1990, and March 1991 Council meetings. Over 9,000 comments were received on the options under consideration by the Council. The Council's review of the results of the scientific and industry advisory meetings and the public comments resulted in the development of this Regulatory Amendment. In addition Plan Amendment 3 was initiated to establish a new target year of 2007 for red snapper. Amendment 3 is currently under review by NMFS for implementation in July 1991.

The Council originally submitted this regulatory amendment to NMFS on October 15, 1990, with a proposal to establish a red snapper commercial quota of 2.57 million pounds and a 6 fish recreational daily bag limit as the Total Allowable Catch (TAC) of 4.5 million pounds for 1991. The Council also proposed a 50 percent reduction of red snapper bycatch in 1993 by the offshore EEZ shrimp trawler fleet. The 50 percent reduction would occur through mandatory use of finfish excluder devices on shrimp trawls, reductions in fishing effort, area and/or season closures of the shrimp fishery, or a combination of these actions. The reduction level was to be from current estimates of bycatch (i.e., 12.4 million juvenile red snapper).

On November 1, 1990, NMFS advised the Council it was holding the Regulatory Amendment in abeyance and requested the Council to reconsider its proposed action in light of new information that had become available indicating estimated 1990 landings were below the allocations, misclassifications of vermilion snapper landings as red snapper had occurred, and the Magnuson Act Amendment had prohibited the Council from restricting bycatch until 1994. The prohibition against reducing bycatch prevented the Council from achieving the 20 percent SPR goal by the target date year of 2000 established in Amendment 1. The Council in November proposed a revision of the 1991 TAC downward to 3.1 million pounds to be implemented as a 1.99 million pound commercial quota and 2 fish recreational bag limit.

In January 1991,NMFS notified the Council it was not proceeding with implementation of the regulatory amendment until additional analyses could be provided to address the relative distribution of the recreation allocation and means of reducing shrimp trawl bycatch without violating the Magnuson Act Amendment. The NMFS felt that the Council needed to reconsider its proposal because of the significant economic and social implications of a single small bag limit on the different fishing modes (charter, headboat, and private boat) and geographic areas (eastern vs. western Gulf). The Council was requested to review 1) alternative ways to reduce shrimp trawler bycatch of red snapper without violating recent amendments to the Magnuson Act; 2) geographical allocations of the recreational bag limit that consider past fishing practices and catches; 3) differential bag limits for various sectors of the recreational fishery; 4) seasonal closures of segments of the red snapper recreational fishery that might enable bag limits to increase during specific periods without exceeding anticipated harvest levels; 5) changes in size limits (including no size limit) that might lead to increased bag limits and quotas; and 6) deductions from the directed commercial landing quota to offset incidental fishing mortality after the commercial quota has been reached. To assist in the Council's review NMFS volunteered to provide additional analyses for consideration. The Council agreed to review the new information and reconsider the proposed 1991 TAC in March 1991 to provide time for both the Council and interested public to evaluate the new analyses. This revised regulatory amendment is the result of the above review and represents the Council's proposed TAC for 1991.

2. PROPOSED ACTION

The Council proposes to establish a 1991 TAC for red snapper of 4.0 million pounds to be implemented by a commercial quota of 2.04 million pounds and a 7 fish recreational daily bag limit. The FMP provides that if the recreational or commercial quota is exceeded, subsequent quotas will be reduced to compensate for the excess. The Council will continue to monitor the status of the stock through review of annual stock assessments and trends in the red snapper recruitment index available from the NMFS research survey cruises. Future management actions will be based on changes in stock size and recruitment levels.

The Council also proposes a 50 percent reduction of red snapper in shrimp trawl bycatch by 1994. The 50 percent reduction will be from the medium bycatch level of 12. million juveniles and will occur through mandatory use of finfish excluder devices on shrimp trawls, reductions in fishing effort, area/season closures of the shrimp fishery, or a combination of these actions.

3. MANAGEMENT OBJECTIVE AND OPTIMUM YIELD

The primary objective and definition of Optimum Yield (OY) for the Reef Fish Fishery Management Plan is to stabilize long term population levels of all reef fish species by establishing a certain survival rate of biomass into the stock of spawning age to achieve at least 20 percent spawning potential ratio.

Definition of Overfishing

The following is the definition of overfishing contained in 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 (SPR).

4. REEF FISH FRAMEWORK PROCEDURE AS SPECIFIED IN THE FMP

Optimum Yield can be achieved with annual 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 an Allowable Biological Catch (ABC) range and the Council will set a TAC and prescribe fishing restrictions annually 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 April 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 percent SPR); d) estimate annual surplus production F(max) or other population parameters deemed appropriate; e) summarize statistics on the fishery for each stock or stock complex; f) specify the geographical variations in stock abundance, mortality, recruitment, and age of entry into the fishery for each stock or stock complex; and g) analyze social and economic impacts of any specification demanding adjustments of allocations, quotas, or bag limits.

2. The Council will convene a Scientific Stock 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, with the exception of red snapper which has a target year of 2007[1]. 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 and 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, including the research and data collection necessary to improve the assessments. The working group may also recommend additional species for future analyses.

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[1] The Council has submitted a plan amendment to NMFS for approval to establish a target year of 2007 for attaining the SPR goal for red snapper.

3. The Council will conduct a public hearing on the working group report(s) at, or prior to the time, it is considered by the Council for subsequent action. Other public hearings may also be held. The Council will request review of the report(s) by its Reef Fish Advisory Panel and Standing Scientific and Statistical Committees and may convene these groups to provide advice before taking action.

4. The Council in selecting a TAC level 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. **<u>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.</u>**

   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[2]. 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 target date SPR goal.

5. The Council will provide its recommendations to the RD for any specifications in TACs for each stock or stock complex, quotas, bag limits, trip limits, size limits, closed seasons, and gear restrictions necessary to attain the TAC, along with the reports, a regulatory impact review and environmental assessment of impacts, and the proposed regulations before October 15, or such other time as agreed upon by the Council and 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 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 final rule by December 1, or such other time as agreed upon by the Council and RD.

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.

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[2] 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.

c. Target dates in which the 20 percent SPR goal is to be reached with the constraint that the upper limit of the target date cannot exceed the time period equivalent to 1.5 times the biological generation time of the species under consideration (this action is proposed under Plan Amendment 3 currently under consideration by NMFS for implementation).

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

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

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.

6. STATUS OF RED SNAPPER STOCK

This section is taken from the Scientific Assessment Panel Report (June 1990) and is also based on the stock assessment (Goodyear and Phares 1990), the biological workshop (Nichols 1990a), and the economic workshop (Waters and Platt 1990) reports.

The 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.

Abundance Trends

There has been a general decline in commercial and recreational landings from 1983 to 1989 (Figures 1-3). Catch per unit effort (CPUE) is frequently assumed to be proportional to stock abundance. Although there are no directed effort data available for the entire time period, several sources of CPUE data for recent years were analyzed.

Catch per trip trends from the directed fisheries were inconsistent. Florida's trip ticket data exhibited higher CPUEs in 1984-1985 and lower values afterwards while CPUE estimates from the other data sets examined did not indicate significant differences among years.

Red snapper tend to aggregate around reefs and other structures which can be located easily with LORAN. This characteristic for aggregating near locatable structures makes red snapper particularly vulnerable to exploitation, since fishermen targeting red snapper can maintain their catch rates even with reduced stock abundance. The catchability of red snapper would be expected to remain constant or only slightly decline with declining population size, and the lack of change in catchability can mask declines in the stock. Therefore, CPUE in the directed fishery appears to be a poor indicator of red snapper stock size, except that a decline in CPUE may reflect a change in the stock which is far more serious than the extent of the decline suggests.

The bycatch of commercial sized red snapper in the shrimp trawl fishery could reflect the relative abundance of red snapper since they are an incidental or nontargeted catch. Catch per trip fluctuated at a level of approximately 14 pounds from 1970-1974 and declined to a low of 1.3 pounds in 1987 (91 percent decline). The 1988 estimate was 2.8 pounds per trip which is higher than the 1987 estimate but is only about 15 percent of the average of the earlier years (Figure 4). Substantial testimony was received from the shrimp industry on the reliability of using commercial sized red snapper catch rates derived from past voluntary landing statistics as an index of red snapper stock abundance. Significant quantities of red snapper were said to be harvested (targeted) by hook and line from trawl vessels and not by trawl gear, as indicated by landing statistics. Prior to the fuel crisis in the early 1970s fuel was inexpensive enough to warrant devoting time to actively target red snapper when not shrimp fishing. Fishermen also indicated that even assuming that a large portion of the shrimp vessel landings were by trawl the decline in landings correlated exactly with the time that electronic navigational gear became available allowing vessels to avoid rough bottoms where adult red snapper were found. Prior to 1984 shrimp vessels were still able to fish in Mexican waters where red snapper were more likely to be targeted by boat crews when they were not actively shrimping. The industry claims the bycatch landings of adults were reduced as a result of the technical ability to avoid snapper habitat and historically much of it was from hook and line caught fish, not trawl caught as recorded, and were predominantly from foreign waters. Even though every attempt has been made in these analyses to separate foreign from domestic harvests the historical landings system was based on voluntary reporting without substantial means for verification so it is likely that distinction of historical landings by gear type and area of harvest may be in error. Therefore these bycatch data for adults may not accurately reflect trends in adult red snapper abundance.

Recruitment Trends

The recruitment index from the NMFS fall groundfish survey indicates a decline in recruitment of 0 and 1 year old red snapper from 1983 through 1987 (Figure 5). Recent increases in the recruitment index (1988-1990) are not of sufficient duration to suggest that recruitment has increased to previous levels. The average recruitment index for the 1972 to 1982 data is three times that of the 1983 to 1989 data, and the median is two times higher. The 1990 recruitment index was the fourth highest of the entire series. However, on average the available spawning stock is not expected to produce recruitment levels as high as those observed in the last three years. It is probable that environmental conditions have favored red snapper egg and larval survival since 1988.

Changes in the recruitment index are mirrored by the recreational landings over the 1979 to 1988 period. The sharp drop in recruitment index which occurred in 1983 was reflected in the 1984 recreational landings. Changes in the recruitment index of 0 and 1 year old fish are observed in the recreational landings of 1 and 2 year old fish after the fish recruit to the fishery.

Shrimp Trawl Bycatch Estimates

The most critical red snapper fishery issue involved estimating the bycatch of juvenile red snapper in shrimp trawls. The biological workshop reviewed and updated previous estimates of bycatch (see Figure 6). The consensus of the workshop was that the statistical method used was appropriate for developing a point estimate of red snapper bycatch in shrimp trawls. The estimate of juvenile red snapper bycatch was 16.0 million fish in 1988. For analytical purposes an average of the 1984-1988 estimates was used, resulting in a bycatch estimate of 12.4 million red snapper per year.

Another issue was whether the recent implementation of turtle excluder devices (TEDs) in the shrimp fishery would reduce red snapper bycatch. Several TED studies were made available, but most of those studies only recorded the aggregated weights of finfish and did not record the species. A summary of snapper bycatch data by number as well as weight of fish is available from the ongoing NMFS observer program where boats pull TEDs on one side of the boat only. Although the category "snapper" included all species and sizes, this NMFS observer study provides the most pertinent index of red snapper bycatch. The NMFS study indicated that the average number of snapper caught in trawls with TEDs was not statistically different from trawls without TEDs. It was concluded that TEDs, as they are currently used in the shrimp fishery, would not reduce red snapper bycatch.

The shrimp fishing industry provided substantial testimony that the TEDs currently being used in the fishery, in addition to excluding large red snapper, are reducing bycatch of juvenile red snapper in addition to other finfish by at least 13 percent. Concern was expressed that the results from the ongoing NMFS Galveston study are preliminary and have not been thoroughly reviewed. Other finfish excluder devices, such as the "Louisiana Shooter" are also in use in selected areas of the Gulf; NMFS has recently initiated a study to evaluate the relative effectiveness of different gear modifications for reducing red snapper and other finfish bycatch.

Fishing Mortality Rates

Fishing mortalities were calculated from a catch-at-age table using catch curves and virtual population analysis and a natural mortality of 0.2 per year. The annual average instantaneous fishing mortality for all ages during 1979 to 1988 was 0.33 per year, which was similar to the estimate in the previous assessment (Goodyear 1988). Total average mortality exerted on a cohort of fish is 0.53 which means that, on average, about 41 percent of each age class dies annually.

The highest fishing mortalities were associated with the shrimp bycatch of age 1 juvenile fish followed by age 3 fish. The shrimp bycatch affected only age 0 and age 1 fish, and there was considerable overlap among the remaining components of the fishery with bottom longlines landing older fish in general (Figure 7). Fishing mortality for ages 5+ averaged 0.40 per year. For comparison the red snapper yield per recruit analyses provided estimates of $F_{0.1}$ and F_{max}--two management benchmarks typically used to determine overfishing--at 0.16 per year and 0.25 per year, respectively. The Council's Reef Fish Scientific Assessment Panel expressed concern with the ability of a fish stock to maintain productivity with these relatively high fishing mortality rates.

Spawning Potential Ratio (SPR)

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 SPR for red snapper has been below one percent since 1984, the earliest year for which SPR can be estimated and is greatly below the 20 percent level that defines overfishing. The fishery is overfished and is not achieving optimum yield.

Conclusions

Red snapper is a slow growing species known to live as long as 20 years and probably forms 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 reinforced earlier conclusions that the red snapper population in the Gulf of Mexico was overfished. The present value of SPR for red snapper is 0.6 percent, substantially below the 20 percent goal established in Amendment 1. The spawning stock has been below 1 percent SPR, since 1984--the first year for which spawning stock size can be estimated. With all sources of fishing mortality eliminated, it would take red snapper at least 8 years to rebuild to 20 percent SPR if recruitment returns to the low levels observed in 1986 and 1987.

7. MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEW

Introduction

The Regulatory Impact Review (RIR) serves as the basis for determining whether any proposed regulations are major under criteria provided in Executive Order 12291 (E.O. 12291) 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).

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 and shrimp fisheries. Although the current FMP subject to proposed regulatory amendment covers only reef fish within its management unit, the proposed management measures would also affect the shrimp fishery. The rationale adopted by the Council to restrict shrimping activities was that this fishery has been identified as a major source of red snapper fishing mortality due to incidental catches of juvenile red snappers in shrimp trawls.

Proposed Alternative

Establish a red snapper 1991 TAC of 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 pounds).

The Council also proposes to effect a 50 percent reduction of red snapper bycatch in 1994 by the offshore EEZ shrimp trawler fleet. The 50 percent reduction will occur through 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.

Rationale: The Council accepted this alternative because negative social and economic impacts were minimized in the short-term and long-term socioeconomic impacts will be positive. This alternative maintains the existing structure of the directed fishery and associated secondary industries and coastal communities while further reducing the TAC by 20 percent more than status quo 1990 TAC of 5.0 million pounds. It is the Council's intention to rebuild the red snapper stock to 20 percent SPR by the target year of 2007 while attempting to maintain the integrity of the associated industries and economies dependent on the fishery.

Biological Impacts: Amendment 1, implemented in 1990, has already effected significant impacts on the existing fishery and substantial reductions in prevailing fishing mortality. On the recreational fishery, harvests have been reduced up to 80 percent and prevailing fishing mortality has been reduced from 30 to 58 percent (Table 1) by the implementation of the 13-inch size limit and 7-fish bag limit. Although the 13-inch size limit was initially implemented in November 1984, prior to Amendment 1 the size limit had little impact on the recreational fishery because each angler was allowed to keep five fish under the size limit, and until May 1987 headboat anglers were completely exempt from the size limit.

The impacts of Amendment 1 on the commercial fishery are less known because 1990 data are not available. The size limit, implemented in 1984, effected about a 9 percent reduction in potential harvest. Red snapper less than 13 inches in size accounted for 14 percent of total commercial harvest in 1984--the first year of size information from all commercial sectors--and only 5 percent during 1985 through 1988 (Goodyear and Phares 1990: Tables 24, 26, 28). There is also circumstantial information that Amendment 1 effected a sizable reduction in fishing effort. Numerous recreational fishermen testified during the Amendment 1 public hearings that the 7-fish limit and permit requirements would discourage them from continuing to fish for red snapper. Since implementation of Amendment 1, a number of fish dealers have testified that their production is down due to the absence of recreational catch from private boat and oil rig anglers who sold their catches in the past for extra income. The longline prohibition inshore of 50 fathoms reportedly also has curtailed that commercial sector's harvest which, prior to Amendment 1 accounted for about 20 percent of the total red snapper commercial harvest. If the preliminary 1990 landings of 2.3 million pounds are an indication of the nonquota effects of Amendment 1 then the commercial fishery has been reduced by about 26 percent more than was intended by the 3.1 million pound 1990 quota.

This proposal reduces overall TAC by an additional 20 percent. The reduction is the result of lowering the commercial quota from 3.1 million pounds to 2.04 million pounds or 34 percent. The recreational allocation has been increased from 1.9 million pounds to 1.96 million pounds to be effected by maintaining the 7-fish bag limit initially implemented through Amendment 1. The relative allocation redistribution is the result of the framework measure that changed the time period for allocation from 1985-87 (as used for 1990 TAC--62 percent commercial vs. 38 percent recreational) to 1979-87 (51 percent commercial vs. 49 percent recreational) as required by the framework procedure. In retrospect this reallocation may offset the apparently greater reductions in recreational harvest effected by Amendment 1. Long-term projections of this measure indicate that the 20 percent SPR goal could be reached by 2010 if current recruitment levels are not maintained. Simulation analyses indicate if recruitment is maintained at modest levels, say at least as high as that experienced in 1988 (index = 7.3; below the median level of 8.5), which is the sixth smallest yearly index in the 19 year history of the data series, the SPR could be reached by 2007 without further reductions in TAC provided that bycatch is reduced by 50 percent by 1994.

Although projection of the 1991 TAC into the 21st century indicates the 20 percent SPR goal may not be met until 2010 it is the intention of the Council to follow the rebuilding program set forth in Amendment 3 by achieving 20 percent SPR by 2007. This 1991 TAC is allowed under the framework provision that a series of annual TACs can be set above ABC so long as they reach a level of ABC within three years that will attain the SPR goal. Recent recruitment indices for red snapper (1988-1990) indicate that recruitment has increased over the previous period (1984-1987) of low recruitment and that the stock is capable of recovery with continued moderate decreases in fishing mortality. If the current recruitment trend deteriorates, indicating the stock is not rebuilding as planned, the Council will take more restrictive action to ensure attainment of the SPR goal.

The red snapper population will be continually monitored by stock assessments and as provided in the framework procedure, management measures will be adjusted, as necessary, to ensure that the red snapper stock continues to rebuild toward the Council's goal of 20 percent SPR by 2007, as implemented by Amendment 3. The data base and interpretations of the data are necessarily continually changing with each assessment. It is expected that available data will improve over time and will lead to better scientific advice and management.

In addition to the action proposed above for 1991, the Council has proposed to achieve a 50 percent reduction in bycatch by 1994 from the 1984-1988 average bycatch level of 12.4 million juvenile red snapper. The 50 percent reduction will occur as a result of documentation of any reductions achieved by the fleet by 1994 through reduced effort, gear and fishing practices and by further requiring in 1994 trawl modifications to exclude finfish, reductions in effort, area or season closures of specific areas and time periods where juvenile red snapper are abundant, or a combination of these actions for the additional reduction necessary to achieve the 50 percent reduction. The NMFS should work with industry, states, and universities to develop suitable means for effecting bycatch reductions.

The current level of bycatch needs to be estimated through onboard observers to accurately assess the effectiveness of bycatch reduction due to various TED designs and recent decline in the number of offshore shrimp vessels operating in the Gulf. The goal of 50 percent reduction cannot be measured if we do not know current bycatch levels; it is unacceptable to use extrapolated data from 1982 to measure this important component of red snapper mortality.

In summary, the proposed management measures will be effective in controlling fishing mortality and achieving the goal of increasing the SPR of red snapper. The reductions in fishing mortality effected by this proposed alterative afford 20 percent greater protection to the existing stock than status quo and provide for rebuilding the red snapper stock toward the 20 percent SPR goal by the target year 2007 in full compliance with the Fishery Management Plan, as amended.

Socioeconomic Impacts: The implicit TAC for 1990 was 5 million pounds (MP). Approximately 62 percent of was allocated to the commercial sector and the rest, to the recreational sector. The proposed total reduction of 1 MP will be borne by these two sectors in manner that would implement the allocation of 51 percent for the commercial sector and 49 percent for the recreational sector. This latter allocation ratio is part of Amendment 1, which took effect in 1990.

The 1990 commercial quota for red snapper was 3.1 MP. Based on the 1985-1987 average commercial landings this quota was previously projected to reduce the 1990 commercial harvest by 20 percent. Reported commercial catch for 1989, the year before the quota took effect, was recently calculated to be about 3.0 MP. A preliminary estimate for the 1990 commercial harvests using data available as of March 1991 is 2.32 MP. December landings for Louisiana are still highly preliminary, however. Projections using a biological simulation model (Goodyear, 1989) indicated that commercial landings should be about 3.1 MP and 2.4 MP in 1989 and 1990, respectively. These numbers appear to approximate closely the estimated landings for these two years. Using this biological model, the projected harvest for 1991, given that only Amendment 1 was in effect, is 3.1 MP. A 2.04 MP commercial quota is expected to reduce the 1991 commercial harvest by about 34 percent based on projected harvest, 12 percent based on estimated 1990 landings, or 48 percent from the 1985-1987 average landings. It is not readily apparent which percentage reduction is appropriate. In all likelihood, the 1985-1987 average is not a realistic base, because fishing conditions have greatly changed especially after the implementation of Amendment 1. The proposed quota is anticipated to reduce commercial catch for 1991 from 12 to 34 percent of what would be caught without the quota reduction.

There were 1,599 reef fish permittees in 1990, and potentially they will be adversely impacted by the quota reduction. There is no sufficient information to quantify the extent of impacts on these permittees. However, some scenarios may be explored to depict the possible direct impacts of the quota reduction on these permittees. These permittees fish for various species and employ various gear types. Out of these 1,599 permittees, 325 are classified as charter and headboats and 144 as shrimp trawls. These permittees can be dropped from the analysis mainly because they can be considered to be not mainly dependent on "commercial" fishing for red snapper. In addition, out of the 899 permittees from Florida, only 29 fished exclusively for red snapper in the 1988-1989 fishing season although only 5 of these 29 landed more than 100,000 pounds of red snapper (personal communication with Dr. Robert Muller, FDNR). Assuming that all reef fish permittees in Texas (99), Alabama and Mississippi (46), Louisiana (69), together with 29 in Florida, fish exclusively for red snapper, the total number of permittees adversely affected by the quota reduction would sum to 243. This is about 15 percent of all reef fish permittees or 21 percent of all those "commercially" fishing for reef fish. Under the above described condition, the quota reduction would not impact a substantial number of red snapper fishermen. Noting, however, that many of those adversely impacted actually fish for other species or could substitute for other species, the actual number of those adversely impacted could be fewer than 243.

The current requirement to qualify for a reef fish permit is that more than 50 percent of one's earned income be derived from commercial fishing. As a worst case scenario, we assume that those adversely affected derive 100 percent of their income from red snapper fishing and no species substitution or alternative employment is possible. Under this scenario, the quota reduction which could range from 12 percent to 34 percent would translate to a reduction in their income from about 8.1 percent to 25.4 percent. These percentage reductions in income are derived as follows: Consider, for simplicity, that the present harvest is 100 pounds and price per pound is $1. Gross income from harvest is thus $100 ($1 <u>times</u> 100). A 12 percent reduction in harvest translates to a 4.4 percent increase in price, using the price flexibility for red snapper of -0.3698 (12 percent <u>times</u> 0.3698). Thus, the new price per pound is $1.044 ($1 <u>plus</u> $0.044). Multiplying this new price with the reduced harvest of 88 (100 <u>minus</u> 12) pounds, results in new gross income of $91.87. The reduction in income is $8.13, or 8.1 percent. The 25.4 percent reduction is similarly derived. If only 50 percent of income is derived from red snapper fishing, the quota reduction would translate to income reduction ranging from 4.1 percent to 12.7 percent, or about one-half of the effects when 100 percent of the income is derived from red snapper fishing. Under these scenarios, the impacts of the quota reduction on fishermen's income could range from being insignificant to significant.

The 1990 recreational bag limit was 7 fish per person per day. Under Amendment 1 this bag limit was expected to reduce recreational harvest by approximately 20 percent based on 1985-1987 recreational harvest of red snapper. Since the same bag limit is proposed for 1991, no immediate adverse impacts on the recreational sector ensue from the preferred alternative. If an impact were to occur, it may be to the advantage of the recreational sector. This would happen only if the reduction in commercial catch is partly taken by the recreational sector.

In recent years, the majority of commercial and recreational red snapper landings have come from Louisiana and Texas. The reduced commercial quota would be borne mostly by those fishing in these areas and by the areas' support industries. Since the reduction in harvest due to this measure is not likely to be substantial, the short-term impacts on the customary ways of life in coastal communities are expected to be minimal. There is nonetheless a possible positive impact on coastal communities strongly dependent on industries supporting recreational fishing if the reduction in commercial quota translates to more successful recreational fishing trips. The long-term social impacts of the measure cannot be determined. At this juncture, it is better to recognize the important issue that any changes in the lifestyle of red snapper fishing communities that would materialize have to be investigated to determine whether they are the result of management change or due to other factors unrelated to management action.

The proposed measure would not materially affect compliance and related enforcement with respect to the recreational sector. There may be some problems with respect to the commercial sector, particularly with those that fish for many species in addition to red snapper. The extent of this problem is not quantifiable. If both commercial and recreational fishermen expect further restrictions on their future harvests, current fishing effort and possibly unreported landings would rise. This situation would necessitate higher enforcement cost in order to realize the rebuilding target.

The added proposal to restrict the shrimp fishery in the future has no short-run impacts on either the directed red snapper and shrimp fisheries. When restrictions on the shrimp fishery are implemented as to effectively reduce red snapper bycatch, benefits to the directed red snapper fishery will ensue. The estimated long-term impact on the directed red snapper fishery presupposed achievement of the target bycatch reduction. The impacts on the shrimp fishery largely depend on the type of measures adopted at that time. Area closures of EEZ waters only or closures of state or federal waters, except off Louisiana, were previously determined to result in negative impacts to the shrimp industry (GMFMC, RIR to the Draft Reef Fish Regulatory Amendment, September 1990). The use of an excluder device that would result in shrimp loss was found to result in negative impacts. However, no analysis was made as to whether there exists a certain acceptable percentage loss in shrimp from the use of an excluder device that is less in value than the cost to the shrimpers of the bycatch. A study along this line also needs to determine the value to the finfish fishery of the major species discarded. A reduction in shrimping effort has the potential to benefit both the directed red snapper and shrimp fisheries. A reduction in shrimping effort translates directly in a reduction in bycatch. The shrimp fishery is currently overcapitalized and the effort is at high levels. A further increase in effort is also not expected to increase yield in brown, white, and pink shrimp (Klima et al., 1990).

Rejected Alternatives

Rejected Alternative 1: **Establish a red snapper 1991 TAC of 3.6 million pounds to be allocated with a commercial quota of 1.84 million pounds and a 5-fish recreational daily bag limit (1.76 million pounds), along with a 50 percent reduction of red snapper bycatch in 1994.**

Rationale: The Council rejected this alternative because the more restrictive TACs on the directed fishery would create greater negative social and economic impacts in the short-term without greater long-term benefits over that provided by the preferred alternative (see Section 7.3. below). The existing structure of the fisheries would be more disrupted and associated industries and coastal communities would be at greater jeopardy due to the lack of alternative employment opportunities.

Biological Impacts: This alternative would rebuild the red snapper population somewhat more quickly than the preferred alternative. The 20 percent SPR goal would be reached in 2008 with current projection trends in stock recovery, one year later that the SPR goal or two years sooner than the preferred alternative. This alternative, in addition, would achieve a 50 percent reduction in red snapper bycatch by 1994 similar to the proposed alternative.

__Socioeconomic Impacts:__ This alternative would reduce the 1990 TAC by 1.4 MP or by 28 percent. The proposed allocation conforms to the ratio specified in the FMP.

The commercial quota would reduce that sector's 1991 harvest by about 21 percent based on the 1990 estimated catch, or 39 percent based on projected commercial harvest for 1991 (using Goodyear's biological simulation model). As with the Preferred Alternative, this quota reduction would not affect a substantial number of red snapper fishermen. Using similar approach as in the Preferred Alternative, the quota reduction which could range from 21 percent to 39 percent would translate in income reduction ranging from 14.7 percent to 30.5 percent when assuming a 100 percent income being derived from red snapper fishing, or from 7.3 percent to 15.2 percent when assuming a 50 percent income being derived from red snapper fishing. As with the Preferred Alternative, the impacts of quota reduction could range from being insignificant to significant. Being more restrictive than the Preferred Alternative, this can be expected to effect a higher negative impact in the short term.

The 7-fish bag limit under Amendment 1 was estimated to reduce fishing mortality from the recreational sector by 19 percent. The 5-fish bag limit would further reduce fishing mortality in the recreational sector to about 28 percent. Based on the projected harvest for 1991 using a biological model (Goodyear, 1989), the reduction in bag limit from 7-fish to 5-fish would translate to about 17 percent reduction in recreational harvest. This reduction would directly impact both the recreational anglers and the operators of for-hire vessels.

Approximately 336,000 trips by recreational fishermen would be potentially affected by the reduction in recreational bag limit. Of the 826 for-hire vessels, primarily headboats and some charter boats fishing from Panama City westward would be affected, i.e., 43 headboats and potentially 459 charter boats. Although catch and release may be practiced by recreational anglers, keeping catches is a highly significant factor in the decision to undertake a fishing trip (Milon, 1989). A reduction in catch rates brings about a larger decrease in consumer surplus than an increase in that surplus for a similar percentage increase in catch rates (Green, 1989). The latter implies that losses in consumer surplus can be recouped only when substantial increases in catch rates are later allowed. The reduction in bag limit would have differential impacts on the profitability of the for-hire sector. The mean percent of time spent in targeting snapper is high for charter and party boats in the Gulf states (Holland and Milon, 1989; Ditton et al., 1989). Northern Gulf boats are particularly dependent on red snapper trips, especially on those trips made in the EEZ. The species assemblage highly targeted by charter boat operators consists of red snapper, red drum, and speckled trout. The latter two species are basically inshore species. Party boat operators also target a species assemblage consisting of red snapper and king mackerel (Ditton et al., 1989). Thus, the bag limit reduction would largely fall on these for-hire operators.

In recent years, the majority of commercial and recreational red snapper landings have come from Louisiana and Texas. The reduced quota and bag limit would be borne mostly by those fishing in these areas and by the areas' support industries. Among the fishery participants in the recreational sector of the red snapper fishery, the negative impacts may be heavier on the for-hire boat operators in the western Gulf. The extent to which this proposed measure affects customary ways of life in coastal communities is not precisely known. It is important to recognize the important issue that any changes in the lifestyle of red snapper fishing communities that would materialize have to be investigated to determine whether they result from a management change or from other factors unrelated to fishery management.

This alternative may have some effects on compliance and related enforcement, particularly with respect to the commercial sector. Generally these problems would be associated with those fishing for other species in addition to red snapper. The extent of this problem is not determinable.

Earlier discussions with respect to the proposal to reduce red snapper bycatch in the shrimp fishery also apply to this management alternative.

Rejected Alternative 2: **Establish a red snapper 1991 TAC of 3.1 million pounds to be allocated with a commercial quota of 1.58 million pounds and a 4-fish recreational daily bag limit (1.52 million pounds) along with a 50 percent reduction of snapper bycatch in 1994.**

Rationale: The Council rejected this alternative because the more restrictive TAC would create significant negative social and economic impacts on the directed fishery in the short-term. Long-term benefits would be less than that possible under the preferred alternative. The existing structure of the fisheries would be substantially disrupted and associated industries and coastal communities would be jeopardized due to the lack of alternative employment opportunities. Many of the coastal fishing communities are already experiencing high unemployment rates--as high as 20 percent in the Rio Grande Valley area of south Texas.

Biological Impacts: This alternative would rebuild the red snapper population somewhat more quickly than the preferred alternative. The 20 percent SPR goal would be reached in 2006 with current projection trends in stock recovery, four years sooner than the preferred alternative.

This alternative also would achieve a 50 percent reduction in red snapper bycatch by 1994 similar to the proposed alternative.

Socioeconomic Impacts: Under this alternative, the TAC would be reduced by 1.9 MP or by 38 percent relative to the 1990 TAC. The proposed allocation conforms to the mandated ratio.

This alternative closely parallels Rejected Alternative 2, but is more restrictive. The commercial quota would reduce that sector's 1991 harvest by about 32 percent based on 1990 estimated catch, or 49 percent based on projected commercial harvest for 1991 (using Goodyear's biological simulation model). As with the Preferred Alternative, this quota reduction would not affect a substantial number of red snapper fishermen. Using similar approach as in the Preferred Alternative, the quota reduction which could range from 32 percent to 49 percent would translate in income reduction ranging from 23.84 percent to 39.82 percent when assuming a 100 percent income being derived from red snapper fishing, or from 11.92 percent to 19.91 percent when assuming a 50 percent income being derived from red snapper fishing. As it appears, the impacts of quota reduction under this alternative would be significant. This alternative, being more restrictive than the Preferred Alternative and Rejected Alternative 1, can be expected to effect a higher negative impact in the short-term.

The 7-fish bag limit under Amendment 1 was estimated to reduce fishing mortality from the recreational sector by 19 percent. The 4-fish bag limit would further reduce fishing mortality in the recreational sector to about 33 percent. Based on the projected harvest for 1991 using a biological model (Goodyear, 1989), the reduction in bag limit from 7 fish to 4 fish would translate to about

28 percent reduction in recreational harvest. This reduction would directly impact both the recreational anglers and the operators of for-hire vessels.

In recent years, the majority of commercial and recreational red snapper landings have come from Louisiana and Texas. Thus, the reduced quota and bag limit would be borne mostly by those fishing in these areas and by the areas' support industries. Among the fishery participants in the recreational sector of the red snapper fishery, the negative impacts may be heavier on the for-hire boat operators in the western Gulf. The extent to which this proposed measure affects customary ways of life in coastal communities is not precisely known. It is important to recognize the important issue that any changes in the lifestyle of red snapper fishing communities that would materialize have to be investigated to determine whether they result from a management change or from other factors unrelated to fishery management.

Due to the relative restrictiveness of this alternative, problems on compliance and related enforcement are bound to arise. Generally, these problems would be associated with those fishing for other species in addition to red snapper. The extent of this problem is not determinable.

Earlier discussions with respect to the proposal to reduce red snapper bycatch in the shrimp fishery also apply to this management alternative.

Rejected Alternative 3: **Status Quo -- Maintain the red snapper TAC of 5.0 million pounds for 1991 to be allocated with a 3.1 million pound commercial quota and a 7-fish recreational daily bag limit (1.9 million pounds).**

Rationale: The Council rejected this alternative because, although it significantly reduced prevailing fishing mortality when first implemented by Amendment 1, it would not effect any additional recovery of the spawning stock. Continuation of the status quo allocation (62 percent commercial and 38 percent recreational) would be in violation of the framework procedure's intended allocation of 51 percent commercial and 49 percent recreational, based on the 1979-87 historical harvests, as indicated by the landings data in Amendment 1. This alternative also did not address the need for future action to reduce shrimp trawl bycatch. The Council believes that, given the current overfished condition of the red snapper stock, continuation of status quo is insufficient to effect sufficient recovery of the resource.

Biological Impacts: A concern with this alternative is that only limited recovery can be effected over the next decade; status quo measures projected to 2010 would achieve only a 2 percent SPR. Recovery of the red snapper fishery to OY requires reductions in fishing mortality by both the directed and bycatch fisheries.

Socioeconomic Impacts: There are no short-term impacts expected from this measure. Its long-term impacts would depend on the future biological status of the stock as well as on the commercial and recreational demand for red snapper. Maintenance of status quo would result in a gradual reduction of catchable fish over time (report of the Reef Fish Scientific Assessment Panel, 1990). This alternative would effect a gradual reduction in benefits to both the commercial and recreational sectors over time. This reduction in benefits over time will occur only if no reduction in shrimp trawl bycatch of juvenile red snapper is effected. In addition, the allocation of TAC between the commercial and recreational sectors under the status quo does not conform to the

Council's decision to distribute the annual TAC in a ratio that gives 51 percent to the commercial sector and 49 percent to the recreational sector.

Rejected Alternative 4: **Establish a red snapper 1991 TAC of 4.5 million pounds to be allocated with a commercial quota of 2.57 million pounds and a 6-fish recreational daily bag limit (1.93 million pounds), along with a 50 percent reduction of red snapper bycatch in 1994.**

Rationale: This alternative was rejected because it both violates the framework allocation requirements and provides less reductions in fishing mortality than the preferred alternative.

Biological Impacts: This alternative would achieve the 20 percent SPR goal in the year 2011, assuming no reductions in future TACs. The biological impacts of this alternative are similar to, but somewhat less conservative than those of the preferred alternative.

Socioeconomic Impacts: The proposed TAC here is 0.5 MP or 10 percent lower than the 1990 TAC. The proposed allocation does **not** conform to the mandated 51:49 commercial/recreational ratio.

The commercial quota is actually higher than the estimated 1990 commercial catch of 2.32 MP. Relative to the projected 1991 harvest based on Goodyear's biological simulation model, this quota would reduce the commercial sector's 1991 harvest by about 17 percent. As with the Preferred Alternative, this quota reduction would not affect a substantial number of red snapper fishermen. Using similar approach as in the Preferred Alternative, the quota reduction of about 17 percent would translate in income reduction of about 12.0 percent when assuming a 100 percent income being derived from red snapper fishing, or about 6.0 when a 50 percent income being derived from red snapper fishing. As it appears, the impacts of quota reduction under this alternative would be almost inconsequential.

The 6-fish bag limit would reduce fishing mortality in the recreational sector from 19 percent to 23 percent, or only 4 percent more. Based on the projected harvest for 1991 using a biological model (Goodyear, 1989), the reduction in bag limit from 7-fish to 6-fish would translate to about 8 percent reduction in recreational harvest. The projected reductions in recreational and commercial catch would minimally impact the fishery, including the support industries.

Rejected Alternative 5: **Establish a red snapper 1991 TAC of 3.1 million pounds to be allocated with a commercial quota of 1.99 million pounds and a 2-fish recreational daily bag limit (1.11 million pounds), along with a 50 percent reduction of red snapper bycatch in 1994.**

Rationale: This alternative was rejected because it violates the framework allocation requirements and results in a too restrictive TAC resulting in potentially significant negative social and economic impacts in the short-term. The existing structure of the recreational sector would be substantially disrupted and associated industries and coastal communities dependent on tourism generated by the availability of red snapper would be adversely affected.

Biological Impacts: This alternative would rebuild the red snapper population somewhat more quickly than the preferred alternative. The 20 percent SPR goal would be reached in 2006 with current projection trends in stock recovery, four years sooner than the preferred alternative and exhibit biological impacts similar to Rejected Alternative 2 above.

<u>Socioeconomic Impacts:</u> The TAC, under this alternative, would be reduced by 1.9 MP or by 38 percent relative to the 1990 TAC. The proposed allocation does **not** conform to the mandated 51:49 commercial/recreational ratio.

The commercial quota would be 0.33 MP or 14 percent lower than the estimated 1990 commercial catch of 2.3 MP. Relative to the projected 1991 harvest (based on Goodyear's biological simulation model), this quota would reduce the commercial sector's 1991 harvest by about 26 percent. As with the Preferred Alternative, this quota reduction would not affect a substantial number of red snapper fishermen. Using similar approach as in the Preferred Alternative, the quota reduction which could range from 14 percent to 26 percent would translate in income reduction ranging from 9.7 percent to 18.6 percent when assuming a 100 percent income being derived from red snapper fishing, or from 4.9 percent to 9.3 percent when assuming a 50 percent income being derived from red snapper fishing. The impacts of quota reduction under this alternative would be relatively small.

The 2-fish bag limit would reduce fishing mortality in the recreational sector from 19 percent to 48 percent. Based on the projected harvest for 1991 using a biological model (Goodyear, 1989), the reduction in bag limit from 7-fish to 2-fish would translate to about 58 percent reduction in recreational harvest. It appears that this measure would have significant adverse impacts on the recreational sector with respect to short-term harvest and consequently on income of the for-hire operators and benefits of the anglers.

Among the fishery participants in the recreational sector of the red snapper fishery, the negative impacts may be heavier on the for-hire boat operators in the northern and western Gulf. These for-hire operators are particularly dependent on red snapper trips, especially on those trips made in the EEZ. The species assemblage highly targeted by charter boat operators consists of red snapper, red drum, and speckled trout. The latter two species are basically inshore species. Party boat operators also target a species assemblage consisting of red snapper and king mackerel (Ditton et al., 1989). The bag limit reduction would largely fall on these for-hire operators. Indeed the adverse short-term impacts on the anglers themselves cannot be discounted. These direct impacts would also generate rippling effects on the support industries, particularly those located in coastal communities greatly dependent on recreational fishing for their main source of livelihood.

This alternative may also affect compliance and enforcement. In the commercial sector, the enforcing the quota with respect to fishermen that fish for other species in addition to red snapper. Particularly due to the highly restrictive nature of the measure on the recreational sector, compliance with the bag limit and other applicable rules, e.g., size limit, would be relatively low.

Earlier discussions with respect to the proposal to reduce red snapper bycatch in the shrimp fishery also apply to this management alternative.

Rejected Alternative 6: **Increase the size limit for red snapper to 16 inches total length.**

Rationale: This alternative was rejected because the increase in the size limit from 13 to 16 inches would not improve the rebuilding of red snapper because of release mortality but would result in a reduction in harvest in the short run.

Biological Impacts: This measure would result in the wastage of fish since about 60 percent of the fish caught by recreational and commercial fishermen are smaller than 16 inches total length. It is believed that 33 percent of all undersize fish (under 13 inches in size) released die from being caught and the release mortality may be greater with a larger size limit because larger fish reportedly exhibit a greater release mortality.

Socioeconomic Impacts: This measure would have relatively significant short-term impacts on both the commercial and recreational sectors in as much as close to 60 percent of fish caught by these fishermen are less than 16 inches in total length. The current estimate (Goodyear and Phares, 1990) that 33 percent of those fish caught and released would die poses problems with respect to the potential for the stock to recover upon imposition of this size limit at this time. It is then likely that both short- and long-term impacts are negative. In addition, this measure would necessitate higher enforcement costs, because the change from a 13-inch to a 16-inch size limit is substantial enough to create compliance problems.

Rejected Alternative 7: **Implement time/area closures on the shrimp trawl fishery in 1991.**

Rationale: This alternative was originally rejected because available data indicate seasonal or area closures would not necessarily reduce bycatch unless the closures extended throughout the most of the fishing season (Nichols 1990b). Since the Council's first consideration of this alternative, the 1990 Amendment to the Magnuson Fishery Conservation and Management Act has prevented regulation of bycatch reduction until 1994.

Biological Impacts: The proposed May 1 - July 31 shrimp closure that the Council presented at public hearings in August 1990 was ultimately determined to provide impacts ranging from a 40 percent decrease to a 10 percent increase in red snapper bycatch. The closure was proposed for a time period that potentially may have increased shrimp revenues, rather than for maximum bycatch reduction. Only closures of 10 months duration or more indicated consistent substantial decreases in bycatch. The loss in shrimp production that would result from such lengthy closures would be substantially greater than any gain in future red snapper production and thus would not provide optimal benefits to the nation.

Another concern relative to attempting to implement time/area closures is that the shrimp trawl observer database extends only from 1972 through 1982 and may not accurately reflect either the current magnitude or the temporal and spatial distribution of bycatch. The results of a more recent but quite limited observer program for evaluating shrimp trawl bycatch indicates a spatial distribution of bycatch across the northern Gulf that is quite different from the earlier study. While the Nichols (1990b) study raises questions whether specific time/area closures would be effective at all, certainly before they are implemented more detailed fishery dependent bycatch data are needed (see Section 9--Scientific Research and Data Needs).

The current level of bycatch needs to be estimated through onboard observers to accurately assess the effectiveness of bycatch reduction due to various TED designs and the recent decline in the number of offshore shrimp vessels operating in the Gulf. The goal of 50 percent reduction cannot be measured if we do not know current bycatch levels; it is unacceptable to use extrapolated data from 1982 to measure this important component of red snapper mortality.

Socioeconomic Impacts: This measure was previously analyzed (Nichols, 1990a) to result in bycatch reduction ranging from 27 percent for a three-month closure to 69 percent for a ten-month closure. More recent analyses (Nichols, 1990b) showed that reasonable reductions in bycatch can be achieved only by longer (e.g., 10 months) time closures and in areas covering both state territorial seas and federal waters. A previous study (GMFMC, RIR for Reef Fish Regulatory Amendment, 1990) revealed that ten-month closures involving both state and federal waters or shorter and longer time closures covering only federal waters would have significant negative impacts on the shrimp industry. These negative impacts would likely outweigh any possible gains in the directed red snapper fishery. A three-month closure (May 1-July 31) was determined to result in positive gains to the shrimp fishery only for the Louisiana area west of the Mississippi River and only if the closure included the Louisiana Territorial Sea; for all other areas the closure resulted in negative impacts. This has been recently determined to have either minimal positive ~~or~~ substantial negative reductions in red snapper shrimp trawl bycatch. In addition, the gains to the shrimp fishery were more likely to accrue to offshore vessels with the cost mostly borne by the inshore fishery.

Strong opposition by the shrimp fishermen around the Gulf to closures indicates that enforcing this measure would necessitate a relatively high cost to the government. It is necessary, of course, to determine whether the net result to this measure with enforcement cost integrated into the analysis would be a gain to society.

Congress added in a recent amendment to the Magnuson Act a constraint that no regulation be imposed on the shrimp fishery to reduce bycatch until 1994.

Rejected Alternative 8: **Require shrimp trawl gear modifications to reduce red snapper bycatch in 1991.**

Rationale: This alternative was originally rejected because no gear modifications have been developed to reduce red snapper bycatch that can be implemented in 1991. Since the Council's first consideration of this alternative the 1990 amendment to the Magnuson Fishery Conservation and Management Act has prevented regulation of bycatch reduction until 1994.

Biological Impacts: The biological impacts of gear modifications to reduce bycatch would be wholly beneficial to the red snapper stock. Although such technology does not exist today, in the next few years over $1.5 million of funding is going to a number of research projects to evaluate the finfish bycatch problem and development of finfish excluding devices. The NMFS is conducting research 1) to comparatively evaluate different gear modifications designed to reduce finfish bycatch, 2) to analyze the economic impacts of finfish bycatch, and 3) to conduct an observer program for shrimp trawl bycatch. The Gulf Shrimp Research and Development Foundation will receive support in 1991 and 1992 to assess the feasibility of gear that will exclude a significant number of finfish from shrimp trawls in the western Gulf of Mexico while retaining an acceptable level of shrimp. The Southeastern Fisheries Association will receive funding for 1991 and 1992 to conduct an international conference on the reduction of bycatch in shrimp trawling operations and alternative harvesting methods for the shrimp fishery. The Gulf and South Atlantic Fisheries Development Foundation, Inc. proposes to develop a plan for data collection and future NMFS/industry cooperation in improving the efficiency and selectivity of fishing gear through reductions in the harvest and mortality of non-targeted species (bycatch) in the Gulf trawl and longline fisheries, with emphasis on the shrimp fishery. Texas A&M University will conduct research on potential reductions of shrimp trawl bycatch of selected finfish in the Gulf of Mexico and North Carolina State University will be developing and evaluating finfish separator devices and TEDs to reduce bycatch in the shrimp fishery.

Within just a few years the results of the combined research activities listed above will provide a number of alternative mechanisms for reducing bycatch in the shrimp trawl industry. The current level of bycatch needs to be estimated through onboard observers to accurately assess the effectiveness of bycatch reduction due to various TED designs and the recent decline in the number of offshore shrimp vessels operating in the Gulf. The goal of 50 percent reduction cannot be measured if we do not know current bycatch levels; it is unacceptable to use extrapolated data from 1982 to measure this important component of red snapper mortality.

<u>Socioeconomic Impacts:</u> Possibly with the exception of the NMFS TED equipped with a fish excluder, no modified gear presently exists that significantly reduces bycatch without resulting in significant shrimp loss. State-of-the-art knowledge in this area considers a 50 percent reduction in bycatch to be achievable (Nichols, 1990a). The extent of shrimp loss due to a modified gear is not yet known. In previous analysis (GMFMC, RIR to the Reef Fish Regulatory Amendment, 1990), a ten percent shrimp loss per trawl drag was assumed, and results definitely indicated negative impacts with up to 23 percent reduction in economic rent to the shrimp fishery. Further intensive research definitely must be done to develop a modified trawl gear and to determine the tradeoff between shrimp loss and bycatch reduction.

Recent Congressional action, however, prevents further Council action on this alternative until 1994.

Comparative Analysis of Preferred and Rejected Alternatives

Description of Measures Compared

Three alternatives, with the status quo as the base case, are quantitatively compared. Those alternatives that cannot be quantified or do not conform to the FMP's 51:49 percent commercial/recreational allocation of the TAC are not included in the comparative analysis. The status quo, or base case, consists of measures implemented under Amendment 1. The major relevant features of the base case are a 5.0 MP TAC, with a 3.1 MP quota allocation for the commercial sector and a 1.90 MP allocation to the recreational sector via a daily bag limit of 7-fish per person, and no reduction in red snapper bycatch in shrimp trawls. The three alternatives are labeled as Preferred Alternative 1 (and 1a), Rejected Alternative 1, and Rejected Alternative 2. Although there is only one alternative for the 1991 TAC it was analyzed using the biological simulation model in the following two scenarios: 1) retaining the TAC = 4.0 MP for 1991 through 1993 and then reducing TAC to 3.1 MP for 1994 through 2006 in order to meet the SPR goal by 2007, and 2) retaining the TAC = 4.0 MP until 20 percent SPR was reached in 2010.

The preferred alternative also serves to illustrate two (among many) possible long-term scenarios for the regulatory measures on red snapper chosen by the Council for the 1991 fishing year. The source of difference between the two scenarios is the policy parameters that are fixed or varied. That is, the management measure may be fixed without constraining the rebuilding period or the rebuilding period may be fixed with the management measures varied to attain the SPR target within the specified rebuilding period. In Preferred Alternative 1, the rebuilding period is fixed to terminate in 2007 while the management measures are varied. In Alternative 1a, on the other hand, the measures are fixed while the rebuilding period is not constrained to end at some date in the future. Preferred Alternative 1 has the following features: for the 1991-1993 period -- 4.0 MP TAC, with a 2.04 MP quota allocation to the commercial sector and a 1.96 MP recreational sector allocation under a 7-fish daily bag limit per person; for the 1994-2006 period -- 3.1 MP TAC, with a 1.58 commercial quota allocation and a 1.52 MP recreational allocation under a 4-fish bag limit; for the 2007-2020 period -- 12 MP TAC, with a 6.12 MP and 5.88 MP quota allocation to the commercial and recreational sectors, respectively; and, 50 percent bycatch reduction starting in 1994. The TAC reduction beginning in 1994 is imposed in order to reach the 20 percent SPR by 2007. Alternative 1a has the following closely similar features: for the 1991-2010 period -- 4.00 MP TAC, with a 2.04 MP commercial quota allocation and a 1.96 MP recreational allocation under a 7-fish bag limit; for the 2011-2020 period -- 12 MP TAC, with 6.12 MP and 5.88 MP quota allocations to the commercial and recreational sectors, respectively; and, 50 percent bycatch reduction beginning in 1994. These two preferred alternatives differ with respect to the year the 20 percent SPR is reached: 2007 for Preferred Alternative 1 and 2010 for Preferred Alternative 1a. Preferred Alternative 1a achieves the 20 percent SPR at a later date, because it allows for a higher TAC during the rebuilding period. Worth noting is the provision for a 12 MP TAC after the 20 percent SPR is reached. This is the maximum allowable harvest that maintains such SPR level given a 50 percent bycatch reduction.

Rejected Alternatives 1 and 2 are the similarly numbered rejected alternatives discussed above. Rejected Alternative 1 consists of the following features: for the 1991-2008 period -- 3.6 MP TAC, with a 1.84 MP commercial quota and a 1.76 MP recreational allocation under a 5-fish bag limit; for the 2009-2020 period -- 12 MP TAC, with 6.12 MP and 5.88 MP quota allocations to the commercial and recreational sectors, respectively; and, 50 percent bycatch reduction beginning in 1994. The 20 percent SPR is reached in 2008. No attempt was made to constrain this alternative to 2007, because a single year difference was considered inconsequential. Rejected Alternative 2 has the following more restrictive features: for the 1991-2006 period -- 3.1 MP TAC, with a 1.58 MP commercial quota allocation and a 1.52 MP recreational allocation under a 4-fish bag limit; for the 2007-2020 period -- 12 MP TAC, with 6.12 MP and 5.88 MP commercial and recreational quota allocations, respectively; and, 50 percent bycatch reduction beginning in 1994. SPR reaches 20 percent in 2006.

A summary description of these alternatives are presented in Table 2.

Methodology

The basic approach taken is the measurement of net economic benefits accruing to each of the compared alternatives vis-a-vis the status quo. Although regional and distributional impacts are no less important, this quantitative analysis does not include these effects, because the necessary data are unavailable.

The proposed changes in red snapper regulations are expected to impact the major segments of both the commercial and recreational red snapper industries. In the estimation of impacts on the commercial sector, data is available to quantify the changes in benefits to the harvest segment of the industry. Impacts on the intermediate sectors (i.e., processors, wholesalers, retailers, etc.) and on the consumers cannot be quantified with available information. In the recreational sector, available information allows the estimation of changes in benefits to the recreational anglers and the for-hire vessel operators. In the ensuing discussion, impacts on the commercial sector pertain to impacts on the harvest sector while those on the recreational sector refer to the sum of impacts on the recreational anglers and the for-hire vessels operators.

Regulation-induced changes in commercial benefits were equated to changes in vessel fleet profits. Commercial profits were estimated as ex-vessel revenues minus variable costs. Ex-vessel revenues were calculated by multiplying ex-vessel price and dockside landings. Commercial landings for the policy period were generated using a biological simulation model (Goodyear, 1989). A price forecasting model was used to predict prices corresponding to projected landings, and costs were projected using an empirical relationship between catch rates and variable costs (Waters and Platt, 1990).

Changes in angler benefits were estimated as changes in consumer (angler) surplus. Consumer surplus may be roughly defined as the difference in what consumers are willing to pay to make a fishing trip and what they actually pay. Changes in consumer surplus were estimated using a recreational demand model. Since there is no empirical estimate of recreational demand for red snapper, the demand model estimated for Gulf king mackerel was used. The use of this latter demand estimate is premised on the possibility that anglers behave, on balance, similarly when fishing for red snapper as they do for king mackerel. Two MARFIN-financed studies appear to point out this possibility (Ditton et al., 1989; Holland and Milon, 1989). Changes in benefits to the for-hire vessel operators were equated to changes in their net operating profits, i.e., total revenue minus variable cost. Income statements for headboats and charter boats sampled in the two mentioned MARFIN-financed studies were used to calculate the net operating profits for the entire for-hire vessel fleet. Total changes in benefits to the recreational sector were derived as the sum of changes in consumer surplus and for-hire vessel operating profits. Total benefits in the recreational sector were projected for the entire policy period using projected recreational harvest as the major determinant. That is, recreational benefits were adjusted annually with changes in recreational harvests. Recreational harvests for the entire policy period were generated using the same biological model employed to forecast commercial harvest.

Since the impacts were estimated over a period of time, net present valuation was used to serve as the criterion for evaluation of tradeoffs of economic values over time. Net present valuation essentially converts economic values over time into some common denominator in order to make sensible comparisons of accumulation of values over time. This technique requires the choice of an appropriate discounting rate. For this analysis, two discount rates were chosen: 10 percent and 5 percent. The higher value is mandated by the Office of Management and Budget guidelines for the preparation of a RIR. The lower value is used to determine the sensitivity of impacts to the choice of a discounting rate.

Results

The overall effects of each option are presented in Table 3. Note the sensitivity of results to the choice of a discounting rate. The positive effects for the entire policy period (1991-2020) of the Preferred Alternative 1 and Rejected Alternative 2 become negative when the discounting rate is increased from 5 percent to 10 percent. Since a higher discounting rate weights more the effects in earlier years and less those in later years, the later benefits could not cover earlier losses when the rebuilding period is shorter. Undoubtedly this occurrence is partly determined by the allowable catch after the rebuilding period. The results imply that for the given TAC of 12 MP after the rebuilding period, overall effects tend to be highly sensitive to the discounting rate when such rebuilding period terminates before 2008.

Because the alternatives do not have identical rebuilding periods, they are not strictly comparable. Given this caveat, some ranking of alternatives may be enunciated. In terms of total effects for the entire policy period (1991-2020), the two scenarios for the preferred option occupy the two extremes in ranking when using a 5 percent discounting rate. The two rejected options fall in between the two extremes. While Preferred Alternative 1a has the highest positive impacts, Preferred Alternative 1 posts the lowest. Under a 10 percent discounting rate, the ranking changes slightly with Preferred Alternative 1 replacing Rejected Alternative 4 as third in terms of total effects for the entire policy period. As alluded to earlier, this ranking depends to a large measure on the rebuilding period and the allowable catch after the rebuilding period. In general, the ranking of an alternative is positively related to the length of the rebuilding period, given a TAC of 12 MP when the stock has recovered to the desired level. Although the four alternatives can be ranked accordingly in terms of their overall effects for the entire policy period, the level of effects for the options with relatively similar rebuilding period, namely, Preferred Alternative 1, Rejected Alternative 1, and Rejected Alternative 2, do not appear to be substantially different from one another. It is interesting to note, however, that a two-year extension of the rebuilding period beyond 2008, as with Preferred Alternative 1a, makes a significant positive difference in overall impacts.

The ranking of options over time follows a certain pattern. Alternative 1a consistently ranks highest, and is generally followed by Rejected Alternative 1. Preferred Alternative 1 and Rejected Alternative 2 generally rank lower, with the lowest ranking determined by the discounting rate used.

Of particular note is the loss in benefits within the 1991-1995 period. Both preferred options have lower losses than the rejected ones regardless of the discounting rate. Preferred Alternative 1a, however, still registers the lowest loss in benefits for this period.

Considering the relative ranking of the two scenarios for the preferred alternative over time, the total impacts of the preferred measures for the entire policy period may be considered to range from $28.3 million to $40.2 million under a 5 percent discounting rate, or from minus $2.9 million to plus $7.4 million under a 10 percent discounting rate.

Table 4 shows the distributional effects on the commercial and recreational sectors of various alternatives over the policy period and various sub-periods thereof. The total effects discussed above are partly determined by the way costs and benefits of regulations are shared by the commercial and recreational sectors of the red snapper fishery. In turn, the differential impacts of regulations on these two sectors are partly determined by the chosen allocation ratio. Under the status quo, the implicit commercial/recreational allocation ratio was 62:38, whereas under the various alternatives considered here the ratio was explicitly changed to 51:49 by the framework procedure in Amendment 1.

The pattern of distributional effects between the commercial and recreational sectors is distinctively consistent. All options bring about higher positive or lower negative impacts on the recreational sector regardless of the discounting rate used or the sub-period considered. The difference in the magnitude of effects for these two sectors appears to be relatively substantial. Under the Preferred Alternative 1, for example, the difference in effects for the entire policy period is $18.3 million ($23.3 <u>minus</u> $5.0) when using a 5 percent discounting rate or $19.7 million ($8.4 <u>minus</u> -$11.3) when using a 10 percent discounting rate. This significant difference is brought about by the interplay of at least two factors. First, the allocation of harvests between the two sectors has been altered as earlier mentioned. This alteration has resulted into higher negative impacts in earlier years but about the same positive impacts in later years for the commercial sector relative to the recreational sector. Second, the method of estimating the impacts allows for varying changes in commercial profits and constant changes in recreational benefits in response to changes in harvest. This particular difference in valuation of impacts means that while positive benefits for the recreational sector increase at a constant rate, those for the commercial sector increase at a decreasing rate in response to increases in harvest.

Earlier discussion on total effects for the entire policy period mentioned the sensitivity of results to the discounting rate used in the sense that the direction of effects changed when applying different discounting rates. It can be seen from Table 4 that this sensitivity emanates from the commercial sector. In all options, the impacts on the commercial sector for the entire policy period are positive when using a 5 percent discounting rate but negative when using a 10 percent discounting rate. This condition mainly implies that for the commercial sector losses in earlier years are large enough relative to gains in later years. The positive effects on the recreational sector are enough to cover the negative effects on the commercial sector for Alternative 1a and Rejected Alternative 1 but not for Alternative 1 and Rejected Alternative 2.

The positive impacts on the recreational sector are larger with a longer rebuilding period. Preferred Alternative 1a, thus, shows the largest positive benefits to the recreational sector mainly because of its longer rebuilding period. On the other hand, the impacts on the commercial sector appear to peak at some period. This peak could be somewhere between a rebuilding period terminating in 2006 and that terminating in 2008. Preferred Alternative 1a, which has the longest rebuilding period, is associated with the lowest positive impacts on the commercial sector.

At this point, it is worth stressing that part of the positive effects under any of the options considered is due to the 50 percent bycatch reduction. The effects of this bycatch reduction on the shrimp industry cannot be addressed at this time due to the lack of specific details on the regulatory measures that may be implemented to achieve the target bycatch reduction.

Conclusions

Taking into account the two scenarios for the preferred alternative and the importance of choosing an appropriate discounting rate, the Preferred Alternative is expected to effect a change in benefits to the commercial and recreational sectors of the red snapper fishery by an amount ranging from -$2.9 million to $40.2 million over the entire policy period. The amount of impacts in terms of net benefit changes do not exceed $100 million annually for the entire policy period of 1991-2020. The short- and long-term impacts on the recreational sector have been determined to be positive. While the short-term impacts on the commercial sector are negative, the long-term impacts could be positive under a 5 percent discounting rate or remain negative under a 10 percent discounting rate.

Rejected Alternative 1 is expected to effect change in benefits to the entire red snapper fishery ranging from $0.4 million to $33.2 million for the entire policy period. The impacts of Rejected Alternative 2 range from -$4.0 million to $30.7 million. Rejected Alternative 3 is the status quo, and therefore is not expected to have short-term impacts on the fishery. In the long run, benefits to the red snapper fishery are expected to gradually diminish under this alternative as the stock becomes further depleted. Rejected Alternative 4 is expected to have minimal effects on the fishery. Rejected Alternative 5 is expected to minimally affect the commercial sector; but, its effects on the recreational sector is expected to be substantial. Rejected Alternative 6 closely parallels the Preferred Alternative in terms of changes in benefits to the red snapper fishery. It is, however, expected to incur higher enforcement cost. Shrimping closures (Rejected Alternative 7) have been determined to result in significant bycatch reduction only when state and federal waters are closed over a relatively long period. Shrimp trawl modifications (Rejected Alternative 8) offer some potentials of up to 50 percent reduction in bycatch. However, further research needs to be undertaken to develop a gear that will reduce bycatch significantly without an accompanying significant shrimp loss. Direct limitation of shrimping effort offers potential gains to both the directed red snapper and shrimp fisheries. Recent Congressional action regarding regulations intended to reduce bycatch has rendered practically void Rejected Alternatives 5 and 6.

This amendment is expected to impact potentially about 1,600 reef fish commercial fishermen, although a majority of these are part-time red snapper fishermen and may not be substantially affected. In the recreational sector approximately 336,000 recreational fishing trips and 856 for-hire boat operators will be potentially impacted. The proposed regulations maintain the same harvest level for this sector at least for 1991; hence, the impacts on this sector is expected to be minimal.

The additional enforcement cost directly attributable to this amendment does not appear to materially increase. Through a series of meetings and public hearings, some public cost has been incurred towards the formulation of this amendment. In the sense that all those meetings addressed some broader issues whose consideration is left at a future time, like restrictions on the shrimp fishery, the cost thus incurred could not be attributed solely to the current amendment.

8. 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 change in the TAC for red snapper will allow continuation of a directed 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 is necessary to rebuild the overfished red snapper stock.

Effect on Endangered Species and Marine Mammals: The NOAA conducted a consultation under Section 7 of the Endangered Species Act regarding the impact of Amendment 1 which included the framework measures under which this action is being taken. Therefore, no additional Section 7 consultation is necessary. A biological opinion resulting from that consultation found that neither the directed fisheries nor the proposed action will jeopardize the recovery of endangered or threatened species or their critical habitat.

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

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

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

Irreversible and irretrievable commitments of resources: There are no irreversible commitments of resources caused by implementation of this amendment.

Finding of No Significant Environmental Impact

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

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

Approved: ______________________________ ________________

Assistant Administrator for Fisheries Date

9. 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

- a statistically designed onboard observer survey to evaluate the magnitude of red snapper bycatch in the trawl fisheries and its impact on the red snapper population
- estimates of release mortality rates
- evaluate shrimp bycatch data from the Texas Parks and Wildlife shrimp survey
- further analysis of SEAMAP and groundfish survey length frequencies and catch rates
- an index of spawning stock size
- fecundity and maturity by age information
- evaluation of the current and historical levels of offshore trawling vessels fishing the Gulf and fishing effort by geographical area and water depth
- evaluation of bycatch reduction effectiveness of approved TEDs

Socioeconomic Needs

- identify levels of participation in the reef fish multi-species fishery
- local and regional economic assessment of the shrimp bycatch and impacts of restricting bycatch
- a detailed sociological study of the Gulf of Mexico reef fish fishery
- relevant social variables added to the MRFSS data collection program currently maintained by NMFS to provide an understanding of red snapper anglers
- special studies to address decision making behavior of user groups regarding various regulatory alternatives for decision makers to consider and implement more palatable regulations
- descriptive studies of the commercial red snapper fishery and their communities
- documenting variability within recreational and commercial fisheries regarding harvest, profitability, motivations, and satisfactions

Social Impact Assessment Needs

The Council has two sociologists on the Reef Fish Scientific Assessment Panel to provide advice on social impacts of potential management action. However, their participation cannot and should not be regarded as a substitute for a relevant social impact research program sponsored by the National Marine Fisheries Service.

Social scientists are concerned with knowing about the composition of marine fisheries (recreational and commercial), how they are organized in groups and how they will likely react to proposed changes in the management regime. In addition to demographic characterizations of fisheries, it is important to understand patterns of participation and how proposed changes will impact their livelihood and lifestyle. From a recreational standpoint, we need information on variation in the angler population with regard to benefits sought and satisfaction. We need to know the impacts of management on peoples and their communities over time in order to understand displacement of user groups and succession in fisheries. By observing and monitoring how segments of the marine fisheries industry differentially cope and adapt to management actions over time, more effective implementation and management is possible.

While the Magnuson Fishery Conservation and Management Act mandates an understanding of the social impacts of fisheries management, little research data is available to managers regarding red snapper or any other Gulf fishery for that matter. There is no social research program in support of fisheries management within NMFS. Furthermore, there is considerable misunderstanding of the social component of marine fisheries management. When decision makers lack a predictive understanding of what is palatable to various segments of the fishery resource protection goals may not be achieved. Without an understanding of management measures palatable to various user groups, scientific assessment panels may be less than effective in providing decision assistance to the Gulf Council. Acquisition of appropriate research data will require support on a continuing basis, not as a "single-shot band aid" whenever management decisions reach a crisis level that demands social input.

There are no previous social studies regarding the commercial fishery, the recreational private-boat fishery, and the recreational charter/party boat angler fishery. We have little understanding of how these various groups will be impacted by the proposed management scenarios or how they will respond in their fishing activity. Methodologies exist to explore these matters but have never been supported in the past. From a MARFIN research project completed in the last three years regarding the charter and party boat industry in the Gulf of Mexico, we know something about the distribution of these two fisheries in the United States, the likelihood of their being impacted by rulemaking and how important red snapper is to their respective boat operations. Major "hotspots" for the Gulf of Mexico charter boat fishery would be Texas, Alabama, and Florida where 11 of 26 boats (42%), 15 of 32 boats (47%), and 128 of 536 boats (24%), respectively, that target snapper (all species), target them equal to or more than 50 percent of the time. In Texas, 16 of the 16 party boats that target snapper (all species), did so more than 50 percent of the time. In Florida, over one-half (32 of 58) of the headboats that targeted snapper (all species), did so equal to or more than 50 percent of the time. We have no information on what these operators are likely to do in the face of new regulations and/or closure. Some operators reported that they favored bag limits over size limits.

Social impact assessment information must be collected prior to crisis conditions developing. Social scientists need feedback regarding likely management needs so appropriate studies can begin now. Research funding support must be made available to achieve the goals specified in the Magnuson Fishery Conservation and Management Act.

10. REFERENCES

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11. PUBLIC REVIEW

A total of 15 public hearings were held to obtain public comments on this regulatory amendment including three held during the Gulf Council meetings in September and November 1990 and March 1991 in New Orleans, Tampa, and Panama City Beach respectively. Copies of this document may be obtained from the Gulf of Mexico Fishery Management Council office, 5401 West Kennedy Boulevard, Suite 881, Tampa, Florida 33609, 813-228-2815.

The public hearings, with the exception of the ones conducted during Council meetings, were held at the following dates and places:

Mon., August 20, 1990
Florida Keys Community College
5901 West Junior College Road
Key West, Florida

Tues., August 21, 1990
Patio of the Exhibition Hall
1320 Hendry Street
Fort Myers, Florida

Wed. August 22, 1990
Ramada Airport Hotel
5303 West Kennedy Blvd.
Tampa, Florida

Mon., August 27, 1990
Panama City Marina Civic Center
8 Harrison Avenue
Panama City, Florida

Mon., August 27, 1990
Ft. Brown Memorial Ctr. Complex
600 International Boulevard
Brownsville, Texas

Tues., August 28, 1990
Texas A&M Research and Extension Center
Route 2, Highway 44
Corpus Christi, Texas

Wed., August 29, 1990
Galveston County Court House
722 Moody
Galveston, Texas

Thurs., August 30, 1990
New Orleans Theater of Performing Arts
1201 St. Peter Street
New Orleans, Louisiana

Tues., August 28, 1990
Mobile Civic Center
401 Civic Center Drive
Mobile, Alabama

Wed., August 29, 1990
Gulf Coast Research Laboratory
1650 East Beach Boulevard
Biloxi, Mississippi

Thurs., August 30, 1990
Holiday Inn Central-Holidome
2032 N.E. Evangeline Thruway
Lafayette, Louisiana

Fri., August 31, 1990
Cameron Elementary School
Main Street (Highway 82)
Cameron, Louisiana

LIST OF AGENCIES CONSULTED

Gulf of Mexico Fishery Management Council's
-Scientific and Statistical Committee
-Reef Fish Advisory Panel
-Reef Fish Scientific Assessment Panel
-Shrimp Advisory Panel

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

RESPONSIBLE AGENCY:

Gulf of Mexico Fishery Management Council
Lincoln Center, Suite 881
5401 West Kennedy Boulevard
Tampa, Florida 33609
813-228-2815

Table 1

Estimates of reductions in fishing mortality on anglers fishing from headboat, charter boats, and private boats effected by the red snapper 13 inch size limit and 7 fish daily bag limit implemented by Amendment 1 to the Reef Fish Fishery Management Plan in 1990. Three assumptions about mortality reductions were evaluated: 1) no release mortality, 2) release mortality is experienced by undersize fish only and anglers stop fishing once the bag limit is reached, and 3) release mortality is experienced by both undersize fish and fish caught in excess of the bag limit where anglers fishing effort is the same as the average effort during 1986-1989. Category 1) above also equals the percent reduction in harvest of fish that was effected by Amendment 1 relative to the average 1986-1989 harvest. Data taken from Goodyear et al. (1991), Tables 16-24.

	Mortality experienced by released fish		
Fishing Mode	No Release Mortality (reduction in catch)	Undersize Release Mortality Only	Undersize & Excessive Catch Release Mortality
Headboats	81%	58%	54%
Charter boats	45%	32%	30%
Private boats	50%	40%	34%

Table 2

DEFINITION OF MANAGEMENT ALTERNATIVES FOR RED SNAPPER

Management Alternative	Commercial Fishery	Recreational Fishery	Bycatch Reduction	Year SPR=20%
Baseline	3.1 MP quota for 1991-2020	7 fish bag for 1991-2020	0% for 1994+	Unattainable
Preferred Alternative 1	2.04 MP quota for 1991-1993 1.58 MP quota for 1994-2007 6.12 MP quota for 2008+	7 fish bag for 1991-1993 4 fish bag for 1994-2007 5.88 MP quota for 2008+	50% for 1994+	2007
Preferred Alternative 1a	2.04 MP quota for 1991-2010 6.12 MP quota for 2011+	7 fish bag for 1991-2010 5.88 MP quota for 2011+	50% for 1994+	2010
Rejected Alternative 1	1.84 MP quota for 1991-2008 6.12 MP quota for 2009+	5 fish bag for 1991-2008 5.88 MP quota for 2009+	50% for 1994+	2008
Rejected Alternative 2	1.58 MP quota for 1991-2006 6.12 MP quota for 2007+	4 fish bag for 1991-2006 5.88 MP quota for 2007+	50% for 1994+	2006

<u>Notes</u>

1. The policy period is 1991-2020. The starting year is 1991, since this regulatory amendment is expected to be implemented this year. The terminal year (2020) was chosen in order to allow for at least ten years of less restrictive management regime under each alternative.

2. The baseline scenario corresponds to regulations under Amendment 1. All alternatives assume the baseline TAC and commercial/recreational allocation for the entire policy period. All alternatives, other than the base case, assume a 6.12 MP and 5.88 MP quota for the commercial and recreational sector, respectively, after the SPR level of 20 percent is reached. These numbers were derived by applying the 51:49 commercial/recreational ratio in allocating a 12 MP TAC. Note that 12 MP is the maximum TAC that maintains a 20 percent SPR (after it is reached) when a 50% bycatch reduction is realized.

3. Preferred Alternatives 1 and alternate analysis 1a are presented as possible long-term scenarios, given the Council's proposed TAC, commercial quota, and recreational bag limit for 1991. Preferred Alternative 1 further restricts commercial and recreational harvests in 1994 in order to achieve the 20 percent SPR target by 2007. Preferred Alternative 1a maintains the same commercial and recreational harvests until it achieves the 20 percent SPR target in 2010.

Table 3

APPROXIMATE CHANGES IN TOTAL NET BENEFITS TO THE RED SNAPPER FISHERY
(Million Dollars)

Baseline: 3.1 MP Commercial Quota in 1991-2020
7 Fish Recreational Bag Limit in 1991-2020
0 Percent Reduction in Bycatch in 1994+

Period	Preferred Alternative 1 -2007-	Preferred Alternative 1a -2010-	Rejected Alternative 1 -2008-	Rejected Alternative 2 -2006-
	5 Percent Discounting Rate			
1991-1995	-13.8	-10.5	-15.3	-18.7
1991-2000	-26.2	-15.8	-23.1	-28.2
1991-2007	-29.3	-7.1	-20.4	-26.9
1991-2020	28.3	40.2	33.2	30.7
	10 Percent Discounting Rate			
1991-1995	-12.5	-9.7	-14.0	-17.4
1991-2000	-21.6	-13.6	-19.9	-24.4
1991-2007	-23.6	-8.9	-18.5	-24.6
1991-2020	-2.9	7.4	0.4	-4.0

Notes

1. The policy period is 1991-2020. The starting year is 1991, since this regulatory amendment is expected to be implemented this year. The terminal year (2020) was chosen in order to allow for at least ten years of less restrictive management regime under each alternative.

2. The baseline scenario corresponds to regulations under Amendment 1. All alternatives assume the baseline TAC and commercial/recreational allocation for the entire policy period. All alternatives, other than the base case, assume a 6.12 MP and 5.88 MP quota for the commercial and recreational sector, respectively, after the SPR level of 20 percent is reached. These numbers were derived by applying the 51:49 commercial/recreational ratio in allocating a 12 MP TAC. Note that 12 MP is the maximum TAC that maintains a 20 percent SPR (after it is reached) when a 50% bycatch reduction is realized.

3. Preferred Alternatives 1 and 1a are presented as possible long-term scenarios, given the Council's proposed TAC, commercial quota, and recreational bag limit for 1991. Preferred Alternative 1 further restricts commercial and recreational harvests in 1994 in order to achieve the 20 percent SPR target by 2007. Preferred Alternative 1a maintains the same commercial and recreational harvests until it achieves the 20 percent SPR target in 2010.

Table 4

APPROXIMATE CHANGES IN NET BENEFITS TO THE COMMERCIAL AND RECREATIONAL RED SNAPPER FISHERY
(Million Dollars)

Baseline: 3.1 MP Commercial Quota in 1991-2020
7 Fish Recreational Bag Limit in 1991-2020
0 Percent Reduction in Bycatch in 1994+

Period	Preferred Alternative 1 -2007-		Preferred Alternative 1a -2010-		Rejected Alternative 1 -2008-		Rejected Alternative 2 -2006-	
	Com	Rec	Com	Rec	Com	Rec	Com	Rec
	5 Percent Discounting Rate							
1991-1995	-13.0	-0.8	-11.2	0.7	-14.3	-1.0	-16.3	-2.4
1991-2000	-24.7	-1.5	-20.5	4.7	-23.5	0.4	-25.6	-2.6
1991-2007	-31.2	1.9	-23.2	16.1	-27.3	6.9	-30.1	3.2
1991-2020	5.0	23.3	4.0	36.2	6.2	27.0	6.1	24.6
	10 Percent Discounting Rate							
1991-1995	-11.8	-0.7	-10.3	0.6	-13.1	-0.9	-15.1	-2.3
1991-2000	-20.4	-1.2	-17.0	3.4	-19.9	0.0	-22.0	-2.4
1991-2007	-24.2	0.6	-18.5	9.6	-22.0	3.5	-25.1	0.5
1991-2020	-11.3	8.4	-9.5	16.9	-10.3	10.7	-12.3	8.3

Notes

1. The policy period is 1991-2020. The starting year is 1991, since this regulatory amendment is expected to be implemented this year. The terminal year (2020) was chosen in order to allow for at least ten years of less restrictive management regime under each alternative.

2. The baseline scenario corresponds to regulations under Amendment 1. All alternatives assume the baseline TAC and commercial/recreational allocation for the entire policy period. All alternatives, other than the base case, assume a 6.12 MP and 5.88 MP quota for the commercial and recreational sector, respectively, after the SPR level of 20 percent is reached. These numbers were derived by applying the 51:49 commercial/recreational ratio in allocating a 12 MP TAC. Note that 12 MP is the maximum TAC that maintains a 20 percent SPR (after it is reached) when a 50% bycatch reduction is realized.

3. Preferred Alternatives 1 and 1a are presented as possible long-term scenarios, given the Council's proposed TAC, commercial quota, and recreational bag limit for 1991. Preferred Alternative 1 further restricts commercial and recreational harvests in 1994 in order to achieve the 20 percent SPR target by 2007. Preferred Alternative 1a maintains the same commercial and recreational harvests until it achieves the 20 percent SPR target in 2010.

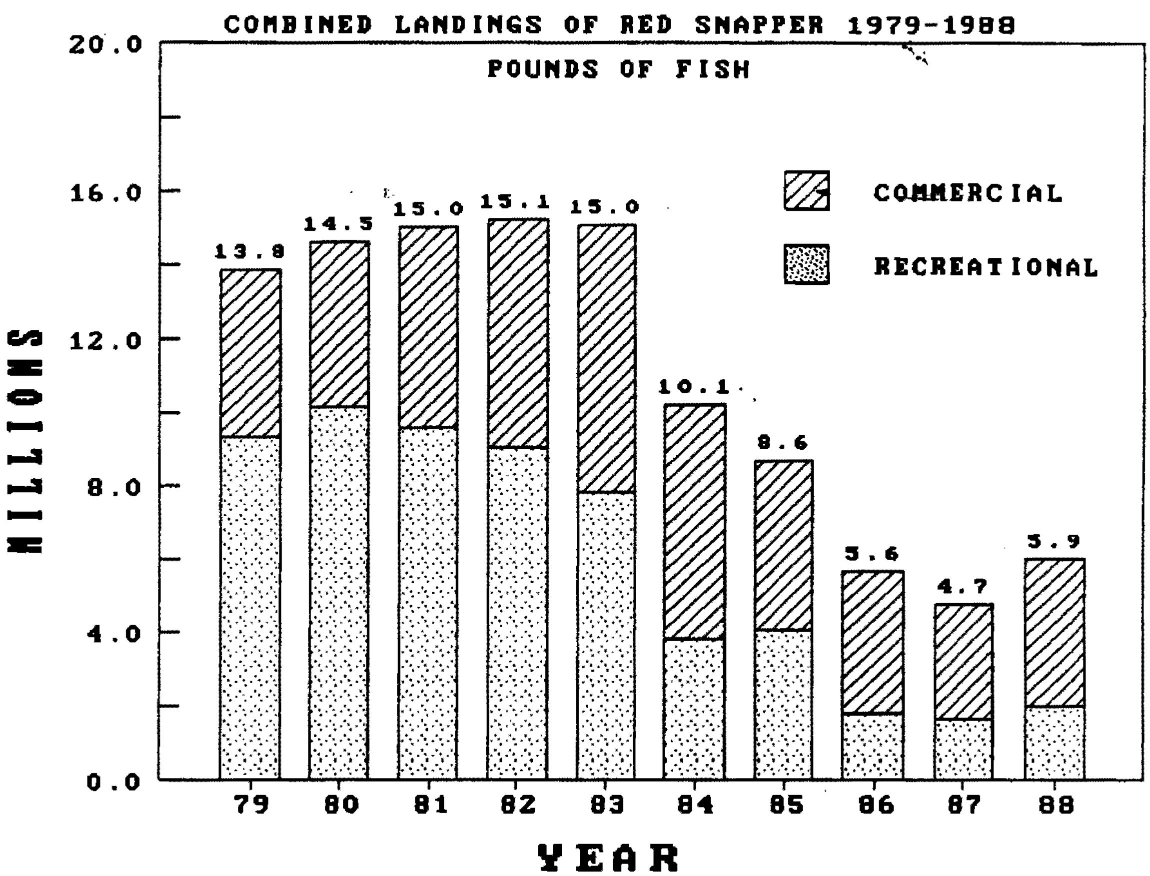

Figure 1. Estimated biomass of the combined commercial and recreational harvest of Gulf of Mexico red snappers (1979-1988).

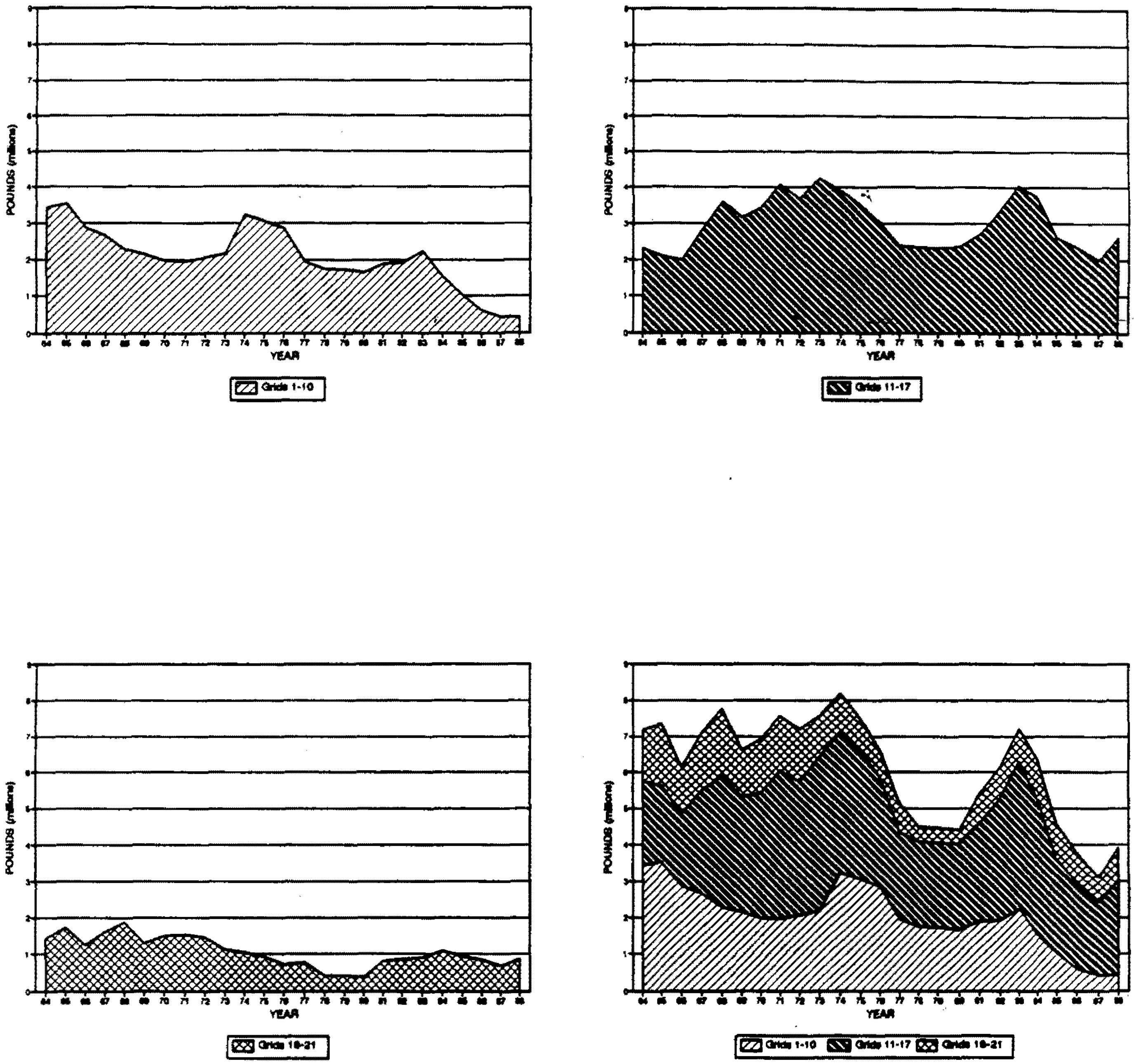

Figure 2a. Commercial red snapper landings from the U. S. Gulf of Mexico for the period 1964-1988. Grids 1-10 represent waters off west Florida; grids 11-17 represent waters off Alabama, Mississippi, and Louisiana; and grids 18-21 represent waters off Texas. Data from Goodyear and Phares, 1990.

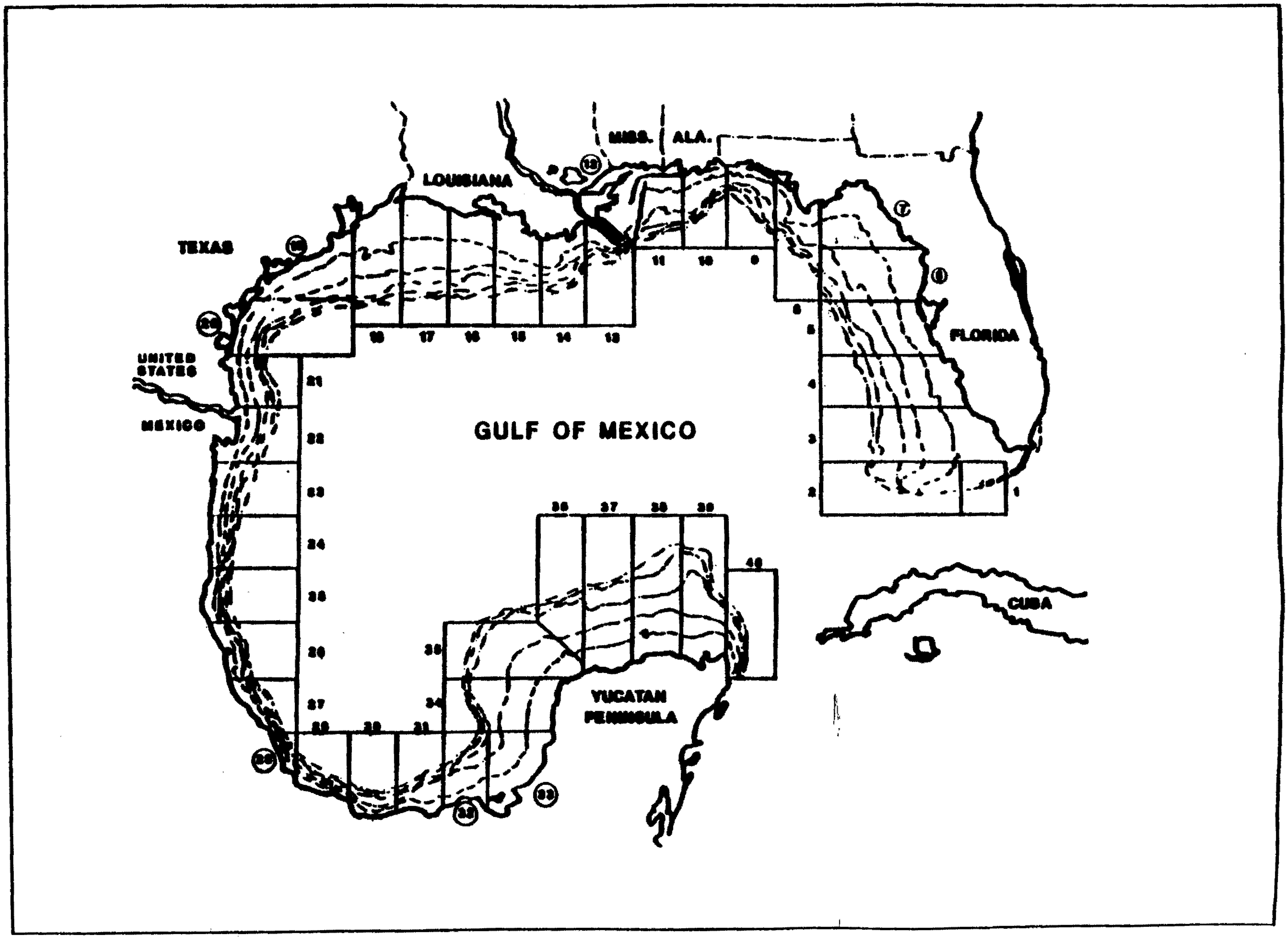

Figure 2b. Commercial landings NMFS [illegible]atistical grids. Grids 1-21 represent U. S. Gulf of Mexico wate[illegible]

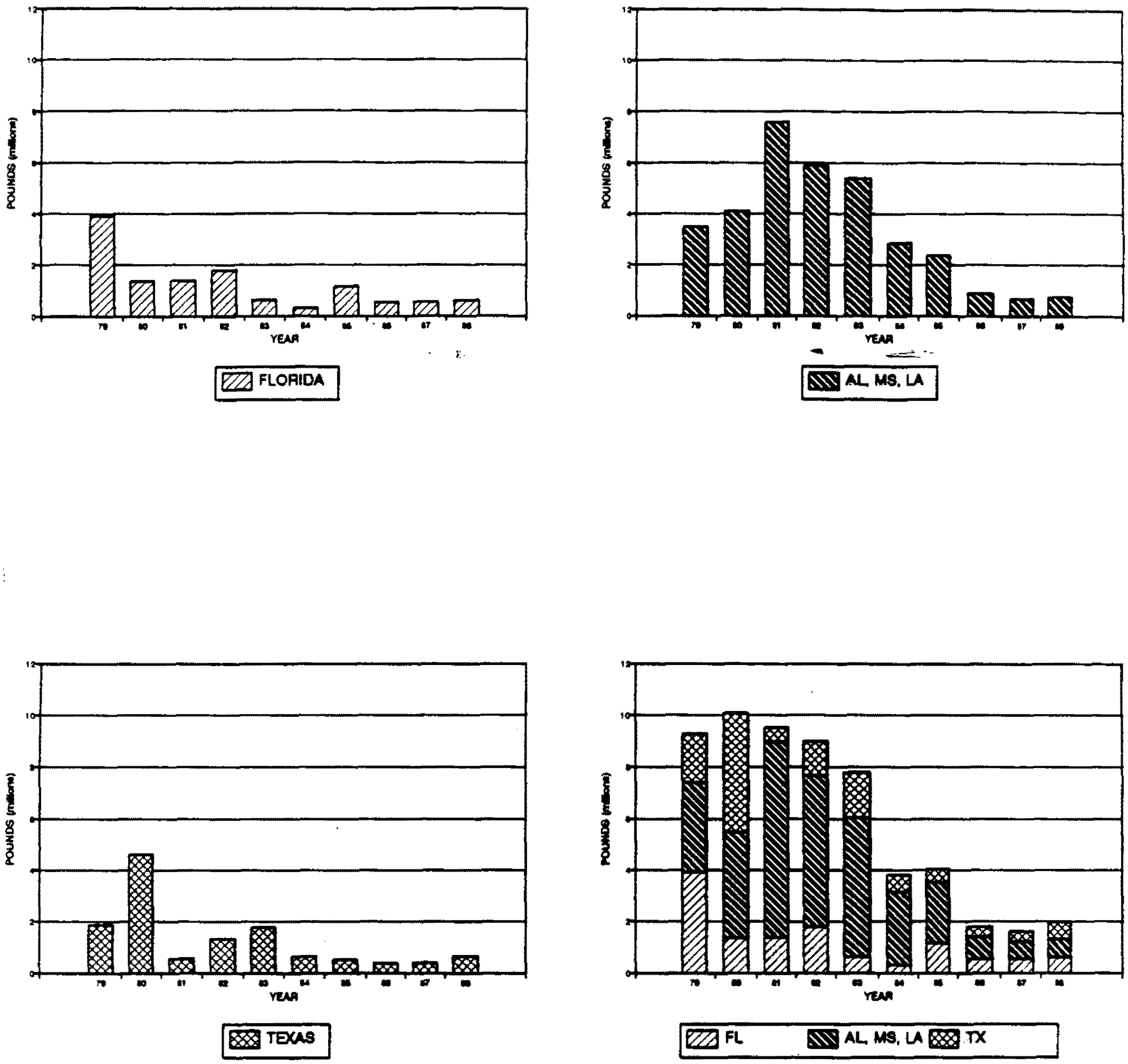

Figure 3. Recreational red snapper landings from the Gulf of Mexico for the period 1979-1988. Data from Goodyear and Phares, 1990.

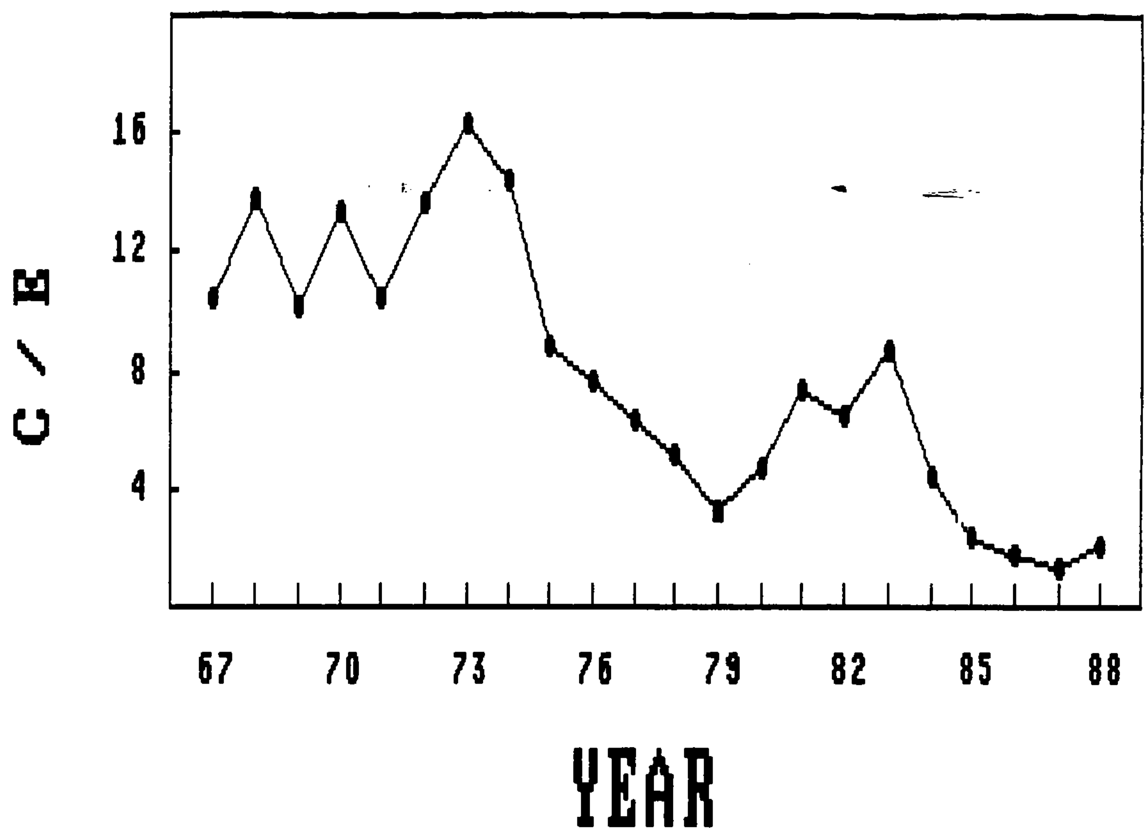

Figure 4. Catch per unit effort, derived from reported landings and effort, for red snapper sold from the bycatch of shrimp trawls, 1967-1988.

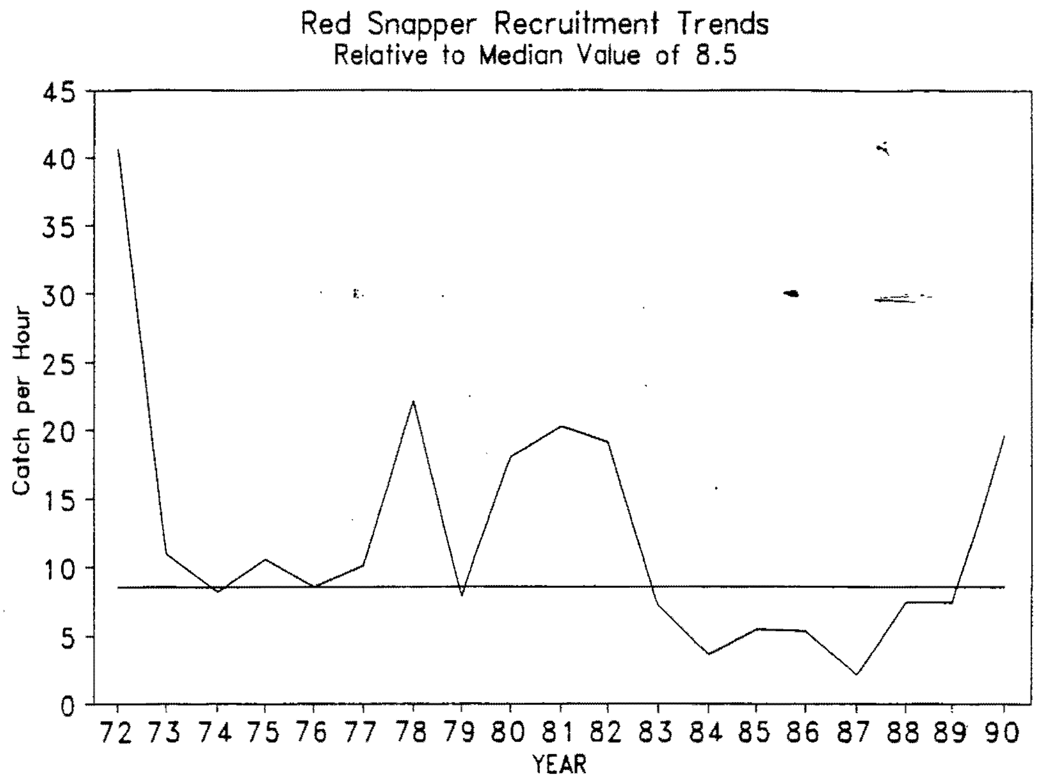

Figure 5. Red snapper recruitment trends in the Gulf of Mexico from 1972 through 1990. The horizontal line represents the median value of 8.5 for the entire series. Data from the NMFS Fall Groundfish Survey.

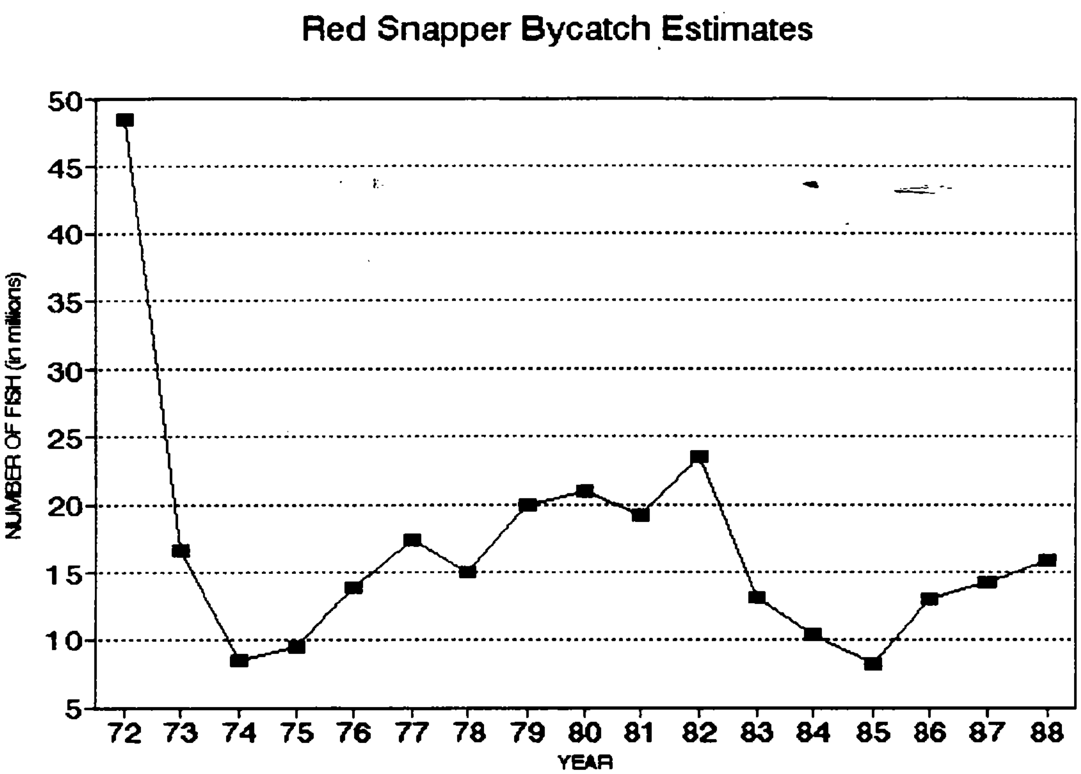

Figure 6. Annual northern Gulf red snapper shrimp trawl bycatch estimates (in millions of fish) for the period 1972-1988. Data from NMFS, Pascagoula Laboratory.

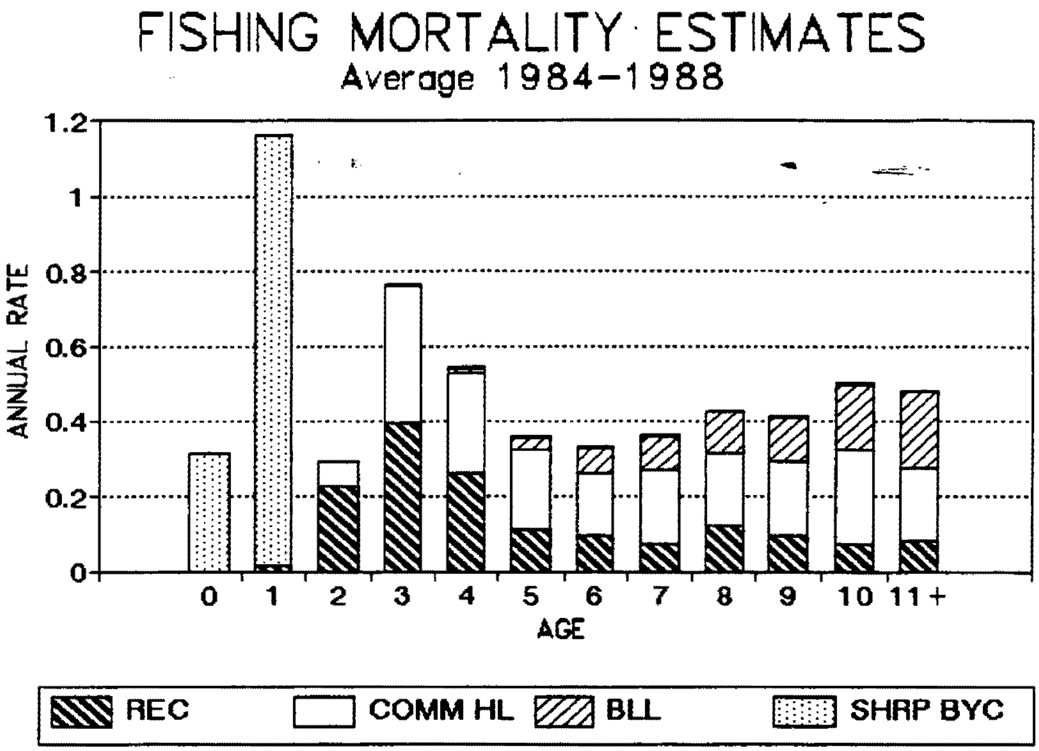

Figure 7. Distribution of red snapper average 1984-1988 fishing mortality by age and fishery category (recreational--REC, commercial hook and line--COMM HL, bottom longlines and buoys--BLL, and shrimp bycatch--SHRP BYC).