REGULATORY IMPACT REVIEW

and

REGULATORY FLEXIBILITY ANALYSIS

for

AMENDMENT 1

to the

FISHERY MANAGEMENT PLAN

for the

REEF FISH FISHERY OF THE GULF OF MEXICO

August, 1989

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1. INTRODUCTION

1.1. Executive Order 12291

Executive Order 12291 established guidelines for promulgating new regulations and reviewing existing regulations. Under these guidelines each agency, to the extent permitted by law, is expected to comply with the following requirements: 1) administrative decisions shall be based on adequate information concerning the need for and consequences of proposed government action; 2) regulatory action shall not be undertaken unless the potential benefits to society for the regulation outweigh the potential costs; 3) regulatory objectives shall be chosen to maximize the net benefits to society; 4) among alternative approaches to any given regulatory objective, the alternative involving the least net cost to society should be chosen to the extent practicable; and, 5) agencies shall set priorities regularly with the aim of maximizing the aggregate net benefit to society, taking into account the condition of the particular industries affected by regulations, the condition of the national economy, and other regulatory actions contemplated for the future.

In compliance with Executive Order 12291, the Department of Commerce (DOC) and the National Oceanic and Atmospheric Administration (NOAA) require the preparation of a Regulatory Impact Review (RIR) for all regulatory actions which either implement a new fishery management plan or significantly amend an existing plan, or may be significant in that they reflect important DOC/NOAA policy concerns and are the object of public interest.

The RIR is part of the process of developing and reviewing fishery management plans and is prepared by the Regional Fishery Management Councils[1] with the assistance of the National Marine Fisheries Service (NMFS), as necessary. The RIR provides a comprehensive review of the level and incidence of impact associated with the proposed or final regulatory actions. The analysis also provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve problems. The purpose of the analysis is to ensure that the regulatory agency or Council systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether the proposed regulations implementing the fishery management plan or amendment are major under Executive Order 12291. If the proposed

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[1]It is an administrative and policy decision that the Councils prepare a RIR. The Executive Order provides that the agency promulgating the rules prepares a RIR.

regulations will have a significant impact on a substantial number of small entities, then an Initial Regulatory Flexibility Analysis (IRFA) will be prepared and incorporated into a joint document that also meets the requirements of the Regulatory Flexibility Act (RFA).

1.2. Regulatory Flexibility Act

The purpose of the Regulatory Flexibility Act is to relieve small businesses, small organizations, and small governmental entities from burdensome regulations and recordkeeping requirements. In as much as Executive Order 12291 encompasses the RFA requirements, the RIR usually meets the requirements of both, especially for this amendment since commercial, charter, and party boat fishermen affected are all largely small business entities.

2. PROBLEMS AND OBJECTIVES

The problems and objectives are identified in Section 4 of Amendment 1.

There are many problems identified that require amendments to the current FMP. Perhaps the most severe one pertains to the finding that many reef fish species are being depleted. The problem is partly due to significant increases in fishing pressures from both commercial and recreational sectors and partly due to overfishing resulting from an overestimate of maximum sustainable yield in the current FMP.

The major long-run objective of attaining a minimum spawning stock ratio of 20 percent basically necessitates fishing restrictions, since many reef fish species exhibit ratios below the target minimum. In this regard, the objective of maximizing net benefit from the fishery may or may not be possible with a spawning stock ratio as low as 20 percent.

3. MANAGEMENT MEASURES

The full text of the measures, proposed and rejected, are stated in Section 11 of Amendment 1. The measures considered are many and varied, all designed to address the multifaceted problems identified to characterize, currently or in the near future, a multi-species reef fish fishery. Some of these measures are closely interrelated and often reenforce or work against one another in their impacts.

The measures adopted are so structured as to incur short-run losses for an expected continuous long-run gain. The foremost objective of the ensuing analysis is to determine the nature of the gains and losses and the extent to which expected gains can more or less than compensate for the losses. The reef fish segment of the Gulf fishery is one area where both commercial and recreational sectors

have about equal participation in terms of catches. Both sectors are then expected to lose or gain from the proposed measures in an equal manner.

On balance, the measures considered preserve the open access stature of the reef fish fishery, although one measure--more than 50 percent earned income requirement--somewhat deviates from the rest in its impact but not neccessarily in its intention. It has been demonstrated that measures of the type herein considered may offer potential gains that would be eventually dissipated, although saving certain species from depletion would enhance non-user values, like option, bequest, or existence values. In essence, the measures adopted may be viewed as an initial move to better manage the fishery and its host of attendant resources. To what extent this initial move is beneficial in the long-run is one main focus in the succeeding analysis of impacts.

4. FRAMEWORK OF ANALYSIS

4.1. Structure of Impact Analysis

The impacts of the management measures are analyzed from both short-run and long-run perspectives. The basis for most short-run analyses is the information characterizing the fishery in the 1985-87 period. The basis for long-run analysis is the likely condition that will prevail in the fishery up through the year 2000. This end year corresponds to the end period set forth by the Council in attaining the 20 percent minimum spawning stock ratio as a long-term optimum yield goal.

The direct short-run impacts are essentially reductions in ex-vessel value of commercial landings and reduction in consumer surplus of the recreational sector. The distribution of these impacts are discussed. Geographical, gear type and market level impacts are estimated. However, the main focus of the analysis is the determination of benefits and losses on both commercial and recreational sectors. The net benefits, as well as the distributional effects, are quantified to the extent possible.

Section 5 of the RIR is devoted to an analysis of the proposed measures. These measures are grouped and analyzed under the following subsections:

Subsection 5.1. Size and Catch Limits
Subsection 5.2. Gear Restrictions
Subsection 5.3. Permits and Gear Identification
Subsection 5.4. Stressed Area Boundaries
Subsection 5.5. Fishing Year
Subsection 5.6. Closed Seasons/Areas
Subsection 5.7. User Group Conflict Resolution
Subsection 5.8. Statistical Reporting Requirements

Recourse to this categorization is done for better analysis of the numerous measures. However, it is well worth noting that measures from one category may have direct bearing on those of another category. Where it is deemed essential, measures from different categories are concomitantly considered.

Each of these subsections usually contains several measures. Where feasible, closely interrelated measures under a subsection are combined to determine their collective effects.

Section 6 of the RIR discusses the likely impacts of the rejected measures. These measures are categorized and analyzed using the same criteria as in Section 5. In this case no grouping of measures was attempted due mainly to the countless combinations of these measures that are possible and no one combination can be regarded as superior to others. There are also instances where rejected measures under the same subsection are mutually exclusive. Additionally, explicit classification of effects into short-run versus long-run and commercial versus recreational is not done, but these effects are nevertheless treated in the discussion of the effects of each rejected measure.

Section 7 summarizes the relative impacts of both the proposed and rejected measures. This section also presents the cumulative effects of the proposed measures. It may be pointed out at this juncture that a strict quantification of the cumulative effects is not possible because of information constraints on the precise nature and magnitude of effects of certain proposed measures. Cumulating the effects of the rejected measures is not feasible.

4.2. Economic Models Used for Impact Analysis

Demand and supply estimates are major requisites for determining the impacts of regulations. For the commercial reef fish industry in the Gulf region, only ex-vessel demand estimates for groupers and snappers (Keithly and Prochaska, 1988) are available. These estimates are used in this RIR to determine short-run changes in the revenues of the commercial harvest sector of the reef fish industry. The estimated demand parameters and associated statistical characteristics are presented in Table 4.2.1.

The two equations are taken as a system for estimation purposes, and are estimated using seemingly unrelated regression technique. These equations are essentially derived, inverse demand equations for the snapper and grouper stock complexes. Each of the ex-vessel demands is derived from the commodities' demand by the final consumers. The two demand equations are inverse demands in the sense that prices are considered to depend on quantities, among others. Since all the varibles, except the binary ones, are expressed in logarithmic form, the estimated coefficients are interpreted as flexibilities, which are measures of the

responsivenes of prices (dependent variable) to changes in any of the associated factors (independent variables).

The estimated equations appear, on balance, very satisfactory. The respective (first stage) R-squared is high, roughly indicating that the variables included in the model account for most of the changes in prices. The Durbin-Watson statistics are also close to 2, implying the absence of serial correlation. Additionally, all but one (referring to snapper imports) coefficients are tested to be statistically different from zero. And, all slope coefficients estimated come out with expected signs.

The directly relevant parameters for determining ex-vessel revenue changes are the price flexibility coefficients, namely, -0.4614 for groupers and -0.3698 for snappers. A 10 percent reduction in landings of grouper (snapper) means its price will increase by 4.614 percent (3.698 percent). Multiplying this new price into the reduced landings gives out the new total ex-vessel revenues. The difference in total revenues before and after the price (and quantity) change is the change in total revenue resulting from a regulation causing that landing reduction.

Future prices, needed for long-run analysis, are estimated using a price forecasting model (Waters, 1988). This model is presented in Table 4.2.2. Although Waters estimated two equations, one for snapper and another for grouper, only the snapper equation is usable at this time, and so is the only one presented in the table. The usability of the model is basically dependent on forecasted landings, and landings for red snapper only can be forecasted with a biological simulation model developed at the National Marine Fisheries Service (Goodyear, 1989). Forecast landings of groupers and other reef fish species cannot be adequately generated; therefore, long-run yields that are expected to result in long-run benefits cannot be forecasted.

The equation was estimated with the Cochrane-Orcutt iterative technique. The estimated equation appears very satisfactory for estimating future prices, given landings forecast. All the estimated parameters are statistically different from zero. The R-squared (both adjusted and unadjusted) is also very high, or alternatively, the standard error of the estimates is very low.

To estimate price for each year considered, values for variables on the right-hand side, namely,landings forecasted for the current and prior years, prior year predicted price, and current and past years (variable YEAR), are plugged into the equation. Total ex-vessel revenue for each year is the product of predicted price and forecasted landings for the year.

It should be stressed that these models can only generate changes in the ex-vessel revenues of the commercial harvest sector. The absence of estimated cost functions precludes estimation of changes

in harvest sector producer surplus resulting from regulations. Also, full accounting of changes in surpluses in the commercial sector resulting from a regulation requires estimation of consumer surplus change at the retail level, changes in net profits at all intermediate markets, and change in the producer surplus at the primary (harvest) sector (Just and Hueth, 1979). The only available estimate for RIR purposes is demand in the harvest sector.

Estimating the impacts of regulations on the recreational sector is very imprecise due to the absence of a reasonable recreational demand estimate for reef fish in the entire Gulf region. In another Gulf fishery, Milon (1988) estimated two general types of travel cost recreational demand models for king mackerel, namely, a pooled site model and a multinomial logit model, using data from the Marine Recreational Fisheries Statistics Survey and the Marine Recreation Fishing Socioeconomic Survey. He employed these models to estimate changes in consumer surplus resulting from changes in king mackerel catch rates.

With severe limitations,[2] Milon's estimates are used to arrive at some general indication of the magnitudes of changes in consumer surplus as a result of adopting regulations for the recreational sector of the reef fish fishery. The use of mackerel demand estimates is premised on the possibility that anglers behave, on balance, similarly when fishing for reef fish as they do for king mackerel. Two MARFIN-financed studies (Ditton et al., 1988; Holland and Milon, 1989) have concluded that charter and party boat captains generally seek assemblages of species in their trips. Prominently featured in these assemblages is the combination of king mackerel and snapper as target species groups. To a limited extent, this finding can be construed to indicate that angler demand for snapper, in particular, and reef fish, in general, can be roughly approximated by angler demand for king mackerel, at least for those fishing through charter and party boats.

Of the many models estimated by Milon, results for the semilog pooled site demand model, specifically the semilog estimates he employed in calculating changes in consumer surplus, are used in this RIR. The choice of these particular estimates is essentially arbitrary, although the expediency of using them and the conservative estimates of consumer surplus changes they provide are reasons for their use in this report.

Although in principle, the estimated equation should be used in estimating changes in consumer surplus as a result of changes in catch rates, a more convenient way of estimating consumer surplus

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[2]Even in cases where these estimates are used for king mackerel, several limitations have been pointed out by the author. See Milon's cited paper for discussion of these limitations.

change is to use the surplus changes already estimated by Milon (Tables 5.1 and 5.2 in the cited study). These surplus changes per angler per trip for 25 percent and 50 percent changes in catch rates are presented in Table 4.2.3.

As presented in Table 4.2.3, a 50 percent change in catch results in consumer surplus change that is twice as much as that of a 25 percent change in catch rate. This occurrence is essentially a function of the estimated equations. For purposes of this RIR, any change in consumer surplus resulting from a change in catch rate is estimated as a proportion to that found in Table 4.2.3. For example, a 30 percent reduction in reef fish catch results in a change in consumer surplus of -$2.90, which is dtermined as follows: (.30/.25) x -$2.42. Two estimates, one where travel time is valued at $3.35 per hour and the other where no value is assigned to travel time, are used to represent high and low changes in consumer surplus.

Changes in economic activities resulting from regulations are estimated using an input-output framework. Usual indicators of economic activities are output, income, and employment. Output, income and employment, respectively, refer to the value of produced commodities, earnings of households, and number of jobs.

Changes in economic activities are driven by exogenous changes, usually changes in the so-called final demand sector of the national or regional economy. For the marine fishing segment of the economy, exogenous changes result from changes in ex-vessel value of commercial landings or changes in angler expenditures. For the RIR, these exogenous changes are brought about by regulations on reef fish harvest of both commercial and recreational sectors.

Economic impacts within the input-output framework are made up of three categories, the sum of which comprises the total economic impacts:

Direct impact - initial purchases made by the directly affected industries.

Indirect impact - purchases of inputs by directly affected industries to produce goods and services demanded by other industries.

Induced impact - purchases of goods and services resulting from wages paid by the directly and indirectly affected industries.

Determination of these impacts necessitates the use of "multipliers." The multipliers used for this RIR are based on the Regional Input-Output Modeling System (RIMS-II) of the Bureau of Economic Analysis of the U.S. Department of Commerce. The specific

multipliers used are the so-called Type II multipliers, which take into account direct, indirect and induced effects. State level multipliers are readily available at the 531-sector level of detail for all Gulf states, except Mississippi. For this state, only the 39-sector level of detail is readily available.

The multipliers used to calculate impacts are those corresponding to the RIMS-II sector "commercial fishing" for the commercial sector and "other amusement and recreation services" for the recreational sector, when a 531-sector level of disaggregation is available. For the 39-sector level of disaggregation, multipliers used for commercial and recreational sectors are those corresponding to RIMS-II sectors "forestry and fishery products" and "hotels and lodging places and amusements", respectively. These aggregated sectors contain within them the respective sectors used from a more disaggregated RIMS-II table of multipliers. The weighted average of all state multipliers are taken as the Gulfwide multipliers, using as weights the 1985-87 average commercial or recreational harvests in each state. Different Gulfwide multipliers are derived for each species group to account for variation of species landed in each state. This means that more weights are assigned to the multiplier of a state having the most landings of a certain species group. These multipliers are presented in Table 4.2.4.

The general remark that can be made about these specific economic models (as described above) used in quantifying impacts of some of the measures, adopted or rejected, by the Council in Amendment 1 to the reef fish FMP is that they fall short of being considered ideal methods for RIR purposes. Given, however, the relative scarcity of "usable" economic models for analyzing regulatory measures specifically impacting the Gulf reef fish fishery, these models are deemed to be instructive enough to depict general tendencies of projected impacts.

4.3. Remark on Figures and Tables

Most references to figures and tables are for those found in Amendment 1 to the Reef Fish FMP. These figures and tables have two numbers as identifiers, for example Figure 7.1 and Table 7.1. There are also tables that are generated in this RIR. These tables have three numbers as identifiers and they are numbered according to sections and subsections under which they are discussed, for example, Table 7.1.1 indicates that it is the first table in the first subsection of Section 7 of the RIR.

5. ANALYSIS OF PROPOSED MANAGEMENT MEASURES

5.1. Size and Catch Limits

a. Red Snappers

a.1 Current Scenario

The FMP, implemented in 1984, established a size limit of 13 inches total length for red snappers. However, there are exceptions: 1) incidental catches of undersize fish (including those caught by recreational fishermen) up to five fish per person are allowed; 2) trawl fishing in the EEZ, except roller trawling in stressed areas, is exempted from the undersize fish possession limit.

The Council, through this amendment, has adopted a 20 percent SSBR ratio as an optimum yield goal to be achieved by the year 2000. A lower ratio is construed to imply that the species is overfished and possibly at the state where recruitment may be jeopardized. The recent stock assessment (Goodyear, 1988b) has demonstrated that the red snapper species is well below the target SSBR (see Figure 11.1). This situation is further illustrated by the history of commercial landings which invariably depicts a long-term decline (Figure 7.2). The advent of a fast-growing recreational sector has added more pressure to the stock's declining status (see Table 8.1 and Table 7.25).

A biological simulation model shows that, under the current management measures, severe depletion of the red snapper stock has occurred and would continue in the future, with the consequence of an exponentially declining potential catch for both commercial and recreational fishermen (Figure 11.4).

a.2 Proposed Measures [3]

There are four related measures here: 1) size limit of 13 inches total length; 2) commercial quota of 3.1 million pounds and daily recreational bag limit of 7 fish per person, with allowance of 14 fish per person for multi-day trips; 3) sale prohibition of undersize fish; and, 4) deletion of current FMP allowance for keeping undersize red snapper.

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[3] It is recognized that the measures considered in the amendment are interconnected so that those measures that do not strictly fall under the size and catch limit category but have direct relevance to the analysis are concomitantly considered or at least referenced.

a.3 Short-Run Impacts

a.3.1 Impacts on the Commercial Sector

The size limit maintains the current FMP provision, but it is expected to be more effective by the "no sale" and "no retention" provisions. The "no retention" provision eliminates gray areas in enforcing the size limit at sea or at the dock. The "no sale" provision would likely discourage dealers from buying undersize fish.

An effective size limit would initially reduce the commercial catch by around 159 thousand fish (Tables 21 and 24, Goodyear 1988b), which convert to around 116 thousand pounds using the length to weight conversion for red snapper, as discussed in Section 8 of Amendment 1. This latter amount represents an equivalent reduction of three percent based on the 1985-1987 average commercial landings.

The commercial quota of 3.1 million pounds represents a 20 percent reduction over the 1985-1987 average commercial landings of red snappers. Catch reductions from the size limit and quota are not additive. The reduction due to the quota exceeds that for the size limit. In principle, the size limit would take effect first by eliminating catches of undersize fish. The rest of the catch reduction would be comprised of larger fish. From the standpoint of the commercial sector, the size limit and quota together would reduce catch of red snapper by around 768 thousand pounds.

The 1985-87 Gulfwide average ex-vessel revenue is around $7.9 million, which if divided by the period's average landings of 3.8 million pounds, would imply an average price of $2.07 per pound. As earlier presented, the price flexibility for snapper is -0.3698 so that a 20 percent reduction in landings translates to a 7.4 percent (0.3698 x 20 percent) increase in ex-vessel price. This change would raise the price to around $2.22 per pound ($2.07 x 1.074). The new ex-vessel revenues would be around $6.8 million ($2.2 x 3.1 million). The difference in ex-vessel revenues before and after the price and quantity changes is the revenue loss to the commercial harvest sector. This revenue loss would amount to around $1.1 million. The absence of estimated ex-vessel supply curve and appropriate demand and supply curves in other markets precludes estimation of full changes in consumer and producer surpluses as a result of reductions in commercial landings.

Quotas, and to some extent size limits, tend to change industry cost. Over the short-run, only the variable cost portion will change. Costs change as fishermen take more or longer trips, or refit their vessels with more efficient gear in a race to fill the quota. Cost change due to the size limit comes in the form of extra labor time expended for sorting fish. In the 1980-1981 season, average variable costs for reef fish vessels were $184,772

and $49,157 for longline and handline vessels, respectively. Inflated by the 1985-1987 average producer price index, the figures would be $208,792 and $55,547 for longline and handline vessels, respectively. The magnitude of cost increase depends to a large extent on the increase in the number and/or length of trips for harvest of red snappers taken by these vessels as a direct result of the regulation. While there is not enough information to make the necessary estimates, it can be stated qualitatively that increased costs will undoubtedly occur. With reduced revenues and increased costs, producer surplus of the harvest sector would decrease.

The proposed reduction would impact primarily on handliners since they compose the gear user-group catching most of the red snappers landed (Tables 7.13 and 8.2). To a limited extent, longliners and shrimp trawlers would partake of the reduction in catch. The numbers of handline and longline vessels have fluctuated from year to year. These numbers stood in 1986 at 610 for handlines and 242 for longlines, with respective employment of 1,983 and 920 men (Table 7.17). The impact of size limit and quota on the number of vessels and corresponding employment is not quantifiable from existing information.

The impact of size limit and quota on full-time commercial fishermen, primarily handliners and longliners, is partly reduced by the "more than 50 percent earned income" requirement which prohibits part-timers from selling reef fish and in effect subjects them to recreational bag limits (see Section 5.3 for full discussion of this measure). Additionally, shrimp trawlers are restricted to recreational bag limits and would not be legally allowed to sell their catch of reef fish so the potential sales revenue from their catch may be redistributed to other gear users, especially full-time commercial handliners and longliners, although the profitability of full-timers may not necessarily be enhanced, since they will incur higher operational cost. The possibility that trawl bycatch would be redistributed to other gear users is minimal, since this bycatch usually consists of juvenile fish which would be dead when discarded. Also, the reported trawl landings are limited so that even with the bag limits, these catches could be met by trawl crews (see Section 5.2 for discussion on shrimp trawls).

The burden of catch reduction would be shared by the five Gulf states. Table 5.1.1 records the amount of reduction in commercial landings and foregone ex-vessel revenues by each state, apportioned on the basis of the state's proportional red snapper landings averaged over the period 1985-1987. Louisiana and west Florida would be the top losers.

The impacts on economic activities (output, income, and employment) of the expected reduction in red snapper landings are presented in Table 5.1.2. The baseline information essentially means that the

current value of commercial landings of red snapper of $7.942 million has total (i.e., direct, indirect and induced) effects amounting to $17.4 million in total purchases, $5.5 million in income to households, and 417.8 jobs. A 20 percent reduction in ex-vessel revenues would result in total reductions of $2.5 million in sales, $0.8 million in income, and 59.2 in number of jobs.

a.3.2 Impacts on the Recreational Sector

The size limit would mean a reduction in recreational catch of around 29 percent based on 1985-1987 average recreational catch (Table 11.4). Independent of the size limit, the daily bag limit of 7 fish corresponds to a 20 percent reduction in recreational catch (Table 11.3). At the least perhaps, a 29 percent catch reduction will be realized in the recreational sector in the short-run. The additional percentage point reduction due to the interaction of size and bag limits is not readily determinable.[4]

The reduction in recreational catch would bring about a reduction in angler benefits as recreational demand shifts downward due to a deterioration in the "quality" of fishing experience (Huppert, 1983). This loss in benefits cannot be correctly quantified without an estimated recreational demand for red snapper, or at least for reef fish. The closest demand estimate perhaps is the one on king mackerel (Milon, 1988). As earlier discussed, this demand estimate is employed to get a very general impression of the magnitudes involved.

Table 5.1.3 reports loss in consumer surplus as a result of a 29 percent reduction in angler catch of red snapper. As can be seen from the table, the loss in benefits to an average angler ranges from $1.55 to $2.81 per trip. On average, an angler makes roughly 5.3 trips in the Gulf for one year. This is determined by dividing the total number of marine recreational fishing trips in the Gulf (20.3 million) by the total number of anglers in the Gulf (3.8 million).[5] Multiplying the annual number of trips per angler into

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[4] If all undersize fish are caught by anglers who catch less than the 7-fish limit, then the bag limit will have its full effect and so will add 20 more percentage points to the size limit induced reduction, making the total recreational catch reduction equal to 49 percent. On the other hand, if all undersize fish are caught by anglers who catch well above the bag limit, the bag limit will not effectively further reduce the catch, and total catch reduction will be equal only to that attributable to the size limit, i.e. 29 percent.

[5] In computing the total number of anglers and total number of trips, out-of-state anglers and their trips are excluded because of the problem of adding up out-of-state anglers across all the Gulf states. A person can be an out-of-state angler for more than

the per trip loss results in annual loss in consumer surplus per angler that ranges from $8.22 to $14.89. Extrapolated to total anglers targeting red snapper, total loss in consumer surplus to the recreational sector would range from $509,903 to $923,656. These total losses are arrived at by multiplying annual loss per angler by the total number of anglers targeting red snapper. The total number of anglers targeting red snapper is derived by multiplying total number of anglers (3.8 million) by the proportion of anglers targeting red snapper(0.016). The proportion of anglers targeting red snapper is lifted from Table 34 of the 1986 MRFSS report.

Cutbacks in trips taken by anglers directly impact the operations of charter and party boats.[6] Table 5.1.4 shows the geographical distribution of these boats. Although both charter and party boat captains target several species, red snapper is usually ranked highly (see Table 5.1.5). Charter boats take an average number of trips ranging from 93.2 to 165.6 trips depending on geographical location, whereas the corresponding number for party boats ranges from 131.9 to 279.5. Most trips are taken in the Gulf areas, except for Louisiana and Texas charter boats which make most of their trips in bay areas (see Table 5.1.6 for details).

Reduction in angler trips affects mainly the operating revenues of charter and party boats. Major cost items are not expected to be affected significantly over the short-run. Table 5.1.7 shows the 1986 average annual gross revenues of charter and party boats. The absence of an appropriate recreational demand curve for red snapper severely limits the possibility of translating reduction in catch to reduction in number of trips taken by anglers, and subsequently to revenues foregone by charter and party boats. Some rough approximation, though, of these foregone revenues are set forth in Table 5.1.8. Trip reductions of 15 percent and 29 percent are considered. The 15 percent reduction is based on a "success elasticity" of 0.515 found in the same study used in calculating consumer surplus change in the recreational sector (Milon,1988), whereas the 29 percent reduction assumes that the expected catch reduction translates in the same percent reduction in angler trips

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one state. The numbers are based on Tables 31 and 32 of the 1986 MRFSS report. The Texas data are taken from the 1985 MRFSS report, since the 1986 report does not include Texas.

[6] Although to some persons the charter and party boats are considered a component of the commercial sector, they comprise the suppliers of angling sites and are thus considered under this portion of the analysis. Information on the structure and operations of charter and party boats are taken from two MARFIN-financed studies (Ditton et al. [1988] for Alabama, Mississippi, Louisiana, and Texas; and Holland and Milon [1989] for Florida).

(i.e., assumes a unitary "success elasticity"). Reductions in revenues of charter or party boats are calculated as follows:

Gross revenue per boat	x	Total number of boats	x	Mean percent of time species is targeted	x	Percent reduction in number of trips

As can be seen from the table, gross revenue reductions range from around 5 thousand to 969 thousand for charter boats and from 126 thousand to 584 thousand for party boats.

As with the case of the commercial sector, reduction in economic activities in the recreational sector has repercussions on the region's economic activities. Changes in economic activities emanating from the recreational sector are driven by changes in angler expenditures. To estimate the percent change in angler expenditures, the average expenditure per angler is multiplied by the average number of trips with and without the expected reduction in recreational catch. Using information from the 1981 Marine Recreation Fishing Socioeconomic Survey, the average expenditure per trip for reef fish, weighted by the number of trips by mode of fishing, is calculated to be around $40, which would be around $48.80 in 1986 when adjusted for inflation. Using this average expenditure value, the estimated reduction in angler expenditures would range from $2.4 million to $4.7 million corresponding to trip reductions of 15 percent and 29 percent, respectively. The impacts of these expenditure reductions on economic activities are summarized in Table 5.1.9. As shown in the table, total reductions would range from $5.13 million to $9.91 million in output, $1.60 million to $3.09 million in income, and 129.5 to 250.3 in number of jobs.

a.4 Long-Run Impacts

Figures 11.1 through 11.4 depict the long-term status of the red snapper stock and fishery under various management scenarios. Under status quo, the reproductive potential of red snapper continues to diminish into the future. This stock condition translates in dwindling potential catch for both commercial and recreational sectors (Figure 11.4).

Individually and collectively, the size limit and quota help to check the decline in red snapper stock, with the stock recovery becoming more pronounced the lower the quota and bag limit. Under the current proposed measure of 13 inches total length, 3.1 million pound quota, and 7 fish bag limit, the target minimum SSBR of 20 percent will not be reached by the year 2000. In this light, the framework for revising management measures as described in Section 9.2 will have to be used for further reductions.

Table 5.1.10 contains comparative figures of landings and values under the status quo and the proposed size and catch limits on red snapper. Landings are obtained from the same biological simulation model used to generate Figure 11.4 (Goodyear, 1989). The dollar values are derived by substituting landing values into a price forecasting equation (Waters, 1988). If the same size and catch limits were in effect from the years 1990 through 2000, gross revenue with the restrictions would be lower for the first three years and would be greater for the rest of the years. Over the entire ten year period, the present value of the gross revenue under the restricted fishery would exceed the present value of gross revenue under the status quo by $3.2 million, using a 10 percent interest rate.

Several qualifications are in order when interpreting the values presented in Table 5.1.10. First, the commercial catch and revenue for the 1985-87 period, as earlier presented, do not exactly match the 1990 figures in the table. However, the revenue reductions are about the same, if the tabulated figures could be attributed solely to the commercial sector. A major reason for the dissimilarity of the two sets of numbers is the full consideration of the declining status of red snapper stock and the behavior of future prices. While these two features are built into the computation of values reported in the table, these are absent in the 1985-87 estimate. Considering, however, that revenue reductions in both sets of figures are approximately equal, the 1985-87 estimate is used for the short-run analysis. At the same time, this makes the short-run analysis consistent as to the base year across different measures for which the simulation model and price forecasting equation could not be used.

Second, the values in Table 5.1.10 correspond to total potential catches of both commercial and recreational sectors. The valuation method employed is strictly applicable to the commercial sector only so that the magnitude of dollar values presented may not be totally correct, although some confidence can be attached to the direction of net effects. If it can be contended that both sectors proportionately share the impacts of management actions, the valuation employed implicitly assumes that recreational fishermen gain satisfaction from the weight of their catches, especially that the size limit would cause anglers to catch fewer but larger fish. A disproportionate net effect would ensue if the reduction in numbers of fish caught were more valuable than the increase in pounds caught.

Third, as is true with any simulation and forecasting models, the longer the time horizon for the forecast, the less reliable will be the model's predictions. Fourth, the predictions presented in the table abstract from all other management measures concurrently proposed under the amendment. Fifth, the forecasts refer only to the revenue side of the industry so that the depicted gain may or

may not be outweighed by management-induced changes in the cost side of the industry.

There are also several issues related to the long-run situation that need to be recognized. The first concerns the status of the red snapper stock under the proposed management measures. As earlier remarked, the proposed measures are inadequate fo attain the target minimum SSBR ratio of 20 percent. The decline in potential catch after 1993, as shown in the table, is reflective of this inadequacy. This situation raises doubt on the effectiveness of the proposed measures many years beyond the year 2000.

The second issue pertains to the increasing fishing pressure forthcoming from the recreational sectors in particular. Marine angler participation is forecasted to steadily increase. A summary of this forecast, based on a study by the Sports Fishing Institute (1988), is presented in Table 5.1.11. Also presented in this table are approximate numbers of anglers and days fished with red snapper as the target species. These latter numbers are arrived at by multiplying angler participation by the 1984-1986 average percent of anglers targeting red snapper, as reported in the MRFSS. As portrayed in the table, the fishing pressure on red snapper in particular is mounting, but the proposed size and catch limits do not have the inherent mechanism to deter much of the forthcoming pressure. The management induced benefits can only add impetus to the intensifying pressure on the fish stock, with the inevitable consequence of dissipating whatever increase in economic rent achieved by the regulation.

b. Other Snappers

b.1 Current Scenario

At present, there are no specific regulations affecting fishing of other snapper species in the EEZ. However, Florida has imposed size limits of 12 inches total length on mutton and yellowtail snappers. Other Gulf states impose no size restrictions.

Commercial landings of these species as a group have increased through time. Of the five other snapper species, namely gray, mutton, yellowtail, lane, and vermilion, under consideration, only the latter two species have registered a strong upward trend in landings (Tables 8.10 and 8.14). While vermilion is a major component of other snapper landings, lane is not (see Table 8.1). The rest of other snapper species, after reaching a peak sometime in 1982, are showing some signs of stable, if not gradually declining landings (Tables 8.13, 8.15 and 8.16).

Recreational catches of other snappers as a group do not show strong evidence of a trend. If the 1982 data were deleted, these landings would show some declining movement over the years (Table

8.1). For the 1979-1987 period, recreational catches have been about equal to those of the commercial sector.

Gray snapper is currently not experiencing as severe an overfishing as red snapper. The SSBR ratio for gray snapper is estimated to be only slightly below the 20 percent target. In fact, this species' SSBR ratio is not expected to fall well below the target ratio under the current management regime of no regulations (see Figure 11.6). Similar description can be ascribed to the stock status of the other four snappers, if gray snapper can be regarded reasonably as an index for other snappers. But the fishing restrictions imposed on other reef fish species would likely create harvest of these other snapper species.

b.2 Measures

There are three related measures: 1) size limit of 12 inches total length on gray, mutton, and yellowtail snappers and 8 inches total length on lane and vermilion snappers; 2) overall recreational daily possession limit of 10 fish, excluding red, vermilion, and lane snappers, and up to 20 fish per angler for multi-day trips; and, 3) sale prohibition of undersize fish. There is no commercial quota on these species.

b.3 Short-Run Impacts

b.3.1 Impacts on the Commercial Sector

The size limits would bring about a reduction of 30 percent, 19 percent, and 4 percent on the commercial catch of yellowtail, gray, and vermilion snappers, respectively. There is not enough information to estimate the effect of the size limits on lane and mutton snappers. Total reduction in landings would amount to 474,711 pounds. This is equivalent to a 15.6 percent reduction in commercial landings of yellowtail, gray, and vermilion snappers, based on the 1985-87 average landings of these species which stand at around 3.05 million pounds.

Table 5.1.12 summarizes the impact of landings reduction on the revenue side of the commercial sector. Using similar procedure and flexibility as in the red snapper case, total ex-vessel revenue foregone by the commercial sector would amount to $503,060.

There are two points worth noting with respect to the estimated landing reduction and foregone revenues. First, reductions due to the size limits on lane and mutton snappers are not included due to lack of information. Second, other snapper landings in Monroe county, Florida, fall under the jurisdiction of both the South Atlantic and Gulf of Mexico Fishery Management Councils. Waters (1988) has estimated that the 1978-85 average percentage of commercial landings in Monroe County that came from South Atlantic

were 76 percent for yellowtail snappers, 31 percent for gray snappers, 0.64 percent for vermilion snappers, 54 percent for lane snappers, and 48 percent for mutton snappers. While the first point would indicate further reduction, the second point would mean less reduction than has been estimated. These two are not necessarily offsetting. In fact, there appears more reason to believe that the latter would dominate so that actual reduction due to the size limit on other snapper would be less than that presented in Table 5.1.12.

As with the red snapper case, full accounting of changes in consumer and producer surpluses cannot be made in the absence of an estimated ex-vessel supply curve and appropriate demand and supply curves in other markets.

Compliance to the size limits may be a problem since there are numerous species under the other snapper complex. A relatively higher enforcement cost may have to be incurred to achieve the expected reduction in catches of these species.

The bulk of the catch reduction falls on handline users. Almost all commercially caught undersize vermilion snappers are caught by these persons (Figure 8.17). Also, about 23 percent of their gray snapper landings are below the size limits (Figure 8.19). Size restrictions on gray and vermilion snappers affect bottom longline and other gear users only minimally. The size limit on yellowtail snappers affect most gear type users, especially users of fish traps, handlines, and electric reels (Figure 8.20). It may be noted, though, that the 50 percent earned income requirement would lighten the impact of the size limits on full timers at the expense of part-timers.

Geographically, the burden of the size limits on other snappers fall largely on west Florida, which accounts for more than 90 percent of Gulf landings of these species (see Tables 8.10 and 8.13 - 8.16). The geographical distribution of landings reduction and foregone revenues is also presented in Table 5.1.12. As alluded to earlier, foregone revenues in states other than Florida are minimal.

Landings reduction due to size limits on other snappers cause reductions in economic activities in terms of reductions in output, income, and employment. Using similar procedure earlier employed for red snapper, these impacts on economic activities are calculated and results are reported in Table 5.1.13. The total impacts of ex-vessel revenue reductions would be reductions of around $1.13 million in output, $0.43 million in income, and 30.7 in number of jobs.

b.3.2 Impacts on the Recreational Sector

The percent reductions in recreational catch of other snappers due to the size limit are summarized in Table 5.1.14. Reductions range from 8 percent for lane snappers to around 60 percent for gray snappers. The percent reduction for gray snappers is particularly significant, since recreational catch (in terms of number of fish) of this species comprises slightly more than 25 percent of total "other snappers" catches. Overall reduction amounts to 898 thousand fish, or 1.1 million pounds. This reduction is roughly equivalent to 35 percent of total other snapper catches of recreational fishermen.

Two qualifications accompany the estimated percentage reductions. First, as with the case of the commercial sector, a significant portion of other snapper catches may originate from the Atlantic side of Monroe County, Florida, so that the reduction in recreational catch of other snapper due to the size limit may be lower than the above estimate. Second, a possibly large portion of reported gray snapper catches comes from state waters, particulary Florida's, so that unless states adopt the same size limit proposed for the Federal waters, actual reduction in catch may be lower than the presented estimate.

Independent of the size limit, the bag limit has several possible effects, depending on the distribution of catch within the bag limit of ten fish. Assuming that the composition of the bag limit is proportional to catches made during the 1985-1987 period, a bag limit of 10, consisting of gray, mutton, and yellowtail, would result in a reduction of 19 percent in recreational catch of other snappers. Again, it is not known how much would be the total reduction in recreational catch of other snappers due to the size and bag limits together. However, it is very likely that the reduction due to the size limit would dominate in the short-run, and thus an overall reduction of 35 percent in recreational catch of other snappers can be expected.

Considering that there are several species under the other snapper complex, some of which are regulated and others not, compliance may become problematic, especially for novice anglers who may not be able to distinguish one species from another. Under this situation, enforcement costs would tend to rise to achieve the desired catch reduction.

Losses in consumer surplus due to a 35 percent reduction in recreational catch of other snappers are presented in Table 5.1.15. The loss in consumer surplus of an average angler would range from $1.88 to $3.39 per trip. Multiplied by the annual number of trips, annual loss would range from $9.96 to $17.97 per angler. Extrapolated to the total number of anglers targeting other snappers, total loss in consumer surplus to the recreational sector as a result of catch reduction in other snapper would range from

$413,948 to $746,851. The total number of anglers targeting other snapper is estimated as a proportion of total number of anglers targeting red snapper. This proportion is 0.67, and is based on the 1981 Marine Recreation Fishing Socioeconomic Survey.

A 35 percent reduction in recreational catch of other snappers would reduce the number of angler trips by 18 percent and 35 percent, corresponding to "success elasticities" of 0.515 and 1.0 earlier used for red snapper. The impacts of these angler trip reductions on the operating revenues of charter and party boats are summarized in Table 5.1.16. The same method earlier used for red snapper is used in calculating revenues foregone by charter or party boats. For charter boats, revenue reductions would range from $2,841 to $478,006 while for party boats revenue reductions would range from $61,874 to $287,847.

Reductions in angler trips mean reductions in angler expenditures. Using the same procedure as in the red snapper case, the reduction in angler expenditures resulting from size and catch limits on other snappers is estimated to range from $1.9 million to $3.8 million corresponding to trip reductions of 18 percent and 35 percent, respectively. The repercussions of these expenditure changes on economic activities are summarized in Table 5.1.17. The total impacts of these angler expenditure reductions would be reductions ranging from $3.62 million to $7.04 in output, $1.22 million to $2.37 million in income, and 86.9 to 168.9 in number of jobs.

b.4 Long-Run Impacts

Figure 11.6 describes the long-run situation in the gray snapper fishery under various management measures. Earlier discussion concluded that in the short-run, the size limit would dominate the bag limit proposed for other snappers. As may be recalled, no quota on catch is proposed for the commercial sector.

The minimum SSBR target will be attained within ten years, even if only the size limit is adopted. This is partly due to the fact that current SSBR ratio for gray snapper is merely slightly below 20 percent and partly due to a significant reduction in recreational catch (60 percent) for this species, subject to a qualification earlier noted. Net gain in benefit is expected to be relatively small. As in the short-run case, gray snapper is taken as an index for other snappers. Lack of data prevented using biological simulation models to examine long-run impacts for other snapper species.

Restrictions on other reef fish species coupled with an almost inevitable significant increase in angler population would increase the pressure on other snapper stocks. The bag limit would eventually become effective, but only with respect to the recreational sector. To a limited extent, the longline prohibition

(see Section 5.2.c for discussion on longlines) prevents further exploitation of this species in certain areas. The requirement on permit to sell reef fish may partly act as a barrier to further entry into the fishery, including the other snapper segment.

c. Groupers

c.1 Current Scenario

The current FMP imposes no restrictions on fishing of groupers in the EEZ. Florida, on its own, has adopted a uniform size limit of 18 inches total length on groupers caught in state waters. Other Gulf states have imposed no size limits.

Commercial landings of groupers have been increasing over the years. Since 1979, they have comprised more than 50 percent of all commercial reef fish landings and have replaced snappers as the dominant species in the commercial reef fish fishery. Market acceptance of the species, as partly demonstrated in increasing price these species command, is a major factor increasing grouper landings. Longline catch accounts for a major portion of supply. Florida, where most longliners concentrate, dominates other Gulf states in grouper landings (Figure 8.21).

Recreational catches of groupers have paralleled commercial landings in recent years. Recreational catches of groupers are slightly over one-half of their commercial counterpart (Table 8.1). Like the case in the commercial sector, most recreational catches occur in Florida.

The SSBR ratio for deep water groupers (misty, snowy, warsaw, yellowedge) cannot be estimated for lack of data. Among shallow water groupers, the SSBR ratio can be calculated only for red, gag and black groupers which are generally harvested from the same areas. A relatively strong evidence of overfishing exists for red groupers. Gag and black groupers are barely within the 20 percent minimum SSBR target. The information base for other grouper species, especially deep water groupers, is too weak to sufficiently describe the stock status of these grouper species.

c.2 Proposed Measures

There are three related measures here: 1) size limit of 20 inches total length on red, Nassau, yellowfin, black, and gag groupers and 50 inches total length on jewfish; 2) recreational bag limit of five fish per person with a two-day catch allowance and commercial quota of 11 million pounds, subdivided into 9.3 million pounds for shallow water groupers and 1.7 million pounds for deep water groupers; and, 3) sale prohibition of undersize fish. Jewfish is excluded from the commercial quota.

c.3 Short-Run Impacts

c.3.1 Impacts on the Commercial Sector

The size limit on red, gag, and black groupers would affect around 65 percent, 4 percent, and 34 percent of commercial landings of these species, respectively (Figures 8.22, 8.27, and 8.28). Information is insufficient to estimate the effect of size limits on commercial landings of such grouper species as Nassau, yellowfin, and jewfish, but the percentage reduction for black and gag is assumed for these species.

Based on 1985-1987 average landings, the 11 million pound quota is roughly equivalent to a 14 percent reduction in total grouper catch of the commercial sector. From the magnitude of percentage reduction, the size limit would dominate the quota for shallow-water groupers; for deep-water groupers, the quota would readily apply. Applying the size limits on shallow-water groupers and the quota on deep-water groupers, total reduction in commercial landings would amount to 42 percent of the 1985-1987 average. The size limit alone on shallow-water groupers would result in a 47 percent reduction in commercial catch of these species. These figures are arrived at by applying the 14 percent reduction due to the quota on deep-water groupers and the following percent reductions in shallow-water species: 65 percent on red grouper, 19 percent on black and gag groupers, and 19 percent on other shallow-water groupers. In poundage terms, the 42 percent reduction would amount to 5.3 million pounds.

Table 5.1.18 summarizes the impact of landings reduction on the revenue side of the commercial sector. Catch reductions and foregone revenues are shown in this table. The flexibility coefficient used to estimate price change is -0.4614, which is lifted from the cited Keithly/Prochaska (1985) study. Allocation of revenue loss by state is based on average grouper landings by state for the 1985-1987 period. Total ex-vessel revenues foregone by the commercial sector would amount to around $6 million.

The effects of size limits and quota on groupers would affect mainly Florida, since about 90 percent of grouper landings take place in this state. Reduction in consumer benefits due to landings reduction cannot be estimated with currently available information.

The impact of size limits and quota on the cost side of the industry cannot be estimated with presently available information. Most grouper catches of fish traps, handlines, and longlines would be affected by the size limit. Electric reel users are impacted to a lesser extent.

Reductions in economic activities induced by landings reductions are calculated using the same procedure employed on previous

species. The calculated figures are presented in Table 5.1.19. Total impacts resulting from reductions in ex-vessel sales would be reductions of $11.29 million, $4.25 million, and 303.9 in output, income and employment, respectively.

c.3.2 Impacts on the Recreational Sector

Although there is a bag limit on the recreational catch of groupers, the proposed size limit can be expected to have a major impact on anglers. Reductions in recreational catch of groupers as a direct result of the size limit are presented in Table 5.1.20. The percent reductions are relatively high, ranging from 34 percent for gag groupers to 92 percent for jewfish. Weighted by the number of recreational catch for the species listed in the table, overall reduction due to the size limit would be around 60 percent.

Anglers in Florida would be primarily affected by the size limit as most catches of groupers by anglers occur in this state. Although anglers using all types of fishing mode are affected, those fishing farther offshore are usually the least impacted.

As previously noted, Florida already has an 18-inch size limit on groupers. The extent of compliance with this law is not known. If current non-compliance is widespread, its extension to the EEZ is a possibility. However, if the major reason for non-compliance is the fact that no Federal regulation on groupers currently exists, then the proposed size limit could reenforce the state's regulation. Of course, the two-inch difference in Florida and Federal size limits still maintains a potential loophole.

Losses in consumer surplus due to a 60 percent reduction in recreational catch of groupers are presented in Table 5.1.21. The loss in consumer surplus of an average angler would range from $3.22 to $5.81 per trip. Multiplied by the annual number of trips, annual loss would range from $17.07 to $30.79 per angler. Extrapolated to the total number of anglers targeting groupers, total loss in consumer surplus to the recreational sector as a result of catch reduction in groupers would range from $1.2 million to $2.1 million. The total number of anglers targeting groupers is estimated by multiplying the total number of anglers by the proportion of anglers targeting groupers. This proportion is 0.0177, and is from Table 34 of the 1986 MRFSS report.

Using the same "success elasticities" earlier employed, a 60 percent reduction in grouper catch would result in a 31 percent to 60 percent reduction in number of trips taken by anglers. The 31 percent and 60 percent trip reductions correspond to "success elasticities" of 0.515 and 1.0, respectively.

Charter and party boats would experience a reduction in their operating revenues as a consequence of the reductions in angler trips. The revenues foregone by these boats, using the same

procedure earlier applied for red snapper, are summarized in Table 5.1.22. Revenues foregone would range from $638 to $3.7 million for charter boats and from $28,434 to $1.3 million for party boats.

Reductions in angler expenditures corresponding to reductions of 31 percent and 60 percent in angler trips would range from $5.5 million to $10.7 million. Based on these expenditure reductions, changes in economic activities are generated,and results are reported in Table 5.1.23. The total impacts would be reductions ranging from $10.35 million to $20.03 million in output, $3.47 million to $6.72 million in income, and 245.4 to 475 in number of jobs.

c.4 Long-Run Impacts

The long-run conditions in the red grouper fishery under various management measures are depicted in Figure 11.5. The proposed 20-inch size limit would have more pronounced impacts than the 18-inch size limit. Although the size limit alone would have a tremendous impact on both commercial and recreational catches, the target SSBR would not be reached. However, it would almost double by year 2000 with significant increases in yield per recruit. Very likely, a net gain in benefits can be derived from the measure, at least for shallow water groupers for which red grouper is taken as an index.

One side effect of the measure may be to induce further exploitation of deep water groupers. A significant amount of these species is being landed in Florida, but an increasing exploitation by fishermen from other Gulf states is evident. Eventually, the grouper commercial quotas would take effect as bigger shallow water species are caught and more harvest of deep water species is realized. To what extent the recreational bag limit would be effective is not known. Although the mentioned longline prohibition and other commercial gear restrictions would free some groupers now exploited by these gear types, the recreational sector may not necessarily take over since other commercial gear users may still be around. To a certain extent however, the bag limit would put up a slight restraint on the growing recreational exploitation of the grouper fishery, particularly to shallow water species.

d. Amberjacks and Sea Basses

d.1. Current Scenario

Fishing of sea basses and amberjacks in the EEZ is not subject to any size or catch limits under the existing FMP. Among the Gulf states, only Florida has adopted an 8-inch size limit on sea basses in state waters. No size or catch restriction is imposed on amberjacks by any of the Gulf states.

Commercial landings of sea basses suggest a downward trend from a peak of 143,000 pounds in 1972. The average for the 1985-1987

period was approximately 26,000 pounds. On the other hand, commercial landings of amberjacks have registered a tremendous increase from a low of 40,000 pounds in 1973 to a high of 1.8 million pounds in 1987. The average landing for the 1985-1987 period stands at around 1.3 million pounds. Florida accounts for most of the commercial landings of these species.

Recreational catches of both amberjacks and sea basses have dominated commercial landings of these species, at least since 1979. A trend in recreational catches of these species is not evident from the reported figures. However, the last three years saw a decline in sea bass catches and an increase in amberjack catches. Most catches of these species occur in Florida.

Current SSBR ratio for greater amberjack, an amberjack species under consideration, has been estimated to be around 7 percent. This low figure suggests that greater amberjacks are now severely overfished. No SSBR ratio can be calculated for black sea bass, the sea bass species under consideration.

d.2. Proposed Measures

The specific measures here consist of the following: 1) size limit of 8 inches total length for black sea bass; 2) recreational size limit of 28 inches fork length and commercial size limit of 36 inches fork length, for greater amberjack; 3) recreational daily possession limit of 3 fish per person, with allowance of up to 6 fish for multi-day trips, for greater amberjack; 4) sale prohibition of undersize fish and fish caught under the bag limit. Neither a commercial quota on sea basses and amberjacks nor a recreational bag limit on sea basses is proposed.

d.3. Short-Run Impacts

d.3.1 Impacts on the Commercial Sector

The size limit on black sea bass virtually has no effect on commercial catch, presumably due to adherence by commercial fishermen to the Florida size limit. The size limit on greater amberjack would affect around 60 percent of total commercial landings of this species.

Table 5.1.24 details the effects of a 60 percent reduction in commercial landings of greater amberjack. There is no ex-vessel demand estimate for greater amberjacks. Also, the demand model of Keithly and Prochaska relates to snappers and groupers only. For lack of an appropriate demand estimate, the flexibility co-efficient for groupers is employed to estimate the change in the price of greater amberjacks. As can be observed from the table, revenue loss is not very large and most of it falls on Florida. Foregone revenue would amount to $362,064 with more than 66 percent of it falling on Florida.

As in previous species, the impacts on the cost side of the industry cannot be quantified with current information. It can only be noted that the size limit would impact mostly users of handlines.

Using similar procedures earlier used, the impacts on economic activities are estimated. Table 5.1.25 contains these estimates of impacts on economic activities. The total impacts of the reduction in ex-vessel revenues would be reductions of around $0.71 million in output, $0.26 in income, and 18.5 in number of jobs.

d.3.2 Impacts on the Recreational Sector

As shown in Table 5.1.26, the size limit on amberjack and sea bass would affect around 63 percent and 7 percent of the recreational catches of these respective species. The bag limit on greater amberjack would reduce recreational catch of this species by around 45 percent, based on 1985-1987 average catch.

The reduction in recreational catch due to the interaction of size and bag limits is not readily ascertainable. At the least, however, a 63 percent reduction on recreational catch of greater amberjacks can be expected from the size and bag limits. For purposes of analysis, reductions of 7 percent and 63 percent in recreational catches of black sea bass and greater amberjack, respectively, are assumed. Total reductions in recreational catch of these species would be around 14 percent of their combined total recreational catches, averaged over the period 1985-1987.

Losses in consumer surplus due to a 14 percent reduction in recreational catch of black sea bass and greater amberjack are presented in Table 5.1.27. The loss in consumer surplus of an average angler would range from $0.75 to $1.36 per trip. Multiplied by the annual number of trips, annual loss would range from $3.98 to $7.21 per angler. Extrapolated to the total number of anglers targeting amberjacks and sea basses, total loss in consumer surplus to the recreational sector as a result of catch reduction in other snapper would range from $141,956 to $257,166. The total number of anglers targeting amberjacks and sea basses is estimated by multiplying the total number of anglers by the proportion of anglers targeting sea basses. This proportion is 0.0092, and is lifted from Table 34 of the 1986 MRFSS report.

To determine cutbacks in angler trips, the same "success elasticities" earlier employed are used. Cutbacks in angler trips due to a 14 percent catch reduction range from 7 percent to 14 percent. The impacts of these trip cutbacks by anglers on the operating revenues of charter and party boats are reported in Table 5.1.28. These figures are calculated using similar procedure used in the case of the red snapper species. Revenue reductions would

range from $381 to $852,214 for charter boats and from $494 to $171,023 for party boats.

In order to estimate the impacts on economic activities resulting from recreational catch reductions in amberjacks and sea basses, cutbacks in angler trips are first translated in terms of reductions in angler expenditures. Corresponding to trip reductions of 7 percent and 14 percent, reductions in angler expenditures would range from $645,762 to $1.3 million. Reductions in economic activities resulting from catch reduction in the recreational sector are estimated using similar procedure earlier used. These impacts are summarized in Table 5.1.29. The total impacts of reductions in angler expenditures would be reductions ranging from $1.21 million to $2.42 million in output, $0.41 million to $0.81 million in income, and 28.9 to 57.8 in number of jobs.

d.4 Long-Run Impacts

The long-run conditions of the greater amberjack fishery under various size limits are described in Figure 11.7. The 36-inch or the 28-inch size limit alone would be inadequate to reach the target minimum SSBR by year 2000, but it could significantly raise the ratio from a current low level of 7 percent to around 15 percent for the 36-inch size limit or 11 percent for the 28-inch size limit. The yield per recruit would also significantly increase above its current level. The increase in potential yield over a ten-year period suggests that some net benefit can be gained from the proposed size limits.

The recreational sector would bear a bigger portion of the initial reduction in greater amberjack catches. To the extent that bigger sized fish would provide more angler benefit, the recreational sector could partake of the benefits from management, even at the face of a three-fish bag limit which could affect a significant portion of this sector. In a limited way, the bag limit provision can partly stall the increase in fishing pressure from the recreational sector. In addition, the required permit to sell could somehow slow down entry into the commercial sector. But then of course, the enhanced attractiveness of greater amberjack as a target species for both sectors would only induce innovations in the methods of catching this species, especially if restrictive measures on other reef fish species are considered.

The long-run situation for black sea bass is relatively unknown. The apparent compliance of the commercial sector to the Florida size limit implies that the proposed similar size limit in the EEZ would have no long-run impact on this sector. It is possible, though, that the proposed size limit would deter this sector from harvesting sublegal sized fish when other sectors of the reef fish fishery are placed under stringent restrictions. The recreational sector, on the other hand, would be affected by the size limit on

black sea bass. The initial effect is relatively insignificant but could turn out to be burdensome as more restrictions are imposed on other target species, or as the commercial sector starts to directly target this species.

5.2. Gear Restrictions

a. Fish Traps

a.1. Current Scenario

The use of traps for fishing reef fish is prohibited in Florida state waters, but is permitted in federal waters. Fish traps, however, are subject to several restrictions when used in federal waters. They are banned in defined stressed areas, and are subject to design specifications if used outside these areas. There is a limit of 200 traps per vessel imposed on this sector. In addition, permits with accompanying tags are required to fish traps, but no fee is assessed for requiring such permits/tags. These permits are issued on a life-time basis. In 1987, the fish trap sector was subjected to a logbook reporting program.

Table 7.18 gives a very general description of the fish trap sector. For the period covered, the fish trap sector has consisted of 36 vessels, 83 persons employed, and 1,432 traps on the average. As of June, 1988, 475 fish trap permits and 32,786 trap tags had been issued by NMFS for the Gulf fishery, or an average of 70 trap tags per permittee. In a 1987 mail survey of 377 then current permit holders, 94 indicated they were actively fishing traps, 164 indicated they were not, and 119 did not respond. Those active ones were issued logbooks, but only 12 reported. In early 1988, few active trap fishermen were located by canvassing major fishing ports (ESO, 1988). The trap fishery is considered to be concentrated mainly in two Florida counties, Collier and Monroe, and trap fishing is conducted primarily during the spiny lobster and stone crab closed seasons.

Reef fish catches of traps comprise a small percentage of total reef fish landings of the commercial sector, with only at an average of 4.1 percent for the period 1985-1987. Slightly greater than 90 percent of reef fish caught by fish traps consists of groupers. To a limited extent, snappers other than red and sea basses are caught in fish traps. Taylor and McMichael (1983) found that target species made up of 91 percent and 61 percent of total weight catches of fish traps in Collier and Monroe counties, respectively. Logbook reports also showed that target species comprised around 96 percent of fish trap catches. However, it has been found out that in areas and cases where they are managed minimally, fish traps have the tendency to capture substantial numbers of non-target species (Craig, 1986; Dammann, 1980; Stevenson and Stuart-Sharkey, 1980) and to severely depopulate reef

fish communities in the Carribean (Stevenson and Stuart-Sharkey, 1980).

a.2. Proposed Measures

The salient features of the proposed measure affecting fish traps are: 1) each permit holder is limited to 100 fish traps; 2) permits and tags are issued on an annual basis and are valid only for the fishing year they are issued, 3) a fee is charged to recover both direct costs of issuing permits/tags; and 4) reports, monthly at the minimum, are required of permittees, with violation thereof resulting in revocation of permits for one year.

a.3. Short-Run Impacts

A few but unknown number of fishermen fishing traps would be directly affected by the 100 trap limit. Of those active trap fishermen who responded to the mail survey conducted by NMFS in 1987, 72 percent indicated they were fishing fewer than 50 traps. Also, around 50 percent of these persons indicated they fished traps for six months or less. It is very likely, then, that the 100 trap limit, by itself, would minimally affect trap fishermen since Table 7.18 indicates an average of 50 traps per vessel in 1986.

There is a possible, but nonquantifiable, effect that may be brought about by the 100 fish trap limit in conjunction with the size limit. The size limit alone would affect around 83 percent of grouper catches by fish traps and around 86 percent of yellowtail snapper catches by fish traps (see Goodyear, 1986b). The overall impact of the size limits (on groupers and snappers) on fish traps is a reduction of around 78 percent of all marketable reef fish catches by fish traps excluding species other than reef fish. One recourse, among many, for fishermen to offset this significant reduction due to the size limit is to increase their number of traps. Under this condition, it is possible that the 100 trap limit would prevent them from expanding to the extent of offsetting a significant portion of size limit induced catch reduction. However, if each trap fisherman is now currently operating at his most profitable position, theory predicts that a reduction in average and marginal productivity, or equivalently an increase in average and marginal cost, will cause a reduction in the number of traps. In this situation, the trap limit will have no effects.

The fee assessed on trap permits would be essentially a transfer of cost from general public to users of fish traps. To a limited extent, this avoids creating more inefficiencies in the sense that actual users of a common resource, rather than the general public, shoulder the cost of resource exploitation. This cost, however, is inconsequential with respect to the actual value of a public resource exploited by fishermen. The cost has been estimated to

be around $23.36 per permit and $0.70 per tag (Justen, personal communication to Swingle, 1989). Assuming all the 475 current permit holders apply annually for 70 traps each (which is about the number of tags per permittee), total annual cost to the fish trap sector would be around $34,371. If only the 94 active fishermen apply, the cost would be $6,802.

The monthly report would require extra cost to trap users in terms of time needed to file reports. It may be noted, however, that at present, active fish trappers are required to file a monthly report, but the amendment makes it mandatory to file a report even when not actively fishing for traps. The current FMP estimated this time to be around one hour per month per vessel owner/operator for all trips during the month. Burden hours for new reporting requirement are estimated at 1,500 hours for all vessels.

a.4. Long-Run Impacts

The permit fees and additional labor cost will continue to be incurred over the years fishermen decide to remain in the fish trap sector. Current information on activities of fish trap fishermen is very limited to determine the impact of the 100 trap limit on the sector's capitalization. If most of these fishermen are primarily spiny lobster and stone crab fishermen, the 100 trap limit will very unlikely affect their decisions on fish trap related capital expenditures.

As earlier mentioned, the size limit on groupers and snappers would increase marginal and average cost of trap fishermen. Over the long-run, the implication of this increase is that marginal producers will leave the industry while each of those remaining will increase his capacity to catch. Among others, this means that each fisherman will increase his number of traps. To the extent that the 100 trap limit prevents such increase, industry profitability will suffer. In this, however, an increase in the release mortality of caught sublegal fish can be indirectly prevented by limiting fish traps. It is not very clear, though, if over-all release mortality of sublegal fish is lowered if these fish are instead caught by other gear types, like hook and lines or longlines.

b. Trawls

b.1. Current Scenario

Under the current FMP, roller trawls, which are used for finfish over rough bottoms, are prohibited in the stressed area. As the stressed area is proposed to be expanded (see Section 5.4 for discussion on stressed area), so will the area for the prohibition on roller trawls. Incidental catches of reef fish by other trawl operations, like shrimp and groundfish trawls, are not subject to size limits, but possession of undersize reef fish is limited to

no greater than five percent of all other finfish and shellfish caught.

Catches of reef fish by trawls are essentially incidental to trawling operations. The average landed trawl catch of reef fish for the 1985-1987 period was 89,974 pounds, or 0.42 percent of total commercial reef fish landings for the period. This represents a considerable decrease in trawl catches of reef fish from the 1972-1984 period which averaged around two percent (Table 7.27). Red snappers (69 percent) and groupers (13 percent) comprise the majority of reef fish caught by trawls.

In addition to the landed poundage figures is the number of fish, especially red snapper, caught by shrimp trawls and probably discarded. It has been estimated that shrimp trawl bycatch of red snapper ranges from 4 to 12 million fish, with bycatch of other reef fish being minimal (see Section 7 of Amendment 1). Obviously, this bycatch consists mostly of pre-recruit red snappers. Most of this bycatch of red snappers occurs off the coast of Texas and Louisiana.

b.2. Proposed Measure

The proposed measure subjects trawl vessels to recreational size and bag limits with respect to their catches of reef fish.

b.3. Short-Run Impacts

The measure, in effect, prohibits the use of trawls for directed harvest and sale of reef fish. There is very little indication of the existence of this sector in the reef fish fishery, so that in this regard, the measure's impact would be very negligible. However, some crew members of trawl vessels who fish for reef fish using hook-and-line when the vessels are not actively trawling would be adversely impacted, since they also would have to comply with the restrictions on recreational catch.

The measure would not change the amount of incidental reef fish catch in trawl operations, although some portion of such catch would be discarded. The reef fish industry revenue would hardly be affected by the measure, even considering some extreme cases of bycatch composition, but taking into account the size and catch limits.

If all reported reef fish landings of trawls were of legal size, the recreational bag limit would not affect the average catch of trawl crews; however, they could not sell the catch. Assuming an average of three people per boat, the possession allowance means 15 red snappers per boat per trip. As of 1983, there were around 5,000 shrimp trawl vessels operating in the Gulf. Even using this number of boats, the possession allowance implies that the current reef fish landings of trawls can be virtually exceeded. In this

case, the 89 thousand pounds, valued at $106 thousand would be lost to the trawl crews. However, these figures are minimal compared to the reduction due to the size limit and quota on several reef fish species. Thus, no additional revenue loss would be forthcoming from the measure affecting trawls. Nevertheless, the measure would impinge on the income of some crew members with around 15,000 fishermen losing, on average, about $7 each annually. Of course, this income reduction would be significant for some trawl crews, and could prompt a renegotiation of crew share in order to shift some of the loss to boat owners.

b.4. Long-Run Impacts

Long-run costs in terms of gear and vessel changes and costs associated with entry/exit in the trawl industry are not affected by the measure. The net benefit specific to the measure depends mainly on the extent to which reef fish stock, and, consequently, revenue to the commercial sector and benefit to the recreational sector are enhanced.

Long-run net benefit accrues if the mortality rate of the discarded fish is low. In the particular case of red snappers, it has been estimated that the elimination of trawl bycatch has the potential to increase the yield to the fishery by 10 to 90 percent (Powers et al., 1987; see also Section 7 of Amendment 1). Also, it has been estimated that, depending on the amount of shrimp trawl bycatch and fish population parameters, losses due to trawl bycatch of juvenile red snappers would range from 111 thousand pounds (125 thousand fish) to 12.8 million pounds (7.6 million fish).

At a 20 percent survival rate between the bycatch age and recruitment to the fishery, potential red snapper catch will increase in the range of 111 thousand pounds (125 thousand fish) to 490 thousand pounds (290 thousand fish), under certain conditions (see Table 8.8). To the commercial sector, this would mean an increase in revenue ranging from $230 thousand to $1.01 million using 1985-1987 average red snapper price. Over the period 1990-2000, an annual increase in catch by such amounts would mean an aggregate revenue ranging from $ 1.5 million to $ 6.6 million, at an interest rate of 10 percent.

It is doubtful, however, that the measure can achieve at least the 20 percent survival rate, since it does not directly prevent shrimp trawl bycatch of juvenile red snappers in particular and reef fish in general.

c. Longlines and Buoy Gear

c.1. Current Scenario

There is no restriction currently imposed on the use of longline and buoy gear for fishing reef fish in the EEZ. Also, none of the

Gulf states has imposed restrictions on the use of these gear types in state waters.

Longlines and buoy gear are of relatively recent origin as part of the Gulf reef fish fishery (see Section 7, pages 55-59). At present, longlines rank next only to handlines in terms of quantity of reef fish caught.

The longline sector's contribution to total reef fish landings increased from 1 percent in 1979 to 36 percent in 1982 and have fluctuated since then. For the 1985-1987 period, longlines account for an average of 29 percent of total reef fish landings. The species accounting for a major portion of these longline catches are groupers (85 percent) and red snappers (6 percent). Of all groupers caught in the Gulf, around 42 percent by weight is accounted for by longlines.

Around 83 percent of longline catches of all species are landed in Florida, and close to 90 percent of these longline landings are groupers. Most Gulf longline vessels are located in Florida (Table 7.26) and most grouper catches are off the coast of southern Florida (Table 7.4). Presumably, longliners fishing off the coast of Florida have learned that longlines are highly efficient gear types. Deep water groupers, though, which comprise around 12 percent of all grouper landings, mostly come from northwest Florida and other Gulf states.

Longlines have been demonstrated to be a highly efficient gear type (Poffenberger, 1985). This could partly explain this gear type's sudden rise in the Gulf reef fish fishery. Despite its efficiency however, there is no clear evidence suggesting a shift to this gear type under current management rules. In fact, the number of longline vessels has been fluctuating since reaching a peak of 282 in 1982. It is possible, though, that conditions in other commercial fishing undertaking, the proposed restriction on fish traps, and the proposed ban on entangling nets would boost interest in longline/buoy gear if no restrictions are imposed on these gear types.

c.2. Proposed Measures

The proposed measure prohibits the use of longline and buoy gear for directed harvest of reef fish within 50 fathom isobath west and 20 fathom isobath east of Cape San Blas, Florida, respectively. In addition, incidental catches from using these gear types in other fisheries within the restricted areas are subject to the daily recreational size and bag limits.

c.3. Short-Run Impacts

For purposes of analysis, the areas subject to the 20 fathom isobath and 50 fathom isobath restrictions are respectively denoted

as eastern and western Gulf. Catches in statistical grids 1 through 7 are considered catches in the eastern Gulf; the rest of the domestic catches, in the western Gulf. This classification closely adheres to the proposed demarcation line for the 20-fathom and 50-fathom isobath prohibition for longlines.

Table 5.2.1 shows catches separated into the eastern and western areas of the Gulf. The percentages in this table are based on longline catches, by species and statistical grids, as reported in the stock assessment (Goodyear, 1988b). In the report, all species of groupers are combined into one category. Based on 1986-1987 average catch of groupers by statistical grid, around 67 percent of deep water groupers and 7 percent of shallow water groupers are caught in the western Gulf. The 1985 breakdown of grouper catches is not used because 98 percent of groupers is reported under the category "unclassified". This information is used to separate deep and shallow water groupers into the eastern and western areas of the Gulf. The allocation for shallow water groupers is also applied to jewfish.

Information from Table 11.26, averaged over the period 1985-1987, is used to assign catches by depth. Taken as indices are red snapper for all snapper species, red grouper for shallow water groupers (including jewfish), yellowedge grouper for deep water groupers, and "all" reef fish for all other reef fish species.

The impacts of longline prohibition on this gear type's catches are presented in Table 5.2.2. As can be observed from the table, longlines in the western Gulf would experience bigger catch reduction than their eastern counterparts. In fact, around 70 percent of the total reduction in longline catch due to the prohibition would come from the western Gulf. Mainly groupers compose the species subject to reduction on both sides of the Gulf. Although most shallow water groupers are caught in the eastern Gulf, the reduction on catch of these species would be slightly bigger in the western side. Deepwater groupers in both sides of the Gulf would not be reduced by the prohibition. Total reduction in longline catches of reef fish for the entire Gulf due to the prohibition would amount to around 750 thousand pounds. Reduction in grouper catch alone would amount to around 458 thousand pounds for the entire Gulf.

The differential impact of the longline prohibition would be partly narrowed by the size limit, especially the size limit on groupers. The size limit alone would affect as much as 49 percent of red grouper, 12 percent of greater amberjack, and 0.4 percent of red snapper catches by longlines. Taking red grouper as an index for shallow water groupers, a 49 percent reduction due to the size limit would translate to a reduction of 2.6 million pounds in longline catches of groupers. This reduction is even bigger than the reduction in longline catches of all species as a result of the prohibition.

Purely on the basis of magnitude of reductions involved, the size limit would be more restrictive than the longline prohibition, at least over the short-run. It is not possible to quantify the impacts on longlines accruing to both size limit and longline prohibition acting together, although there is some reason to believe that their impacts would not be additive as undersize fish are generally caught in shallower waters. Relative to an earlier finding that the size and catch limits on groupers would effect a reduction in commercial catch of 5.3 million pounds, the longline prohibition alone would mean that around 14 percent of that reduction would fall on longliners whereas the size limit would mean that longliners would have to bear 55 percent of that catch reduction. Based on grouper landings alone, longliners would have to forego revenues amounting to $403 thousand and $3.5 million corresponding to the longline prohibition and size limits, respectively, on groupers.

Although the prohibition on longlines and buoy gear would result in a revenue reduction in this sector of the commercial fishery, it is highly probable that such reduction would not add any more percentage points to the reductions in the entire reef fish industry's revenues resulting from the size limit and quota earlier discussed. It is even possible that catch losses due to the prohibition would be partly offset by catches of other gear users, particularly handliners. In that case, however, the profit configuration of the reef fish industry would be altered as the more efficient longlines are replaced, to some extent, by less efficient gear types. The prohibition can aid in reducing the rate of release mortality of undersize fish, considering that gear types that would replace longlines in prohibited areas would probably be less efficient. This holds true as long as fishing intensity by replacement gear types does not equal, much less exceed, that of longlines.

The effects of longline/buoy gear prohibition on the cost side of this sector depend largely on the extra distance travelled as a direct result of the prohibition and on the efficiency of longlines in fishing outside the prohibited areas. The fishing grounds for longlines in the eastern Gulf are considered to extend usually from the 20 fathom isobath to as deep as 160 fathom isobath (Prytherch, 1983; see also Section 7 of Amendment 1). In this regard, the longline and buoy gear prohibition would not significantly alter the length of trips taken by these vessels in the eastern Gulf. It is not exactly known what effect the prohibition has on the efficiency of longlines in nonprohibited areas. But, in principle, it can be expected that marginal productivity would fall.

The western Gulf originally consisted of two groups of longliners - those operating off the coast of northern Florida (around Panama City), and those off the coast of Texas. In later years, some longliners from these two groups started off in Louisiana a similar

industry that is now well established (see Section 7 of Amendment 1 for more discussion). Fishing grounds for northern Florida longliners usually extend from 30 to 150 fathoms and average around 100 fathoms. The fishing grounds for Texas longliners usually extend from 50 to 170 fathoms. It appears then, that the longline prohibition would have its major impact mostly on longliners around northern Florida and very likely on those operating off Louisiana. Obviously, smaller vessels would be adversely impacted by the prohibition.

c.4. Long-Run Impacts

As previously indicated, the size limits would have bigger initial impacts on the revenue of longlines than the prohibition itself. In terms of revenue then, the prohibition would have an effect on only the longline/buoy gear sector, but would have no additional (to the size and catch limits) effects on the reef fish industry as a whole. The additional cost, however, that may result from the prohibition would affect the cost side of both the longline/buoy gear sector and the reef fish industry as a whole. This cost will continue to be incurred for fishermen who decide to stay in this particular sector of the industry. The prohibition will probably induce capital expenditures for vessels capable of travelling longer distances, particularly for further exploitation of deep water groupers and other deep water reef fish species. Partly in this way, the entry cost to the sector would be pushed higher than "normal."

Benefits from the prohibition come from the possibility that it would help toward rebuilding the stock and, consequently, enhance revenue to the commercial sector (not necessarily the restricted longline/buoy gear sector) and benefits to the recreational sector by way of reducing the rate of release mortality of undersize fish. The major factor that could thwart stock rebuilding via the prohibition is the possibility that areas vacated by longline/buoy gear users would be filled in by commercial users of nonprohibited gear types and recreational anglers. It may be noted that some Louisiana fishermen have indicated that their vessels are equipped to use several gear types, so that a switch to nonprohibited gear is a strong possibility. Obviously, vessels equipped with multiple gear types would create enforcement problems.

The amount by which expected benefits outweigh additional cost to the longline/buoy gear sector cannot be quantified.

d. Entangling Nets

d.1. Current Scenario

Under existing FMP, the use of entangling nets - drift, runaround, stab, trammel nets - for fishing reef fish in the EEZ is not subject to any specific restrictions. All of the Gulf states

impose certain restrictions specific to the use of entangling nets in state waters, especially closed areas and seasons. Texas prohibits the use of nets in its waters entirely.

Entangling nets are a minor component of the commercial reef fish industry. Since 1972, landings of entangling nets has been only around one percent of total reef fish landings by the commercial sector (Table 7.27). The average landings for 1985-1987 stands at around 181 thousand pounds. More than 99 percent of these landings are other snapper species, with gray snapper comprising 96 percent of these landings by entangling nets.

Most entangling net landings occur in Florida and occasionally in other Gulf states. For the period 1985-1987, practically all net landings of reef fish occurred in Florida, and were principally from state waters as bycatch from nets targeting other species.

d.2. Measures

The proposed measure bans the use of entangling nets for directed harvest of reef fish. Incidental catches of reef fish from other entangling net operations are subject to recreational size and bag limits.

d.3. Short-Run Impacts

It is not known to what extent the size limits, especially on gray snappers, would impact entangling net operations. If all net catches were of legal size and were taken from the EEZ, then most of the net catches would be lost to both the entangling net sector and the entire commercial reef fish industry as a direct result of the ban on nets, primarily because no quotas are proposed for the species comprising 99 percent of net catches. Under this situation, foregone landings and revenue to the entire commercial sector would be around 181 thousand pounds and $239 thousand. The number of vessels affected by the ban average around 29 vessels for the last three years. However, since most are taken from state waters, the proposed federal action would have little impact, except that in the event that Florida and other Gulf states adopt a similar measure in state waters, this Federal measure could strengthen the enforcement of state laws on the matter.

The repercussions on economic activities due to this reduction are the following reductions: output = $440,286; income = $168,065; employment = 12 jobs. These are arrived at using the multipliers on other snappers, since most entangling net catches consist of these species. Practically all of these reductions would be borne by Florida. It has to be stressed though that these reductions are based on the assumption that all net catches are of legal size and incidental catches are negligible.

d.4. Long-Run Impacts

If landings had been taken from the EEZ, the foregone revenues would extend throughout the period of the ban's effectivity. Assuming the ban lasts forever, these foregone revenues will have a present value of $2.4 million using a 10 percent interest rate. Additional cost to the industry would be in terms of lost investment expenditures for the nets and other net associated vessel equipment, if they could not be effectively used for other purposes.

Possible benefits from the ban come in the form of preventing further depletion of the reef fish stock. Nets offer possibilities of ghost fishing, capturing undersize fish, killing nontarget species including threatened and endangered species, and destroying habitats. To what extent benefits from the ban on nets would be realized is not quantifiable from currently available information. It is worth reiterating the these effects are dependent on the extent of net operations in the EEZ.

5.3. Permits and Gear Identification

a. Current Scenario

The currently imposed permitting and gear identification requirements apply only to fish traps and their use in the EEZ. No other permits are specifically required to harvest reef fish in the EEZ.

Among the Gulf states, Florida has initiated the move to require permits to sell fish, whose harvest is restricted, based on some kind of participation in the commercial fishery. Pending final approval, permits for the taking of reef fish are issued only to applicants who can show proof that at least $5,000 or 25 percent of their total income whichever is lesser is derived from commercial fishing.

b. Proposed Measures

There are two general sets of measures proposed. One set applies only to fish traps and was discussed in Section 5.2.a. The other set pertains to permit requirements applicable to the entire fishery and is the one treated here. The main features of this permit requirement are: 1) an annual commercial fishing permit is required for the sale of reef fish, with the qualifying condition that more than 50 percent of an individual's (owner or operator) earned income must be derived from commercial or charter/head boat fishing; 2) charter and head boat applicants must submit their Coast Guard masters license number and commercial applicants must submit a properly documented vessel number on their applications; 3) only a permitted vessel can sell fish; and, 4) a charter/head

boat with permit to fish under the commercial quota is assumed to be under charter and is required to fish under the bag limit when under charter, or there are more than three persons aboard, including captain and crew.

c. Short-Run Impacts

The proposal, in effect, divides the fishing population into purely recreational and commercial groups, with marginal "part-timers" falling under the former group and thus subject to restrictions applicable therein. However, certain commercial part-timers - charter/head boat operators and crews - are considered to fall under the commercial sector, subject to certain conditions.

Adversely impacted by the measure are an unknown number of part-time fishermen who sell their catch either to supplement their income or to defray part or all of their recreational expenses. To some extent, this measure would cushion the impacts of other measures, especially size and catch limits, on full-time commercial fishermen and on recreational fishermen who would be affected by the size limit.

The measure's benefit depends on its redistributional effects, its capability to strengthen other measures, and its ability to ease fishing pressure. Unless a very unlikely case occurs that landings by part-timers are a significant portion of commercial reef fish landings, the measure is not expected to reduce industry revenue more than that attributable to other measures. Thus, although part-timers suffer revenue losses, these losses would just be redistributed to full-time commercial fishermen in terms of higher revenue than otherwise in the face of size and catch limits and gear restrictions.

A redistribution of the sort described has welfare implications. As is possibly true, "commercial" part-timers (part-timers who sell their catch to supplement their income) are less efficient than full-timers so that such redistribution will enhance efficiency as long as there are no other inefficiencies existing in the industry. Producer surplus under this condition will increase. "Recreational" part-timers (recreational anglers who sell their catch to defray part or all of their recreational fishing expenses) will be compelled to fish with lower expected income, resulting in lower consumer surplus. Given the over-all fishing skill of the angler population, a strong possibility exists that anglers not affected by the measure will not experience larger increase in consumer surplus. Hence, there is a likely reduction in consumer surplus in the recreational sector. The magnitude of this loss in consumer surplus may or may not be outweighed by an increase in producer surplus in the commercial sector.

The measure can be seen to enforce the implementation of the proposed commercial quota and recreational bag limits. This

enforcement feature comes about by some kind of strict delineation of the two groups, those with and those without permits to sell. In this way, the proportional reduction in catches of recreational and commercial fishermen can be appropriately imposed.

To a certain extent, the measure can help in abating fishing pressure on the stock by forcing part-timers to cut their harvest down to the recreational limits. At the same time, new entrants to the commercial segment of the fishery will be partly prevented from legally joining this segment in the short-run. The fish spared by part-timers due to the permit requirement can definitely help in rebuilding the stock, if this requirement results in catch reduction over and above those attributable to other measures, like size and catch limits and restrictions on the use of certain gear types.

Costs to the industry would come in the form of unrecovered investment cost and lost productivity to labor and equipment. Those costs would be borne essentially by part-timers, excluding retired persons since such income is not "earned" income, and would be particularly hard on those who sell their harvest to supplement their income. For those who would qualify for the permit, a fee will be charged equivalent to $17 per permit, which is the same amount of administrative resources are used as in the issuance of fish trap permits.

d. Long-Run Impacts

The short-run costs would continue to be incurred in the future. In addition, certain types of social dislocations would be induced by the permitting requirements. This dislocation affects primarily those who have been active in the fishery for several years but do not possess the needed skills nor have access to financial resources to fully commit to commercial fishing, although to qualify, one needs only to serve as a deck hand on a commercial vessel.

Long-run benefits from the measure would come in several ways. For one, a strict delineation of fishing participants into commercial and recreational groups effected by the measure could help the Council in instituting measures that would proportionately allocate to the two groups the costs and benefits derivable through management of the fishery. If an efficient and equitable allocation is formulated and adopted, this measure can enhance its enforceability. Implementation of certain measures would also be enhanced by such delineation, and if in principle these measures result in positive net benefits, fuller realization of such benefits through this income requirement will be a net benefit directly attributable to this latter measure. One other outcome of the measure that may be beneficial pertains to its nature as a barrier to anyone wanting to join the commercial reef fish fishery if he did not participate in any commercial fishing or

charter/party boat endeavor, at least for the immediately preceding year. In this way, a fast increasing fishing pressure on reef fish can be slowed down, subject to two qualifications. First, this measure will not affect the fishing effort coming from the recreational sector, which is expected to continue increasing in the future. Second, fishing effort from within the commercial sector will also increase if those already qualified intensify their production and if those potentially qualified from other commercial fishery actually join the reef fish fishery.

In sum, benefits from the permitting requirement come essentially from its feature of improving administration and implementation of management measures. Although this requirement involves significant administrative and enforcement costs, some positive net effects can be expected.

5.4. Stressed Area Boundaries

a. Current Scenario

Certain areas in the EEZ off the waters of Florida, Alabama, and portions of Texas, Louisiana, and Mississippi are designated as stressed area. Prohibited in these areas are the use of fish traps and roller trawls and the use of powerheads for harvesting reef fish. Powerheads are prohibited in Florida state waters.

Factors considered in delineating the stressed area included local knowledge of: 1) the fishery and conditions of the stocks in localized geographical areas, 2) the amount of fishing pressure applied to the geographical area, 3) proximity of the offshore geographical areas to cities of high population, 4) coastal access to the reef areas, 5) historical fishing practices occurring in the area, and 6) a need for protection of special habitat.

b. Proposed Measures

The measure proposed is to extend the stressed area boundary to cover waters out to 30 and 10 fathom isobath along the entire coastline of Texas and Louisiana, respectively. No additional gear prohibition is proposed in these areas other than those applicable to current stressed areas.

c. Short-Run Impacts

There appears to be no fish trap and roller trawl activities in currently proposed stressed areas. Thus, the proposed extension of stressed area boundaries is expected to result in minor impacts. Perhaps the only impacted fishermen are those using powerheads in these areas. The extent of this impact is not known.

d. Long-Run Impacts

Extending stressed area boundaries and concomitant gear prohibition precludes further increase of fishing pressure in these areas, particularly through the use of such effective gear as fish traps, roller trawls, and powerheads. Fish traps and roller trawls, especially, have the potential to nonselectively catch reef fish and/or damage the coral reef habitat.

5.5. Fishing Year

a. Current Scenario

The fishing year currently defined for the reef fish fishery extends from January 1 through December 31.

b. Proposed Measure

The same fishing year as currently implemented is proposed.

c. Short-Run Impacts

Conceptually, the choice of the same fishing year would have no short-run effects. However, in view of other proposed measures, particularly the quota, this choice may change the revenue and cost status of the industry. Additionally, this choice of a fishing year presents certain problems in the enforcement of the quota.

Under the current fishing year, peak landings of many reef fish species occur in the middle of the year. The middle of the year also coincides with the trough of prices of many species largely, but not solely, due to peak landings. Red snapper, however, do not appear to experience wide variation in landings, except toward the end of the fishing year.

The quota for subject species will probably be filled toward the middle of the third quarter, assuming "normal" fishing behavior. The nature of the quota, however, is to create a race of sorts among fishermen so that, as a result, the actual fishing period becomes shorter. If the limit is reached sometime in the middle of the year, revenue to the industry will be smaller than otherwise, primarily because prices are lower during these months. There probably will be no cost changes other than those mentioned in conjunction with the discussion on quota, unless the first few months of the year within which there will be increased activities pose more hazard to fishing than later months.

Enforcement will be complicated in two ways under the condition just described. First, more pressure will be exerted on the timeliness of information, for even a short lag will mean that the quota is far exceeded since the end period of the quota coincides with peak landings under normal conditions. Second, prices toward

the end of the year are already high and will be pushed even higher once the fishery is closed. This gives more incentive to chisel on the potential big profit by probably misdeclaring species caught or using some other means.

Very likely, these conditions will be present if another fishing year is chosen, but possibly to varying degrees.

d. Long-Run Impacts

The long-run impacts are very much dependent on the extent of short-run impacts being realized, and so cannot be adequately assessed.

5.6. Closed Seasons/Areas

a. Current Scenario

There are no season or area closures existing under the current FMP.

b. Proposed Measure

Season and area closures are proposed as additional measures that may have to be imposed on the fishery through the proposed framework procedure. In the meantime, no such measures are proposed concurrently with the measures discussed above.

c. Impacts

As part of the TAC procedure, the explicit provision for season and area closures can boost the effectiveness of this framework. In itself, closures act like a quota and can be analyzed as such. They have a distinct potential, though, of being utilized to protect the spawners in a certain area or in a certain period of the year.

5.7. User Group Conflict Resolution

a. Current Scenario

Presently, there are no specific measures aimed at resolving user group conflicts. Resolutions of these conflicts are implicitly subsumed under such measures as stressed areas and gear prohibition.

b. Proposed Measure

The status quo of no specific regulation is adopted as a proposed measure.

c. Impacts

Conceptually, adopting the status quo has no short-run impacts, if no other regulatory measures are imposed. In as much as the other proposed measures implicitly address user conflict resolution, the proposed measure of no specific regulation to settle user conflict can be expected to have virtually no impacts.

The long-run situation depends on the type and severity of inter-group conflict that may crop up. One potential source of conflict is the exploitation of fishery resources in artificial reefs. However, there is a relative paucity of information regarding the construction, contribution, and exploitation of artificial reefs so that the possible impacts of the proposed measure is difficult to assess in this regard.

5.8. Statistical Reporting

a. Current Scenario

The existing FMP provides for a mandatory reporting system from randomly sampled reef fish fishery participants covering: 1) charter, guide, and party boats; 2) not-for-hire recreational boats; 3) commercial fishing boats and vessels (except trap fishing boats/vessels; and, 4) processors and wholesalers or others purchasing reef fish. A specific reporting provision is required of all trap fishing boats/vessels. The FMP also stipulates a request to NMFS to develop a data collection and analysis system specifically tailored to provide sound data base for fishery management purposes.

The current measure on statistical reporting has been considered inadequate to provide the necessary data to address management-oriented problems.

b. Proposed Measures

The general features of the proposed measures are: 1) collection of data by authorized agents from a statistically valid survey sample of commercial and recreational catch the relies upon techniques that ensure data comparability; 2) fishermen and dealers so sampled must make their reef fish with heads and fins intact available at dockside for inspection by said agents; 3) require NMFS selected head boat operators to maintain a fishery record for each trip and report this information to NMFS on at least a monthly basis; 4) require NMFS selected charter boat operators to maintain daily fishing record to be submitted to NMFS on a weekly basis; and, 5) routine reporting, at least once a month, is required of fish trap permittees.

Implications of the fifth feature was earlier discussed in the section on fish trap restrictions, and so is not treated here.

c. Impacts

A good data base is essential for rational management of the fishery resource, including information on fish and other attendant natural, human, and man-made resources. The proposed set of measures on statistical reporting can be regarded as a step toward establishing a sound data base structure.

In certain respects, the proposed set of measures differ from status quo. The first feature renders data gathering to be based on standard statistical principles. The second feature extends the current requirement on red snapper to all reef fish landed in the Gulf states. The third feature changes the frequency of reporting from quarterly to monthly. The fourth feature is actually part of the current FMP, but not implemented by NMFS as it judged as merely duplicating the MRFSS with respect to gathering of information from charter boats.

Benefits from the measure come in the form of generating data that are timely, more accurate, and statistically tractable. These data definitely can aid in effectively enforcing regulations and can increase confidence in stock assessments based on them.

The additional cost accompanying the first feature is expected to be minimal as resources are already expended for data gathering and reporting, except when "statistical validity" requires significantly larger sample or more information. Additional cost required by the second feature would be incurred by fishermen who have to wait until after inspection before heading the fish. With respect to the third and fourth features, additional cost in terms of time expended for filing reports would be incurred by charter and head boat operators, although in the case of head boats there already exists a similar requirement related to the implementation of the Coastal Migratory Pelagic FMP. New burden hours added by the Amendment are approximately 1,816 hours. Administrative cost would also increase in this regard.

If effectively implemented, the information base necessary for a rational and effective management of the reef fish fishery is at best partially generated. Good information on other attendant resources involved in the fishery still would have to be generated so that sound management decisions can be made. As resources for data gathering is limited, it is not readily perceivable whether expending these resources to generate sound data on a single aspect of the fishery, no matter how important this aspect may be, could lead to better management decisions.

As an initial step towards building a sound informational base, the proposed measures are perceived to be well worth the cost.

6. ANALYSIS OF REJECTED MANAGEMENT MEASURES

In most instances, the nature of the rejected measures is similar to that of the corresponding adopted measures. The basic difference between the two classes of measures pertains to their magnitudes of effects. Thus, the conceptual discussions laid out in Section 5 are not repeated here, unless a rejected measure possesses certain characteristics that are vital to the understanding of its nature and consequent effects, or are worth stressing to place it in proper perspective.

Since countless combinations are possible and no one combination can be regarded as superior to others, the grouping of measures done in the previous section is not maintained. Instead, the rejected measures are considered individually under the same general classification as in the previous section (i.e., size and catch limits on red snapper, other snapper, etc.). Additionally, explicit classification of effects into short-run versus long-run and commercial versus recreational is not done, but these effects are treated in the discussion of the effects of each rejected measure.

6.1. Size and Catch Limits

a. Red Snapper

a.1. Rejected Measure 1: Status Quo.

The existing measures on red snapper were summarized earlier (Section 5.1.a.1). The status quo is the base for comparison of measures so that in this case, no short-run effects ensue by adopting the status quo.

The long-run impacts were previously considered together with the corresponding proposed measure. In sum, the fish stock would decline with catches declining as a consequence. Some benefits (equivalent to that achievable under the proposed measure, for example) would be lost by maintaining the status quo.

a.2. Rejected Measure 2

This measure imposes a commercial quota of 1.4 million pounds and a recreational daily bag limit of two fish per person.
The quota and bag limit would reduce short-run commercial catch by 63 percent while the bag limit would reduce recreational catch by 61 percent. Under this measure, the spawning stock ratio by year 2000 would be around 16 percent. The commercial sector would then bear a reduction in catch of around 2.4 million pounds, which are equivalent to foregone ex-vessel revenues of around $ 4.3 million. The recreational sector, on the other hand, would incur losses amounting to around $ 1.7 million.

Under this measure, the spawning stock ratio by the year 2000 would be around 16 percent. Although this is still below the target, it is higher than that attainable under either the status quo or the proposed measure. The long-run potential catch and revenue under this measure will be higher than that under either the status quo or proposed measure. The present value of its resulting net effect is not quantifiable. This can be less than, equal to, or greater than that of the proposed measure, considering that the relatively higher short-run losses will be subjected to lower discounting while the potential long-run gains will be heavily discounted.

a.3. Rejected Measure 3

This measure would establish larger size limits up to 24 inches total length or smaller bag limits down to a 2, 3 or 5 fish bag limits and quotas down to 1.4, 2.1, or 2.9 million pounds.

There are many possible combinations for this measure. For ease of exposition, it is assumed that the combination chosen consists of the following: 24-inch size limit, 2-fish per day per person bag limit, and 1.4 million pound quota. This is one extreme combination possible under this measure.

As earlier shown in connection with the discussion of Rejected Measure 2, the 2-fish bag limit and 1.4 million pound quota would reduce commercial and recreational catch by 63 percent and 61 percent, respectively. The size limit alone would reduce commercial and recreational catch by 68 percent and 98 percent, respectively. The interaction of the size and catch limits cannot be estimated. As was done with the proposed measure, the higher reduction can be expected to dominate. Thus, it can be contended that under this measure initial reduction to the commercial and recreational catch would be around 68 percent and 98 percent, respectively. The short-run impacts of the size limits would be around $4.8 million of foregone revenues for the commercial sector and around $1.7 million to $3.1 million in benefit losses to the recreational sector. These losses are computed using similar procedures employed for the proposed measure.

With the 24-inch size limit alone, spawning stock ratio would increase to only 11 percent by year 2000. However, the combined effects of the size and catch limits would be a significant increase in the spawning stock ratio. Potential long-run catch can be expected to increase significantly. Even if the quota were still in place, profitability to the commercial sector would increase as the cost of finding and catching the quota would decrease with greater availability of red snapper. Consumer surplus of the angling sector as a whole would also increase as this sector's catch increases in poundage and number as more anglers catch the bag limit or as more anglers join the fishery.

Compared to the proposed measure, this measure would bring about bigger short-run losses and bigger long-run gains. But the net effect in present value terms could be less than, equal to, or greater than that of the proposed measure.

a.4. Rejected Measure 4

This measure calls for different size and catch limits for different locations in the Gulf.

This measure is impossible to quantitatively assess because of the numerous possible combinations. At any rate, this measure can be appropriately designed to achieve the same biological and/or economic impacts as the proposed measure, while possibly achieving more equitable distribution of the burden. But the administrative and informational requirement for both so designing a measure and implementing the same, is very costly.

a.5. Rejected Measure 5

This measure purports to allocate red snapper by restricting commercial catch to only bycatch from shrimp and bottomfish trawls, with the rest allotted to the recreational sector.

Under this measure, the traditional commercial red snapper fishery would be eliminated. Based on 1985-1987 average landings, this measure would eliminate around 3.8 million pounds of commercial landings from all gear types, except trawls, at an average ex-vessel value of $ 7.9 million. The impacts of this loss in terms of reductions in total economic activities would be: output = $17.3 million; income = $5.5 million; and employment = 415.5 jobs. Landed trawl bycatch could possibly go up to its historic peak of about 600 thousand pounds, although portions of this catch did not come from domestic stock. It is very unlikely that the recreational sector could take all the potential catch left by the commercial sector, at least over the short-run, thus a rebuilding of the stock can be effectively initiated. If anglers are not allowed to sell their catch, possibly imports will go up or possibly a side market for red snapper will be created. A shift to other species is also a strong possibility.

Extreme as it is, the measure could accelerate the achievement of the target spawning stock ratio. The 20 percent minimum spawning stock ratio targeted would be reached by year 1998. Based on the 1985-1987 average landings, the measure would imply a reduction of around 58 percent of total red snapper catch if no catch limits were imposed on the recreational sector. Potential catch would eventually reach its historic peak registered sometime in the mid 1960's.

It is not possible to estimate the measure's benefits over time because of lack of an applicable valuation technique for angler

benefits over time. Moreover, angler benefits will have to be set against commercial losses in terms of lost productivity and unrecovered investment cost. At the least the present value of these angler benefits should be greater than th present value of foregone profits by the commercial sector. Over the 1990 - 2000 period, the present value of revenues forgone by the commercial sector would amount to around $51.3 million; no estimate for cost can be provided. Socially, the measure is undoubtedly inequitable in its distribution of losses and benefits and significantly impacts small business entities.

b. Other Snappers

b.1. Rejected Measure 1: Status Quo

Maintaining the status quo means imposing no regulations specific to other snapper fishery.

There are no short-run effects of this rejected measure. The long-run impacts were previously contrasted with the proposed measures on these species. Abstracting from all other proposed measures, some benefits would be foregone by maintaining the status quo for other snappers. If proposed measures for other reef fish species are adopted, maintaining the status quo will mean a redirection of effort and its concomitant resources to the other snapper species. In this situation, the spawning stock ratio of these species may be negatively impacted. In addition, over-commitment of other resources to this segment of the reef fish fishery will occur more rapidly than "normal".

b.2. Rejected Measure 2

This measure calls for establishing larger size limits or smaller bag limits and quotas.

The magnitude of this measure's impacts cannot be precisely quantified as it contains various options. However, it is obvious that these impacts would be about similar in direction to, but larger in magnitude than those of the proposed measure. Some possible options are illustrated for gray snappers in Figures 11.9 through 11.11. As can be seen from these figures, short-run losses and long-run benefits become bigger as restrictions become more stringent.

If size limits are designed to correspond to maximum yield per recruit for each species, the size limit configuration, assuming a 33 percent release mortality rate, will be approximately: 11 inches total length for vermilion (Goodyear, 1988c); 13 inches total length for gray (Goodyear, 1988c); 8 inches total length for lane (Goodyear, 1988c); 15 inches total length for mutton (Goodyear, 1988c); and, 10 inches fork length for yellowtail (Goodyear, 1988c). Short-run catch reduction for both commercial

and recreational sectors would be more than 90 percent. For the commercial sector this would mean an initial loss of around $3.7 million. The equivalent loss in angler benefits would be around $1.9 million. The bag limit and quota or some combination of size and catch limits can also be designed to approximate these losses to both sectors.

The benefits accruing to these size limits or their equivalence in bag limits and quota would be a significant increase in yield per recruit and probably recruitment. The target SSBR minimum will be reached and exceeded some four to five years after implementation of this measure, if fishing effort does not increase. Realizing such benefits would cause an increase in cost especially for anglers who would have to travel further offshore to be able to catch larger size fish. Moreover, it is of the nature of biological benefits to make the fishery attractive as to prompt an increase in fishing effort, so that both biological and economic benefits will be eventually dissipated.

b.3. Rejected Measure 3

This measure requires landing of other snappers to conform to state requirements on size and possession limits when these requirements are more restrictive than those for the EEZ and consistent with the FMP objectives and National Standards.

Most commercial and recreational catches of these species are landed in Florida. Currently Florida imposes a 12-inch size limit on mutton and yellowtail snappers. This is the same size limit proposed in the EEZ for these species. On balance then, this rejected measure would bring about the same short-run impacts as those of the proposed measures. It may be noted, though, that an increasing amount of, at least, vermilion snappers is landed in other Gulf states which impose no size nor possession limits on this species. If this were construed as reflecting a long-run trend, certain problems would accompany this rejected measure, especially if restrictions vary among states and are more stringent than those in the EEZ. Enforcement problems would multiply and cost to the industry would increase due to movements of fishermen to less restrictive areas. If all states adopted identical restrictions, but more stringent than those in the EEZ, enforcement would not be as difficult and industry cost would not be affected. If all states adopted identical restrictions as in the EEZ, this measure would have no effects.

c. Groupers

c.1. Rejected Measure 1: Status Quo

Maintaining the status quo for groupers means imposing no size and catch limits on these species.

This measure has no short-run effects. The long-run effects were earlier contrasted with those of the proposed measure. The major implication of the analysis of the proposed measure is that some benefits would be foregone if the status quo were maintained for groupers. Also, the spawning stock ratio would continue to decline and would be lower than that depicted in Figure 11.5. The same situation is expected to occur even if there are no restrictions on other species, since exploitation of grouper species has escalated especially as more efficient gear types, like bottom longlines, have been introduced into the reef fish fishery.

c.2. Rejected Measure 2

This measure imposes larger size limits or smaller bag limits and quotas.

The full range of options possible under this rejected measure cannot be assessed. However, it can be expected that impacts of this measure would be about similar in direction to, but larger in magnitude than, those of the proposed measure on groupers. Figure 11.5 illustrates this point, where more stringent restrictions translate in bigger short-run losses and long-run benefits. It is not possible to estimate the extent to which these options differ in magnitude of net effects.

The size limits that approximately correspond to maximum yield per recruit are: 23 inches for red groupers, 35 inches for gag groupers, and 36 inches for black groupers. Corresponding size limits for other grouper species included in the proposed measure cannot be determined from available information. If these size limits were adopted under the measure, the commercial sector would experience short-run reductions of 82 percent, 80 percent, and 87 percent in catches of red, gag, and black groupers, respectively. The respective reductions for recreational catch would be 87 percent, 90 percent, and 90 percent. These reductions to the commercial sector would mean foregoing $11.7 million in ex-vessel revenues. The loss in angler benefits would range from $6 million to $11.3. These losses are computed using similar procedures as in the case of the proposed measure. Bag limits and quota or some combination of size and catch limits can also be designed to result in similar reductions.

Larger long-run benefits can be expected from a more stringent measure. In addition, the target SSBR would be attained within the time frame set forth by the Council. Industry cost would increase with more stringent measures, and if a larger size limits were adopted, fishing especially for recreational anglers would be pushed into deeper waters. This implicitly compels fishermen to exploit the deep-water groupers.

c.3. Rejected Measure 3

This measure requires landing of groupers to conform to state requirements on size and possession limits when these requirements are more restrictive than those for the EEZ and consistent with the FMP objectives and National Standards.

Among the Gulf states, only Florida has adopted a size limit on groupers (18 inches total length). Also, most grouper landings of both recreational and commercial sectors are in Florida.

If the proposed size limit on groupers of 20 inches were adopted, this specific rejected measure would have virtually no effect with respect to grouper catches. If the states, especially Florida, changed their regulations to be more restrictive, similar remarks earlier made for other snappers would apply here.

c.4. Rejected Measure 4

This measure proposes to impose a recreational bag limit and commercial quota for jewfish.

The precise impact of this measure cannot be assessed because of the many potential levels of bag limit and quota. For the period 1985-1989, landings of jewfish has averaged around 287 thousand pounds, 60 percent of which is accounted for by the recreational sector. A bag limit and quota may be imposed to reduce the amount of jewfish catch to less than the reported average, and possibly even less than what the catch level would be if the proposed size limit of 50 inches total length were adopted. Considering the limited amount of jewfish catches, most levels of bag limits and quota would have relatively minor effects on the fishery.

The long-run benefits from the possible bag limit and quota are also not possible to estimate, since there is relatively limited information on the nature of the jewfish stock, and proxies for purposes of analysis are not available.

d. Amberjacks and Sea Basses

d.1. Rejected Measure 1: Status Quo

Current FMP does not provide for any size and catch limits on greater amberjack and black sea bass, the two species under consideration.

This measure has no short-run effects. In contrast to the proposed measure, some benefits, at least for greater amberjacks, would be foregone if status quo were maintained. Landings of greater amberjack have been increasing and could be indicative of intensifying exploitation of this species. As the current spawning stock ratio is already at a low level of around 5 percent,

maintaining the status quo could pull further down this ratio. The condition would worsen if restrictions were adopted for other reef fish species as effort is diverted to further exploitation of greater amberjacks.

Information on black sea bass is limited to assess the long-run impact of maintaining the status quo. Most sea basses caught in the Gulf are landed in Florida, and apparently fishermen comply with this state's size limit of 8 inches. In this sense, maintaining the status quo may be practically equivalent to adopting the proposed size limit on sea bass. However, as fishing pressure on sea basses increases and more fish are caught, the Florida size limit may be circumvented by declaring fish caught in the EEZ or by landing the fish in other states, or this state's size limit may not apply at all when fish are actually caught in the EEZ. Under this scenario, the sea bass stock would tend to decline to levels where possibly the spawning stock ratio would be well below the target minimum.

d.2 Rejected Measure 2

Larger size limit or smaller bag limits and quotas are the specific features of this measure.

As with the case of the previous species, the full range of alternatives for this measure is not possible to determine because of the many possible options. What is likely, however, is that the effects of this measure are similar in direction to but larger in magnitude than those of the proposed option. The present value of its net effects may be less than, equal to, or greater than that of the proposed measure.

d.3. Rejected Measure 3

This measure requires landing of amberjacks and sea bass to conform to state requirements on size and possession limits when these requirements are more restrictive than those for the EEZ and consistent with the FMP objectives and National Standards.

Remarks earlier stated for a similar measure on other snappers and groupers apply here.

6.2. Gear Restrictions

a. Fish Traps

a.1. Rejected Measure 1

This measure, which is part of status quo, limits each vessel fishing traps in the EEZ to no more than 200 traps.

As part of the status quo, this measure has no short-run effects. There is not enough empirical information to assess fully its long-run impact. From information available, only a handful of permittees fish in the Gulf with 200 traps. The proposed size limits on many reef fish species would increase the cost of fishing, including fishing with the use of traps. The long-run implication of this cost increase would be to force out marginal trap users and increase the capacity of those remaining in the trap segment of the fishery. If such capacity increase required the use of more than 200 traps per permittee, this measure would legally prevent the permittees from doing so. It is possible, however, that the same number of traps would be maintained as in the case before the imposition of the size limits, whether these traps are newly built or secured from those who left this segment of the fishery. In this situation this measure can be regarded as a vehicle that would not restrict further (relative to the proposed measure) commitment of resources in this segment of the fishery. But this statement has to be tempered by recognizing that as managed under either the status quo or the proposed amendment, overcommitment of resources in the reef fish fishery is not prevented even assuming the adoption of the more than 50 percent income requirement to sell reef fish.

a.2 Rejected Measure 2

This measure requires fish trap bottoms to be made of 2 by 4 inch mesh size.

The relevant current requirement is for fish traps to be made of either 1 by 2 inch, 1.5 by 1.5 inch, or 1.5 in hexagonal mesh sizes with each trap having at least two 2 by 2 inch or larger escape windows on each of two sides (excluding the bottom). The cost of redesigning traps to meet the measure's requirement can be expected to be minimal. Under this measure, possibility of escapement due to larger mesh size occurs mainly during the hauling of traps when the caught fish are forced against the bottom of the trap. To the extent that undersize fish are allowed to escape, some future benefits at the expense of current foregone catch may be gained from the measure. However, the extent of such escapement may be limited, although a possibility exists that the proposed size limit on some reef fish species will be enhanced.

a.3. Rejected Measure 3

Under this measure, traps are to be constructed with 2 by 4 inch mesh size for at least two sides of the traps.

The additional cost over the current provision in requiring at least two sides of a trap be made of 2 by 4 inch mesh size is expected to be minimal; although in the case of traps made of hexagonal mesh size, two sides may have to be entirely replaced. It has been estimated that there is some difference in value per

haul between a 2 by 4 inch mesh size and hexagonal mesh size traps, although no statistical test for such difference has been performed. In relation to the rejected measure, this difference may not be significant as only two sides would be constructed of a 2 by 4 inch mesh size. While there may be no significant decrease in revenue to fish trappers related to reef fish under this measure, a possibility exists for loss of revenue for other unregulated, undersize fish that escape traps. The possibility of releasing small fish is especially important for lost traps.

a.4. Rejected Measure 4

This measure requires all mesh on fish traps to be 2 by 4 inches in size.

The cost of redesigning traps in accord with this measure may be more than minor for those traps with hexagonal mesh. Fishermen may even have to buy or build entirely new traps to replace illegal ones, thus prematurely replacing traps. The depreciated value of discarded traps is part of the cost to the fishermen due to the regulation. In addition, it has been found out that mean weights of fish caught in a 2 by 4 inch mesh significantly differ from those caught in any of the currently allowed mesh size (Bohnsack et al., 1988). Thus, this measure can be expected to reduce the catch per haul of fish traps. For areas in southwestern Florida, outside the stressed areas, this measure would reduce the mean weight per haul by around 75 percent. In the face of the proposed size limit on several reef fish species, this reduction may not be significant with respect to catches of reef fish but may with respect to other commercial fish species caught. Thus, while this measure could enhance the benefits from size limits on reef fish and at the same time would allow escapement of non-commercial bycatch, fish trappers would be compelled to forego revenues from commercial catch of other species. This would further reduce the producer surplus of this segment of the fishery.

a.5. Rejected Measure 5

This measure prohibits the use of fish traps in areas where they are not presently used.

No short-run effects are expected from this measure. The long-run effects are relatively uncertain. If current and prospective fish trappers find the current areas where traps are fished as economically best for them, the measure undoubtedly will have no effects; otherwise, the net effect of the measure will depend on how fish traps fare ecologically and economically against other gear types currently or will be used in areas where fish trappers decide to expand. If fish traps are more economically efficient, the measure will have a negative effect, unless fish traps are more ecologically destructive and cannot be effectively regulated.

a.6. Rejected Measure 6

This measure allows the use of sea bass fish traps for directed harvest of sea bass in the EEZ north of 27 degrees north latitude adjacent to Florida's territorial sea, subject to certain design specifications.

The short-run impact of this measure will be a net revenue gain to the fish trap segment of the commercial sector who would be able to fish closer to shore, thereby reducing operational costs. A similar net revenue effect will be realized by the reef fish industry, if this measure does not cause a mere replacement of one gear by another. If such replacement actually does occur and fish traps are the more efficient gear, profitability of the industry will increase, but recreational catch potential may decline.

The long-run impact depends on how ecologically destructive fish traps are to the extent that applicable fish trap design restrictions prevents large non-commercial bycatch and catches of undersize fish, the measure could result in net benefit.

a.7. Rejected Measure 7

This measure prohibits the use of fish traps for the directed harvest of reef fish throughout the entire EEZ.

The short-run impact of this measure would be a 100 percent loss in reef fish catch of fish trap fishermen. This loss would amount to 872 thousand pounds which are roughly valued at $1.3 million, based on 1985-1987 average commercial landings of reef fish. If the prohibition lasts forever, foregone revenues to the fish trap segment will have a present value of $13 million, at a 10 percent interest rate. Considering the effects of size limits on fish traps, the specific reduction in catch, and revenue attributable to this measure would be less than these amounts.

The short-run loss to the industry would probably be smaller than the estimated figures, since other gear types would simply replace fish traps in exploiting the same resource. This measure would tend to raise cost, with industry profitability suffering as a consequence.

Industry cost will also rise, if more inefficient gear types entirely replace fish traps in catching reef fish left out as a result of the prohibition.

b. Trawls

b.1. Rejected Measure 1: Status Quo

The current measure excludes from the minimum size limit for red snapper any domestic trawl vessels fishing for species other than

reef fish in the EEZ, with the exception of roller trawl vessels fishing in the stressed area.

In principle, no short-run effects can be expected from this measure. However, this provision apparently has weakened the full implementation of the size limit. Maintaining this measure would surely continue to create gray areas in enforcing the size limit on red snappers, and as a consequence would jeopardize the realization of the expected benefits from the size limit.

b.2. Rejected Measure 2

This measure requires trawl vessels to comply with the same size and bag limits that are established for the recreational fishery harvesting red snapper.

This measure is similar to the proposed one as applied to red snapper so that analysis applies.

b.3. Rejected Measure 3

This measure prohibits shrimp fishing in areas and during periods of susbstantial red snapper prerecruit bycatch.

Analysis of this measure involves determining the value of shrimp catch foregone and the expected value of red snapper gained. Table 11.25 describes possible "exchanged" values of the two species. From a commercial standpoint, the measure would result in a loss of $13 to $14 of shrimp for each dollar gained in red snapper for the lowest ratios of shrimp catch to potential red snapper catch and up to $26 for the highest ratio. These values warrant several qualifications. First, the cost side of both commercial sectors is not considered in the computation. Second, the value to the recreational sector of each snapper gained is not factored into the computation. Third, an option value, which is generated in the process of rebuilding the red snapper stock, is not considered.

b.4. Rejected Measure 4

This measure requires trawls to be designed to reduce finfish bycatch by a minimum percentage compared to trawls not equipped to exclude finfish.

The nature of this measure is somewhat similar to rejected measure number 3 in the sense that certain trawl catches may have to be foregone in exchange for additional finfish available to other gear users right away or in bigger size in the future. The impact of this measure cannot be determined, especially that this involves construction of trawls to the desired specification. The cost of designing, constructing, and using this gear and the catch foregone will have to be balanced against the value of finfish gained.

b.5. Rejected Measure 5

This measure limits shrimp trawling to 90 minutes tow time.

As in the case of the two previous rejected measures, analysis of this measure involves determining foregone shrimp values versus values of reef fish gained. As this measure severely limits the efficiency of trawls, it appears that net effects will be negative, especially if enforcement problems are factored in. This measure is currently a law by rules promulgated by NMFS under the Endangered Species Act.

c. Longlines

c.1. Rejected Measure 1

This measure prohibits the use of longlines and buoy gear for the directed harvest of reef fish inshore of the 50-fathom isobath throughout the Gulf EEZ, with incidental catches of reef fish in other longline operations limited to the recreational limit.

The nature of this measure is similar to that of the proposed measure, except that the eastern Gulf would shoulder larger reduction in catch and higher operational costs. In fact, the eastern Gulf would bear as much as 86 percent of total reduction in longline catch due to the prohibition. Thus, while the magnitudes of effects are bigger under this measure, similar analysis as done in the proposed measure readily applies here.

Initial reductions in catch due to this measure would be around 3.8 million pounds, which are roughly 61 percent of total longline catches of all reef fish. Reduction in shallow water grouper (still no reduction would apply on deep water groupers) catch alone would be around 3.5 million pounds, 91 percent of which would come from the eastern Gulf. This total reduction borne by longline fishermen is definitely larger than reductions they would shoulder due to the size limit. Foregone ex-vessel revenues to longliners, based on grouper reduction alone, would be at least $5.3 million.

Part of foregone longline catches would be taken by other gear users, primarily hook-and-line users, so that net reduction in catch to the entire commercial fishery would be lower than total reductions borne by longliners. Profits of longliners would decline and those of other gear users would increase. But since longlines are more efficient than handlines, in particular, industry profits would be lower under this measure.

c.2. Rejected Measure 2

This measure prohibits the use of longlines for directed harvesting of reef fish.

The short-run impact of this measure would be a loss to the longline sector of around 6.3 million pounds of reef fish catches, based on 1985-1987 average landings. This reduction would have an ex-vessel value of at least $9.6 million. If the ban lasts forever, this amount will have a present value of $96 million, using a 10 percent interest rate.

Longlines have been demonstrated to be a highly efficient gear so that banning them entirely for harvesting reef fish would have significant repercussions in the profitability of the industry, particularly the grouper fishery. Reef fish stock, especially that of groupers, would be significantly enhanced only if longlines were not merely replaced by other gear types. At the face of the proposed size and catch limits on several reef fish species, it is very likely that most of the fish spared because of the ban on longlines would be redistributed to other gear users. Thus, a redistribution of benefits would ensue by creating more inefficiencies in the fishery.

c.3. Rejected Measure 3

This measure prohibits bottom longlining for reef fish within the stressed area.

The magnitude of impact of this measure cannot be assessed because of lack of information regarding longline activities within the stressed area. At any rate, this measure is similar in effect to that Rejected Measure 1 or the Proposed Measure, with only the magnitudes of effects determining the difference. Thus, the analysis therein would have some relevance here.

c.4. Rejected Measure 4: Status Quo

This measure maintains the status quo of not regulating the use of longlines.

There are no short-run effects of this measure. From existing information, a significant upward trend in the use of this gear type is not evident, even though it has been demonstrated to be more efficient than handlines, at least. As a more efficient gear, however, it tends to speed up the dissipation of economic rent that is anyway inevitable when exploitation of the fishery is not restricted. Diversion of other resources into this segment will likely occur if more stringent conditions are imposed on other gear types and on the size and amount of reef fish catch. Issues concerning equitable utilization of the reef fish resources will be raised in the event that other less efficient gear users start to share proportionally less of the dwindling reef fish stock.

Under this measure, achievement of the minimum spawning stock ratio, especially for groupers, will be slowed down, and the ratio for red snapper may decline further.

d. Additional Gear Restrictions

d.1. Rejected Measure 1

This measure calls for the establishment of minimum hook sizes.

In principle, the strength of this measure lies in its being size and species selective. Its applicability to the reef fish fishery is, however, at best limited as it has been reported that a wide range of hook sizes catch the same sized fish. This measure would entail an additional cost to the industry, and would likely result in some short-run revenue losses if allowable hooks were set at relatively large sizes. Enforcement cost would be basically proportional to the number of allowable hook sizes and would likely require enforcement at sea greatly escalating that cost.

d.2. Rejected Measure 2

This measure limits the types of gear that may be used to take reef fish to only the following: hook-and-line, speargun (without powerhead), fish traps, longlines, run-around nets.

Although not complete, the enumeration of allowable gear types covers most gear types presently used in the reef fish fishery. Short-run effects of this measure would be in terms of revenues foregone by users of those gear types not included in the enumeration, like powerheads and possibly buoy gear. These amounts are relatively minor, especially when contrasted with propective losses due to the size and catch limits.

The long-run impact of this measure would be to restrain innovation in the reef fish fishery by way of discouraging technological advancement in gear usage. Gear types that would be introduced in the absence of this measure would be very likely more efficient. In this regard, a more rapid exploitation of the resource would be thwarted at the expense of efficiency. Of course, there is no assurance that the use of inefficient gear types would not dissipate economic rent to the fishery, especially when viewed against the backdrop of increasing demand for the fishery resource from both commercial and recreational sectors.

d.3. Rejected Measure 3

This measure permits the use of only hook-and-line and spear fishing in the stressed area.

Short-run effects of this measure would be in terms of revenue losses to other gear type users presently operating in the stressed area, particularly users of nets and longlines. Operational costs of the prohibited gear users would also rise as longer distances or time would be required of them to generate the same value of

catch. However, other proposed measures would prohibit longline and nets from fishing the area or keeping commercial quantities of reef fish.

The measure's effects are redistributional in nature and actually would be so even in the short-run if the restriction did not amount to catch reductions over those resulting from the size and catch limits. Over the long-run, catches foregone by the prohibited gear types would be recovered by the permitted gear types. Solely from the commercial viewpoint, this measure would merely introduce inefficiencies in the harvest of reef fish. If recreational anglers take over instead, the increased value to this sector has to be set against the revenues foregone by users of the prohibited gear.

6.3. Fishing Year

a. Rejected Measure 1

This measure calls for changing the definition of the fishing year to begin at some other time of the year or to be different for different species groups.

Certain features of a fishing year different from those currently adopted were discussed in conjunction with the treatment of the proposed fishing year. Some problems earlier outlined for the proposed fishing year can be addressed by this measure. This measure can be so designed as to reduce fishing mortality on the population of some reef fish species during periods they are spawning. But enforcement problems, especially of some proposed measures like quota or closed season, increase as different fishing years are instituted for different species. Additionally, bycatch of a reef fish species for which fishing is closed as a result of directed harvest of another reef fish species would tend to defeat the over-all objective of rebuilding the reef fish complex.

6.4. Stressed Area Boundaries

a. Rejected Measures 1, 2, and 3

There are three measures here that are combined for analysis because of their close similarities. All these three measures propose to narrow stressed area boundaries currently defined for waters off the coast of west Florida.

These measures would open certain areas in west Florida for fish trap and powerhead fishing, two of the gear types presently banned within the stressed area. If these fishermen simply replace other commercial and recreational fishermen from these opened areas, the amount of catch would probably be the same although the profit situation, at least of the commercial trap sector, would be enhanced. Short-run revenues to the fish trap sector, in

particular, would increase especially if commercial bycatch were to increase. Some concern has been raised that the sea bass trap fishery has been unduly restricted in certain areas now considered within the stressed area boundaries, but scarcely exploited by other commercial gear users and recreational fishermen. If this were empirically substantiated, the measures could correct this situation. The long-run impact, however, would be to allow more pressure on a reef fish species, like sea bass.

6.5. User Group Conflict Resolution

a.1. Rejected Measure 1

This measure calls for the establishment of Special Management Zones (SMZ) and prohibiting certain gear types from being used therein.

SMZ's create minor changes if the area involved is small. Over a large number of zones, there will be major impacts. Probably the most important consideration of SMZ's is that the procedure allows the acquisition of private property rights for public resources, especially if the artificial reef congregates fish previously distributed over a larger area. The cost of acquiring the private right is less than the total value of the right thus acquired, or no group would apply under such a provision. But unless such cost of acquisition of right is equated to the value of the resource exploited, the social cost of harvested fish is still being borne by groups both included and excluded from the SMZ's, although benefits are restricted to the former group of participants. Hence, reasons for potential conflicts still exist.

The effects of adopting SMZ's for the Gulf reef fish fishery are impossible to assess, essentially because of the problem of properly defining, assigning, and enforcing property rights and of estimating the costs of these activities.

a.2. Rejected Measure 2

This measure calls for the employment of a Notice Action procedure for terminating a conflict or preventing a violent confrontation between fishermen using different gear types.

This is essentially a procedure for settling potential or actual disputes among different gear users. As such, the cost directly attributable to it is the cost of setting it up and of utilizing it to effect a measure that is intended to solve the conflict. If real conflicts arose, this measure could be a cost-saver compared to the status quo. Its direct benefit lies in its efficiency of enabling fishery managers to design and carry out a measure in a timely fashion before the impending situation gets worse. But there is always the danger of formulating measures and implementing them through Notice Action that may resolve the conflict at the

expense of imposing relatively high costs on some or all of the conflicting groups.

6.6. Closed Seasons and Areas

a. Rejected Measure 1

This measure calls for the establishment of a closed season for selected species of species groupers to assure maximum protection of spawning potential.

Closed seasons are similar in certain respects to quotas in the sense that the fishery would be closed at certain times of the fishing year. Closed seasons, however, offer an added feature of being directed at preventing fishing during spawning seasons. But in a multi-species fishery with varying spawning seasons, closing the fishery for one species will not totally achieve its potential benefits if other segments of the fishery are open, unless a higher enforcement cost is incurred. Even where such cost is incurred, the possibility of wastage through bycatch still exists. Another feature offered by this measure is that it enables fishermen to better plan their fishing activities during the year because of knowledge as to when the fishery is open or closed to them. In quotas, the period of closure is generally unknown and is heavily dependent on the intensity of pre-closure fishing pressure. However, the spawning season for some species occurs during periods of maximum fishing effort by recreational fishermen.

6.7. Permits and Gear Identification

a.1. Rejected Measure 1

This measure requires an annual commercial permit, with no qualifying conditions, for the sale of reef fish.

This measure would generate a list of persons qualified to sell their catch of reef fish. The longer this list, the higher the cost of administration, although this cost can be shifted to the applicants as in the case of the proposed measure. To the extent that the permit cost reflects only the cost of its administration (which has been estimated to be about $23 per permittee) and not the scarcity of the fishery resource, the only other major benefit derivable therefrom would be a population list for future possible surveys of the commercial fishery participants. The other benefit lies in its ability to boost the enforcement of regulations that distinguish as to effects between recreational and commercial sectors, since with all permittees construed to be "commercial fishermen" a proper delineation of the two groups can be made.

a.2. Rejected Measure 2

This measure requires an annual commercial fishing permit for the sale of reef fish, with the qualifying condition that ten percent of an individual's (owner or operator) income must be derived from commercial fishing.

The essential difference of this measure from the proposed one is on the percentage income requirement, which is more than 50 percent under the proposed measure. The impact of this measure would be similar to those discussed under the proposed measure. The magnitudes of effects, however, would be less in terms of costs and benefits than those of the proposed measure. In addition, this rejected measure would equate the required percentage of income to that currently imposed on the mackerel fishery.

a.3. Rejected Measure 3

This measure requires annual permits for charter and head boat owners or operators.

There presently exists a similar requirement under the mackerel FMP. As the permitting requirement is tied to these species, the accompanying requirement to report fishing activities covers only those activities related to mackerel, with information on other species reported in a less thorough manner. The mackerel data gathered from charter and head boat owners/operators have been determined to contribute valuable information for managing the species. Similar benefits can be expected from this measure. However, there would be additional administrative cost in enforcing this requirement and costs on the boat operators in terms of additional time and effort needed to report the activities associated with fishing reef fish. If the administrative cost of issuing permits is shifted to these operators, the latter will incur additional cost of around $23 per operator. Assuming one permit is required of each boat, total costs to the charter and party boat sector will be $21,390 ($23 x 930.)

a.4. Rejected Measure 4

This measure requires vessels or persons harvesting reef fish in the EEZ for subsequent sale to possess a state permit that allows the sale of reef fish in the state of landing.

This measure could greatly boost the enforcement of state requirements on the sale of reef fish. But in the event that sale requirements differ among states, the tendency for commercial harvesters would be to land where practical in states with the least restrictions. Thus, while certain state requirements are avoided, the harvest of reef fish in the EEZ will not diminish. Industry cost will rise under this measure. Moreover, because of the very liberal cost (as low as $1) and lack of income

requirements of state permits, recreational and other fishermen could use this to circumvent the bag limit requirement.

a.5. Rejected Measure 5

This measure establishes a moratorium on the issuance of fish trap permits.

Recent information indicates that of the 475 permit holders, only around 94 are actively fishing traps. Thus, the short-run impact of this measure in terms of catch and revenue reductions would be very minimal. The long-run impact largely depends on the profitability of fishing traps. If fish traps are perceived to be more profitable compared to other gear types, participation of this sector in the harvest of reef fish and other commercial species will increase. The moratorium would restrain the movement of resources into this sector. But since other gear types are allowed to expand, the pressure on the reef fish stock will not be affected. Under this situation, the moratorium will only change the profitability of the entire commercial reef fish industry.

6.8. Statistical Reporting Requirements

a.1. Rejected Measure 1

This measure provides for the replacement of the fish trap logbook with a dockside sampling program, designed by NMFS, and patterned after the present state/federal Trip Interview Program (TIP.)

The present logbook program for fish trap fishermen, as implemented, has not provided adequate information for management, primarily because of very poor response rate on those issued logbooks and the difficulty of validating information supplied. It is very likely that better information would be generated by this measure, but definitely higher costs would be incurred. Considering the limited size of this segment of the commercial reef fish fishery, allocating resources for gathering data about this segment many not be an efficient use of that limited resource.

7. SUMMARY OF EFFECTS

7.1. Proposed Measures

A categorical statement of the over-all effects of the proposed measures is hindered by the precise determination, especially quantification, of the effects of some of the measures. In Section 5, many of the short-run impacts were estimated. The long-run effects posed serious problems of estimation, since computation of models to forecast improvements in biological yield is not possible. Thus, in most cases only the determination of the directions of long-run effects was attempted. Discussion on the measures' impacts on the commercial sector focused mainly on the revenue changes in the harvesting sector. Changes in variable and fixed costs could not be given adequate treatment because of data constraints. Also, changes in consumer surpluses in the commercial sector could not be quantified. With respect to the impacts on the recreational sector, some quantifications of the changes in consumer surplus were attempted using an estimated demand from another Gulf fishery. In addition, changes in the revenues of the charter and party boat sector were estimated. Changes in ex-vessel revenues of the commercial sector and angler expenditures of the recreational sector were consequently traced through their ripple effects on the economy within an input-output framework.

Over the short-run, the commercial sector would have to forego revenues amounting to $7.99 million as a result of the size and catch limits. Additional cost incurred and revenue foregone by this sector would amount to about $748 thousand as a result of other measures, especially gear restrictions, although part of this amount would be already counted under the measures limiting size and catch. Operational costs of the commercial sector can also be expected to increase, on the average, as a result of the measures. Thus, producer surplus of the harvest sector would likely decrease in the short-run. With less available reef fish in the market, consumers are expected to experience higher prices, prompting them to also experience lower consumer surpluses. Possibilities of imports and species substitution would negate some of these consumer losses.

Gear restrictions obviously have differential impacts. But in most cases the size and catch limits have dominant effects as to narrow the differential impacts of the restrictions on gear usage. Potentially, entangling net fishermen would be heavily impacted, because they are banned from the directed reef fish fishery. Their short-run loss would amount to around $239 thousand. As remarked in Section 5, this loss is dependent on the assumption that these fishermen take most of their catch from the EEZ; however since this is not the case, the Federal ban on entangling nets would affect fishermen only indirectly and at the time when the Gulf states, especially Florida, adopt a similar measure.

The recreational sector, on the other hand, would initially incur benefit losses ranging from around $2.23 million to $4.40 million as a result mainly of the size and catch limits. It has to be noted, though, that other restrictions, especially gear restrictions and stressed area, could enhance angler benefits in as much as these restrictions would limit commercial catches in certain areas. As recreational anglers experience less benefits, they would cut down their trips and expenditures. Angler expenditures are expected to decrease in amounts ranging from $10.5 million to $20.4 million. As a direct consequence of these trip reductions by recreational anglers, charter and party fishing boat fleets would suffer reductions in their revenues. Total revenue reductions expected of this sector would range from $3.1 million to $6.0 million for charter boats and from $1.4 million to $2.7 million for party boats.

Ex-vessel revenue reductions and angler expenditure reductions have repercussions on economic activities. The total impacts, i.e. direct, indirect, and induced effects, as a result of reductions in commercial ex-vessel revenues would amount to $15.6 million in output, $5.7 million in income, and 412 in number of jobs. The total impacts resulting from reductions in angler expenditures would be in the following ranges: $20.3 million to $39.4 million in output; $6.7 million to $13 million in income; and, 491 to 952 in number of jobs. Adding these impacts on both sectors, total reductions in economic activities would be in the following ranges: $35.9 million to $55 million in output; $12.4 million to $18.7 miilion in income; and, 903 to 1,364 in number of jobs.

The over-all long-run net effects appear to be positive for both commercial and recreational sectors, at least for the measures limiting size and catch. In the red snapper case, the long-run consequence of the status quo is a virtual collapse of the fishery with significant forgone revenues to the commercial sector and benefits to the recreational sector. The proposed measures are expected to, at least, prevent a further decline in the red snapper stock. In terms of revenue, the proposed measures on red snapper would generate around $3.2 million of net effects, if the same measures were in effect for the years 1990 through 2000. Under the restricted fishery, the cost of catching fish would be less since there is generally more fish available. In this respect, profitability to the commercial sector and benefits to the recreational sector would be tend to increase over time so that surpluses to both sectors would increase, until such time when effort in the fishery would have significantly increased.

The effects of other measures, especially gear restrictions, are not equivocably positive because of the inefficiencies they introduce in the commercial harvesting sector. However, these restrictions have the tendency to benefit the recreational sector by restricting the competitive edge of the commercial harvesting

sector and possibly restricting bycatch of this sector. The extent of net effects accruing to this implicit reallocation of a fishery resource is not known with current information.

A brief summary of impacts of the proposed measures is presented in Table 7.1.1.

7.2. Rejected Measures

The impacts of each rejected management measure are summarized in Table 7.2.1. Analogous to the proposed measures, quantifications are done mainly for the revenue/benefit aspects of the short-run effects. The long-run effects of most measures are qualitatively described. A summation of effects of these rejected measures is more complicated than that for the proposed measures mainly because of the many possible combinations of measures. Further complications are introduced by some measures that contain several possible options within them. For these types of measures, only some form of extreme options have been considered for analysis. Under these conditions, an over-all effect of the rejected measures is not attempted. But as shown in the table, some measures are also contrasted with their proposed counterparts to determine their relative effects.

7.3. Other Costs

As pointed out on several occasions in conjunction with the analysis of the proposed measures, additional administrative and enforcement costs will be incurred in implementing the measures. The cost of issuing permits is estimated to be $17 dollars per permit. In the case of fish traps, an additional cost of $0.70 per tag will be incurred. It is not known how many persons will apply for commercial permit. As for fish traps, the number of applicants can range from 94 to 475 fishermen. This type of cost, however, is intended to be passed on directly to the applicants. The cost that will be borne by fish trap fishermen has already been estimated and was included in determining part of the cost to the commercial sector.

The incremental cost of enforcing the measures is estimated to be around $160,000 and broken down as follows: $100,000 for additional coast guard services, and $60,000 for additional administrative services within the NMFS Southeast Region. It is likely that this additional cost would mean a reallocation of funds from one expenditure item to another within the general budget allocations of the NMFS and Coast Guard agencies. The efficiency implications of this reallocation is not determinable at this time.

Table 4.1.1.

Estimated Dockside Price Equations for Grouper and Snapper

	Intercept	Qt	It	INCt	D	R-square	D.W.
Grouper	-7.797	-0.4614	-0.047	1.6314	0.2659	0.991	2.04
	(0.8846)	(0.1123)	(.0144)	(.0599)	(.0658)		
Snapper	-4.291	-0.3698	-0.0152	1.0797	0.1437	0.997	1.94
	(.8240)	(.0697)	(.0155)	(.0424)	(.0291)		

Symbols:
- Qt = U.S. commercial landings of grouper or snapper
- It = imports of grouper or snapper
- INCt = U.S. disposable income
- D = binary variable, one if before 1967 and zero otherwise

Notes:
1. All estimated coefficients, except that for snapper imports, are statistically significant at the 95 percent level.
2. Numbers in parentheses are asymptotic standard errors.
3. The R-squared and Durbin-Watson (D.W.) statistics refer to the first stage of estimation.

Source: Keithly, W.R. and F.J. Prochaska (1985), "The Demand for Major Reef Fish Species in the Gulf and South Atlantic Regions of the United States".

Table 4.2.2.

Red Snapper Price Forecasting Equation

$$RPFL(t) = -75.3217*(1-RHO) + RHO*RPFL(t-1) - 0.04459083*[STOTL(t) - RHO*STOTL(t-1)] + 0.03907527*[YEAR(t) - RHO*YEAR(t-1)]$$

Symbols:

RPFL = real average annual prices for red snappers.

STOTL = total Gulfwide landings of red snappers, expressed in millions of pounds whole weight.

YEAR = 1956, 1957, ... , 1986.

RHO = first order serial correlation coefficient (RHO = 0.52829).

t = current year

t-1 = previous year

Source: J. Waters (1988), "Price Forecasting Equations for Red Snappers and Groupers in the Gulf of Mexico".

Table 4.2.3.

Estimates of Per Trip Net Economic Value in the Eastern Gulf of Mexico Region for Changes in King Mackerel Catch Rates, Semilog Pooled Site Model, 1986

	Decreases in Catch	
	25%	50%
Average Gulf Site		
High	-$2.42	-$4.84
Low	-$1.34	-$2.67

Notes:
1. High corresponds to model estimates using $3.35 as the value of travel time.
2. Low corresponds to model estimates using $0 as the value of travel time.

Source: J.W. Milon (1988), "Estimating Recreational Angler Participation and Economic Impact in the Gulf of Mexico Mackerel Fishery".

Table 4.2.4.

Gulfwide Input-Output Multipliers for the Commercial and Recreational Sectors, by Species Group

Species Group	Commercial			Recreational		
	Output	Income	Employment	Output	Income	Employment
Red snapper	2.1922	0.6979	52.6	2.1311	0.6646	53.8
Other snappers	1.8422	0.7032	50.0	1.8704	0.6286	44.9
Grouper	1.8805	0.708	50.6	1.8811	0.6311	44.6
Other reef fish	1.9662	0.7042	51.0	1.8718	0.6292	44.7

Notes:

1. Output multiplier represents the total change in dollar purchases for each additional dollar of output delivered to final demand by an industry.
2. Income multiplier represents the total dollar change in earnings of households for each additional dollar of output delivered to final demand by an industry.
3. Employment multiplier represents the total change in number of jobs for each additional one million dollars of output delivered to final demand by an industry.

Sources of basic data: RIMS-II Multipliers, BEA, U.S. Department of Commerce; NMFS General Canvas Landings, Data File; NMFS Marine Fishery Statistics Survey, Data File.

Table 5.1.1.

Landings Reduction and Revenues Foregone by the Commercial Harvesting Sector as a Result of the Quota on Red Snapper

State	Landing Reduction (lbs)	Foregone Revenue ($)
Florida	237,964	348,910
Alabama	30,705	45,021
Mississippi	84,439	123,807
Louisiana	253,316	371,420
Texas	161,201	236,359
Total	767,625	1,125,517

Notes:

1. The 1985-87 average Gulfwide commercial landings and values are 3,838,126 pounds and $7,942,029, respectively. The implied average price per pound is $2.07.
2. A 20 percent reduction in landings implies a 7.4 percent increase in price, using a price flexibility of -0.3698. Thus, price per pound after the change is $2.22.
3. Total revenue foregone is equal to the difference in total revenue before and after the change. Total revenue after the change is $6,816,512.

Source of basic data: NMFS General Canvas Landings, Data File.

Table 5.1.2.

Reduction in Economic Activities in the Gulf States
as a Result of Reduction in Commercial Landings
of Red Snapper

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $7.942	$17.4	$5.5	417.8
20% Reduction $1.125	$2.5	$0.8	59.2

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.3.

Loss in Consumer Surplus to the Recreational Sector
as a Result of Catch Reduction on Red Snapper

Type of Loss	Low	High
Loss per trip per angler	$1.55	$2.81
Annual loss per angler	$8.22	$14.89
Total loss	$509,903	$923,656

Notes:

1. Loss per trip per angler is based on a 29 percent reduction in catch, and calculated using a procedure described in Section 4.2 of the text. High and low estimates correspond to the different values assigned to travel time.
2. Annual loss per angler is calculated by multiplying the loss per trip per angler by the annual number of trips per angler. This latter figure is taken to be equal to 5.3, which is arrived at by dividing the total number of angler trips (20.378 million) by the total number of anglers (3.877 million). These two numbers are based on Tables 31 and 32 of the 1986 MRFSS report. For Texas, which is not included in the 1986 report, similar figures from the 1985 MRFSS report are used. Out-of-state anglers and their trips are excluded, because the number of these anglers cannot be estimated for the entire Gulf.
3. Total loss is calculated by multiplying annual loss per angler by the total number of anglers targeting red snapper. The total number of anglers targeting red snapper (62,032) is estimated by multiplying the total number of anglers by the the proportion of anglers targeting red snapper (0.16), as this latter is reported in Table 34 of the 1986 MRFSS report.

Table 5.1.4.

Number of Charter and Party Boats
Operating in the Gulf Coast

State	Charter	Party
Alabama	35	2
Florida	628	66
Louisiana	45	2
Mississippi	18	2
Texas	112	20
TOTAL	838	92

Sources of data: Holland, S.M. and J.W. Milon (1989), "The Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi Louisiana and Texas".

Table 5.1.5.

Mean Percent Time Targeted for Each Species by All Charter/Party Boats Operating in the Gulf States

	Charter Boats					Party Boats	
Species	FL	AL	MS	LA	TX	FL	Al-TX
Snapper	12.1	51.1	8	14.1	8.1	38.4	50.4
Grouper	15.7	5.5	1.9	0.1	1.5	28.8	3.9
Amberjack	7.7	6	0.8	0.9	0.5	7.5	0.3
Sp. Trout	2.6	2	3.4	42.7	34.6	1.6	3.6
King mack.	9.4	9.8	7.8	3.2	12.2	0.9	8.1
Span. mack.	3.7	3	6.9		0.2	2.6	2
Red drum	1.5	3	7.4	13.2	16.8	1.7	4.4
Bluefish	0.9	0.6	3.3			0.1	1.2
Cobia	3.1	2.2	4.8	2.1	0.5	1.9	0.2
Billfish	12.3	0.4	1.6	0.1	0.2	1.7	0.4
Tuna	3	0.2	0.8	0.4	0.2	1.3	0.3
Shark	5.2	0.6	3.3	1.1	0.4	1.4	0.9
Dolphin	10	0.8	1.8	1.2	1.1	1.6	0.3
Barracuda	3.3	0.3	0.8	0.1	0.3	0.9	0.2
Wahoo	2.6	0.4	0.8	0.1	0.6	0.3	0.2
Bonito	3.8	1.3	1.8		0.8	1.2	0.8
Ladyfish	0.7	0.6	2.3			1.7	0.2
Others	5.2	3.4	4.7	4.6	2.1	3.5	5.2

Notes:

1. Percents for each species are averages for the entire year.
2. Percents may not add up to 100 because some operators target none of some species or more than one species.
3. No entry means no operator targets the particular species.
4. AL-TX refers to party boat operators in Alabama, Mississippi Louisiana and Texas.

Sources of data: Holland, S.M. and J.W. Milon (1989), "The Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas".

Table 5.1.6.

Average Number and Type of Trips Taken by Charter and Party Boats Operating in the Gulf Coast

State	Charter Boats		Party Boats	
	Average Number of Trips	Percent of Trips in Bays	Average Number of Trips	Percent of Trips in Bays
Florida	165.6	15.4	279.5	12.1
Alabama	104.9	0.4		
Mississippi	93.2	1.1	131.9*	13.6*
Louisiana	110.6	58.4		
Texas	99.7	61.3		

* Average for Alabama, Mississippi, Louisiana and Texas party boats.

Sources of data: Holland, S.M. and J.W. Milon (1989), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas."

Table 5.1.7.

Average Annual Gross Revenues of Representative Charter and Party Boat Operating in the Gulf States

State	Charter Boat ($)	Party Boat ($)
Florida	62135	111500
Alabama	32050	
Mississippi	37800	90455*
Louisiana	45800	
Texas	25769	

* Average for Alabama, Mississippi, Louisiana and Texas party boats.

Sources of data: Holland, S.M. and J.W. Milon (1989), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas."

Table 5.1.8.

Range of Revenues Foregone by Charter and Party Boats
as a Result of a Reduction in Angler Trips for
Red Snapper

State	Charter Boats ($)	Party Boats ($)
Florida	619201 - 1197122	339357 - 656090
Alabama	61047 - 118025	
Mississippi	5797 - 11207	126237 - 244058*
Louisiana	30949 - 59835	
Texas	24898 - 48134	

* Average for Alabama, Mississippi, Louisiana and Texas party boats.

Note: Revenue foregone is computed as follows:

Gross revenue per boat	x	Number of boats	x	Mean percent of time the species is targeted	x	Percent reduction in number of trips

Sources of basic data: Holland, S.M. and J.W. Milon (1989), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas".

Table 5.1.9.

Reduction in Economic Activities in the Gulf States as a Result of Reduction in Recreational Catch of Red Snapper

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $16.044	$34.19	$10.66	863.2
29% Reduction $4.652	$9.91	$3.09	250.3
15% Reduction $2.407	$5.13	$1.60	129.5

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.10.

Comparative Catches and Values under the Status Quo and the Proposed Size and Catch Limit on Red Snapper (in million pounds and dollars)

	Status quo		Proposed		Difference
Year	Catches	Values	Catches	Values	(Value)
1990	3.17	6.79	2.59	5.61	-1.18
1991	3.41	7.65	3.08	6.95	-0.69
1992	3.45	8.00	3.44	7.98	-0.02
1993	3.32	7.92	3.51	8.34	0.42
1994	3.13	7.79	3.47	8.42	0.64
1995	2.92	7.29	3.37	8.20	0.91
1996	2.72	6.93	3.26	8.15	1.22
1997	2.54	6.60	3.16	8.08	1.48
1998	2.39	6.32	3.09	8.05	1.73
1999	2.25	6.05	3.04	8.06	2.01
2000	2.14	5.85	3.01	8.10	2.26

Notes:

1. The net present value of the difference in dollar values of the status quo and the proposed measure is $3.16 million.
2. Projected landings are generated using a biological simulation model.
3. Projected values are generated by multiplying landings by the forecasted prices. Prices are generated using a price forecasting model.

Table 5.1.11.

Projected Participation in Total and Red Snapper
Marine Recreational Fishing by Residents of Coastal States
(1,000)

State	1990			1995			2000			2010		
	Pop'n	Total Days Fished	Red Sn. Days Fished	Pop'n	Total Days Fished	Red Sn. Days Fished	Pop'n	Total Days Fished	Red Sn. Days Fished	Pop'n	Total Days Fished	Red Sn. Days Fished
Florida	10141	37883	652	11044	41252	710	11915	44742	770	13281	49001	843
Alabama	3107	2220	38	3163	2168	37	3249	2152	37	3489	2289	39
Mississippi	2016	1409	24	2041	1406	24	2102	1427	25	2263	1412	24
Louisiana	3469	2911	50	3574	3089	53	3711	3259	56	4002	3340	58
Texas	12999	16317	281	13770	17289	297	14654	18653	321	16052	20875	359

Sources of data: Sport Fishing Institute (1988), "Economic Activity Associated with Marine Recreational Fishing in 1985: Volume III--Future Participation in Marine Recreational Fishing"; NMFS Marine Recreational Fishing Survey, 1984-86.

Table 5.1.12.

Landings Reduction and Revenues Foregone by the Commercial Harvesting Sector as a Result of the Size Limit on Other Snapper

State	Landing Reduction (lbs)	Foregone Revenue ($)
Florida	447,211	474,083
Alabama	4,733	5,031
Mississippi	3,416	3,622
Louisiana	15,838	16,601
Texas	3,513	3,723
Total	474,711	503,060

Notes:

1. The 1985-87 average Gulfwide commercial landings and values of other snapper consisting of gray, vermilion, and yellowtail are 3,046,924 pounds and $4,772,934, respectively. The implied average price per pound is $1.57.
2. A 15.6 percent reduction in landings implies a 5.8 percent increase in price, using a price flexibility of -0.3698. Thus, price per pound after the change is $1.66
3. Total revenue foregone is equal to the difference in total revenue before and after the change. Total revenue after the change is $4,269874.

TABLE 5.1.13.

Reduction in Economic Activities in the Gulf States
as a Result of Reduction in Commercial Landings

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $4.773	$8.79	$3.36	238.7
15.6% Reduction $0.614	$1.13	$0.43	30.7

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.14.

Reduction in Recreational Catch
Due to Size Limits on Other Snappers

Species	Percent Reduction	Total Catch (No.)	Total Catch (lbs.)	Catch Reduction (No.)	Catch Reduction (lbs)
Gray	60.26	1,098,643	1,280,677	662042	771736
Lane	7.75	236,673	151,457	18342	11738
Mutton	23.16	53,915	145,186	12487	33625
Vermilion	8.43	333,682	345,125	28129	29094
Yellowtail	50.38	351,194	488,637	176932	246175
Total		2,074,107	2,411,082	897,932	1,092,368

Notes:

1. Total catches (pounds and numbers) are average recreational catch (A+B1) for the 1985-87 period.
2. Percent reductions are based on cumulative length frequency by species landed (A+B1) by recreational anglers, averaged over the 1985-87 period.

Source of basic data: NMFS Marine Recreational Fishery Statistics Survey, Data File.

Table 5.1.15.

Loss in Consumer Surplus to the Recreational Sector
as a Result of Catch Reduction in Other Snappers

Type of Loss	Low	High
Loss per trip per angler	$1.88	$3.39
Annual loss per angler	$9.96	$17.97
Total loss	$413,948.00	$746,851.00

Notes:

1. Loss per trip per angler is based on a 35 percent reduction in catch, and calculated using a procedure described in Section 4.2 of the text. High and low estimates correspond to the different values assigned to travel time.
2. Annual loss per angler is calculated by multiplying the loss per trip per angler by the annual number of trips per angler. This latter figure is taken to be equal to 5.3, which is arrived at by dividing the total number of angler trips (20.378 million) by the total number of anglers (3.877 million) These two numbers are based on Tables 31 and 32 of the 1986 MRFSS report. For Texas, which is not included in the 1986 report, similar figures from the 1985 MRFSS report are used. Out-of-state anglers and their trips are excluded, because the number of these anglers cannot be estimated for the entire Gulf.
3. Total loss is calculated by multiplying annual loss per angler by the total number of anglers targeting other snapper. The total number of anglers targeting other snapper (41,561) is estimated as a proportion of the total number of anglers target targeting red snapper. This proportion is 0.67, and is based the 1981 Marine Recreation Fishing Socioeconomic Survey.

Table 5.1.16.

Range of Revenues Foregone by Charter and Party Boats
as a Result of a Reduction in Angler Trips for
Other Snappers

State	Charter Boats ($)	Party Boats ($)
Florida	245,832 - 478,006	148,036 - 287,847
Alabama	29,922 - 58,181	
Mississippi	2,841 - 5,525	61,874 - 120,310*
Louisiana	15,169 - 29,496	
Texas	12,203 - 23,728	

* Average for Alabama, Mississippi, Louisiana and Texas party boats.

Note: Revenue foregone is computed as follows:

Gross revenue per boat	x	Number of boats	x	Mean percent of time the species is targeted	x	Percent reduction in number of trips

Sources of basic data: Holland, S.M. and J.W. Milon (1989), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas".

Table 5.1.17.

Reduction in Economic Activities in the Gulf States as a Result of Reduction in Recreational Catch of Other Snappers

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $10.749	$20.11	$6.76	482.6
35% Reduction $3.762	$7.04	$2.37	168.9
18% Reduction $1.935	$3.62	$1.22	86.9

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.18.

Landings Reduction and Revenues Foregone by the Commercial Harvesting Sector as a Result of the Size Limit and Quota on Groupers

State	Landing Reduction (lbs)	Foregone Revenue ($)
Florida	4,746,796	5,345,253
Alabama	37,334	42,041
Mississippi	16,000	18,018
Louisiana	373,344	420,413
Texas	160,005	180,177
Total	5,333,479	6,005,902

Notes:

1. The 1985-87 average Gulfwide commercial landings and values are 12,774,400 pounds and $19,473,969 respectively. The implied average price per pound is $1.52.
2. A 42 percent reduction in landings implies a 19.4 percent increase in price, using a price flexibility of -0.4614. Thus, price per pound after the change is $1.81.
3. Total revenue foregone is equal to the difference in total revenue before and after the change. Total revenue after the change is $13,468,067.

Source of basic data: NMFS General Canvas Landings, Data File.

Table 5.1.19.

Reduction in Economic Activities in the Gulf States as a Result of Reduction in Commercial Landings of Grouper

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $19.474	$36.62	$13.79	985.4
42% Reduction $6.006	$11.29	$4.25	303.9

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.20.

Reduction in Recreational Catch as a Result of the Size Limit on Groupers

Species	Percent Reduction	Total Catch (No.)	Total Catch (lbs.)	Catch Reduction (No.)	Catch Reduction (lbs.)
Red	74.98	638,114	2,449,816	478,458	1,836,872
Black	48.53	444,042	2,337,720	215,494	1,134,496
Gag	34.1	203,666	1,301,761	69,450	443,901
Nassau	62.7	46,835	169,088	29,366	106,018
Jewfish	91.67	7,218	169,182	6,617	155,089
Total		1,339,875	6,427,567	799,385	3,676,376

Notes:

1. Total catches (pounds and numbers) are average recreational harvest (A+B1) for the 1985-87 period.
2. Percent reductions are based on cumulative length frequency, by species landed (A+B1) by anglers, averaged over the 1985-87 period.

Source of basic data: NMFS Marine Recreational Fishery Statistics Survey, Data File.

Table 5.1.21.

Loss in Consumer Surplus to the Recreational Sector
as a Result of Catch Reduction on Grouper

Type of Loss	Low	High
Loss per trip per angler	$3.22	$5.81
Annual loss per angler	$17.07	$30.79
Total loss	$1,171,395	$2,112,902

Notes:

1. Loss per trip per angler is based on a 60 percent reduction in catch, and calculated using a procedure described in Section 4.2 of the text. High and low estimates correspond to the different values assigned to travel time.
2. Annual loss per angler is calculated by multiplying the loss per trip per angler by the annual number of trips per angler. This latter figure is taken to be equal to 5.3, which is arrived at by dividing the total number of angler trips (20.378 million) by the total number of anglers (3.877 million). These two numbers are based on Tables 31 and 32 of the 1986 MRFSS report. For Texas, which is not included in the 1986 report, similar figures from the 1985 MRFSS report are used. Out-of-state anglers and their trips are excluded, because the number of these anglers cannot be estimated for the entire Gulf.
3. Total loss is calculated by multiplying annual loss per angler by the total number of anglers targeting red snapper. The total number of anglers targeting grouper (68,623) is estimated by multiplying the total number of anglers by the the proportion of anglers targeting grouper (0.0177), as this latter is reported in Table 34 of the 1986 MRFSS report.

Table 5.1.22.

Range of Revenues Foregone by Charter and Party Boats as a Result of a Reduction in Angler Trips for Groupers

State	Charter Boats ($)	Party Boats ($)
Florida	1,905,553 - 3,688,166	661,174 - 1,279,583
Alabama	19,126 - 37,018	
Mississippi	4,008 - 7,756	28,434 - 55,033*
Louisiana	638 - 1,237	
Texas	13,421 - 25,975	

* Average for Alabama, Mississippi, Louisiana and Texas party boats.

Note: Revenue foregone is computed as follows:

Gross revenue per boat	x	Number of boats	x	Mean percent of time the species is targeted	x	Percent reduction in number of trips

Sources of basic data: Holland, S.M. and J.W. Milon (1989), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas".

Table 5.1.23.

Reduction in Economic Activities in the Gulf States as a Result of Reduction in Recreational Catch of Grouper

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $17.749	$33.39	$11.20	791.6
60% Reduction $10.649	$20.03	$6.72	475
31% Reduction $5.502	$10.35	$3.47	245.4

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.24.

Landings Reduction and Revenues Foregone by the Commercial Harvesting Sector as a Result of the Size Limit on Amberjacks

State	Landing Reduction (lbs)	Foregone Revenue ($)
Florida	531,622	121,653
Alabama	27,222	12,310
Mississippi	30,424	13,758
Louisiana	156,124	70,603
Texas	55,244	24,982
Total	800,636	362,064

Notes:

1. The 1985-87 average Gulfwide commercial landings and values are 1,334,393 pounds and $735,694, respectively. The implied average price per pound is $0.55.
2. A 60 percent reduction in landings implies a 27.7 percent increase in price, using a price flexibility of -0.4614 Thus, price per pound after the change is $0.70
3. Total revenue foregone is equal to the difference in total revenue before and after the change. Total revenue after the change is $373,630.

Source of basic data: NMFS General Canvas Landings, Data File.

Table 5.1.25.

Reduction in Economic Activities in the Gulf States as a Result of Reduction in Commercial Landings of Amberjacks

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $0.736	$1.45	$0.52	37.5
60% Reduction $0.362	$0.71	$0.26	18.5

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.1.26.

Reduction in Recreational Catch
Due to the Size Limits on
Amberjack and Sea Bass

Species	Percent Reduction	Total Catch (No.)	Total Catch (lbs.)	Catch Reduction (No.)	Catch Reduction (lbs)
Amberjack	63	278,715	9,389,000	175,590	5,915,070
Sea Bass	7	1,850,954	4,576,000	129,567	320,320
Total		2,129,669	13,965,000	305,157	6,235,390

Notes:

1. Total catches (pounds and numbers) are average recreational catch (A+B1) for the 1985-87 period.
2. Percent reductions are based on cumulative length frequency by species landed (A+B1) by recreational anglers, averaged over the 1985-87 period.

Source of basic data: NMFS Marine Recreational Fishery Statistics Survey, Data File.

Table 5.1.27.

Loss in Consumer Surplus to the Recreational Sector
as a Result of Catch Reduction on
Amberjack and Sea Bass

Type of Loss	Low	High
Loss per trip per angler	$0.75	$1.36
Annual loss per angler	$3.98	$7.21
Total loss	$141,956	$257,166

Notes:

1. Loss per trip per angler is based on a 14 percent reduction in catch, and calculated using a procedure described in Section 4.2 of the text. High and low estimates correspond to the different values assigned to travel time.
2. Annual loss per angler is calculated by multiplying the loss per trip per angler by the annual number of trips per angler. This latter figure is taken to be equal to 5.3, which is arrived at by dividing the total number of angler trips (20.378 million) by the total number of anglers (3.877 million). These two numbers are based on Tables 31 and 32 of the 1986 MRFSS report. For Texas, which is not included in the 1986 report, similar figures from the 1985 MRFSS report are used. Out-of-state anglers and their trips are excluded, because the number of these anglers cannot be estimated for the entire Gulf.
3. Total loss is calculated by multiplying annual loss per angler by the total number of anglers targeting red snapper. The total number of anglers targeting amberjack and sea bass (35,668) is estimated by multiplying the total number of anglers by the proportion of anglers targeting sea basses (0.0092), as this latter is reported in Table 34 of the 1986 MRFSS report.

Table 5.1.28.

Range of Revenues Foregone by Charter and Party Boats
as a Result of a Reduction in Angler Trips for
Amberjack and Sea Bass

State	Charter Boats ($)	Party Boats ($)
Florida	426,107 - 852,214	85,512 - 171,023
Alabama	4,711 - 9,423	
Mississippi	381 - 762	494 - 988*
Louisiana	1,298 - 2,597	
Texas	1,010 - 2,020	

* Average for Alabama, Mississippi, Louisiana and Texas party boats.

Note: Revenue foregone is computed as follows:

Gross revenue per boat	x	Number of boats	x	Mean percent of time the species is targeted	x	Percent reduction in number of trips

Sources of basic data: Holland, S.M. and J.W. Milon (1989), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleet of the Gulf Coast of Florida"; Ditton, R.B. et al. (1988), "The Social Structure and Economics of the Charter and Party Boat Fishing Fleets in Alabama, Mississippi, Louisiana and Texas".

Table 5.1.29.

Reduction in Economic Activities in the Gulf States as a Result of Reduction in Recreational Catch of Amberjack and Sea Bass

Direct Output Effects	Total Effects		
	Output	Income	Employment
Baseline $9.225	$17.27	$5.80	412.4
14% Reduction $1.292	$2.42	$0.81	57.8
7% Reduction $0.646	$1.21	$0.41	28.9

Notes:
1. Output and income effects are in millions of dollars; employment refers to the number of jobs.
2. Total effects consist of direct, indirect, and induced effects.
3. Baseline refers to the 1985-87 average economic activities.

Table 5.2.1.

Percentage of Longline Catches of Reef Fish from the Eastern and Western Gulf

Species	Eastern Gulf Percent Share	Western Gulf Percent Share
Red snapper	31	69
Vermilion sn.	17	83
Shallow w. grprs.	93	7
Deepwater grps.	33	67
Jewfish	33	67
Amberjack	32	68
Other reef fish	25	75

Note: Percentages are based on longline catches, by species and statistical grids, averaged over the 1988-87 period for groupers and 1984-86 period for other species. The 1987 breakdown for other species is not available, while the 1985 breakdown for groupers is not reliable.

Table 5.2.2.

Reduction in Longline Catches of Reef Fish
Due to the Prohibition

Species	Eastern Gulf (lbs)	Western Gulf (lbs)
Red snapper	0	69494
Vermilion sn.	0	13345
Shallow w. grps.	217968	239783
Deepwater grps.	0	0
Jewfish	422	12515
Amberjack	2935	97758
Other reef fish	1987	93460
Total	223312	526355

Note: Reductions in landings are based on the 1985-87 average landings of longlines, by species.

Source of basic data: NMFS General Canvas Landings, Data File.

Table 7.1.1.
Summary of Individual Effects of the
Proposed Management Measures

Management Measures	Short-run	Long-run
1. Size and Catch Limits		
1.1. Red Snappers		
a. Commercial sector	Revenue loss of $1.12 million; Total impacts: output = $2.5 M income = $0.8 M emplmnt = 59.2 jobs	Net revenue gain of $3.2 M; Likely positive producer surplus
b. Recreational sector	Surplus loss of $0.51 M to $0.92 M; Revenue loss: Charter= $0.62 M to $1.21 M Party = $0.43 M to $0.83 M Total impacts: output = $5.13 M to $9.91 M income = $1.60 M to $3.09 M emplmnt= 129.5 to 250.3 jobs	Likely gain in consumer surplus
1.2. Other Snappers		
a. Commercial sector	Revenue loss of $0.50 million; Total impacts: output = $1.13 M income = $0.43 M emplmnt = 30.7 jobs	Likely gain in producer surplus

Table 7.1.1. (cont'd)
Summary of Individual Effects of the
Proposed Management Measures

Management Measures	Short-run	Long-run
b. Recreational sector	Surplus loss of $0.41 M to $0.75 M; Revenue loss: Charter= $0.31 M to $0.59 M Party = $0.21 M to $0.41 M Total impacts: output = $3.62 M to $7.04 M income = $1.22 M to $2.37 M emplmnt= 86.9 to 168.9 jobs	Likely gain in consumer surplus
1.3. Groupers		
a. Commercial sector	Revenue loss of $6.01 million; Total impacts: output =$11.29 M income = $4.25 M emplmnt = 303.9 jobs	Likely gain in producer surplus
b. Recreational sector	Surplus loss of $1.17 M to $2.11 M; Revenue loss: Charter= $1.94 M to $3.76 M Party = $0.69 M to $1.33 M Total impacts: output = $10.35 M to $20.03 M income = $3.47 M to $6.72 M emplmnt= 245.4 to 475 jobs	Likely gain in consumer surplus

Table 7.1.1. (cont'd)
Summary of Individual Effects of the
Proposed Management Measures

Management Measures	Short-run	Long-run
1.4. Amberjack and Sea Bass		
a. Commercial sector	Revenue loss of $0.36 million; Total impacts: output = $0.71 M income = $0.26 M emplmnt = 18.5 jobs	Likely gain in producer surplus
b. Recreational sector	Surplus loss of $0.14 M to $0.26 M; Revenue loss: Charter= $0.22 M to $0.43 M Party = $0.04 M to $0.08 M Total impacts: output = $1.21 M to $2.42 M income = $0.41 M to $0.81 M emplmnt= 28.9 to 57.8 jobs	Likely gain in consumer surplus
2. Gear Restrictions		
2.1. Fish Traps	Permit and tag cost of $6,768 to $34,200	Negative producer surplus, but may be positive over-all if it helps in stock rebuilding

Table 7.1.1. (cont'd)
Summary of Individual Effects of the
Proposed Management Measures

Management Measures	Short-run	Long-run
2.2. Trawls other measures	Revenue loss of $106 thousand	Negative producer (crew) surplus, but may be positive over-all if it helps enforce
2.3. Longlines	Revenue loss of of at least $403 thousand	Negative producer surplus, but may be positive or negative over-all
2.4. Entangling Nets	Revenue loss of $239 thousand, if most catches are in the EEZ	Revenue loss of $2.4 M, and negative producer surplus, if most catches are in EEZ
2.5. Permits and Gear Identification		
a. Commercial sector	Permit cost to full-timers; revenue loss to part-timers; gain in producer surplus to full-timers outweighs loss in producer surplus to part-timers	Improves enforcement of other measures

Table 7.1.1. (cont'd)
Summary of Individual Effects of the
Proposed Management Measures

Management Measures	Short-run	Long-run
b. Recreational sector	Loss in revenue to part-timers; loss in consumer surplus to part-timers outweighs gain in consumer surplus to full-timers	Improves enforcement of other measures
4. Stressed Area	Loss in revenue to some commercial fishermen; possible gain in benefits to recreational sector	Positive or negative over-all
5. Fishing Year	No impact	Positive or negative over-all
6. Closed Seasons/Areas	No impact	Generally uncertain, but has some more positive feature than a quota
7. User Group Conflict	No impact	Uncertain
8. Statistical Reporting	Labor cost to fishermen; additional administrative cost;	Generates sound data base for better fishery management

Table 7.2.1.
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
1. Size and Catch Limits		
1.1. Red Snappers		
Rejected Measure 1		
a. Commercial sector	No impact	Loss in producer surplus
b. Recreational sector	No impact	Loss in consumer surplus
Rejected Measure 2		
a. Commercial sector	Revenue loss of $4.3 M	Gain in producer surplus which may be less than, equal to, or greater than that of the proposed measure
b. Recreational sector	Consumer surplus loss of around $1.7 M	Gain in consumer surplus which may be less than equal to, or greater thaN that of the proposed measure
Rejected Measure 3		
a. Commercial sector	Revenue loss of around $4.8 M	Gain in producer surplus which may be less than equal to, or greater than that of the proposed measure
b. Recreational sector	Consumer surplus loss of around $1.7 M to $3.1 M	Gain in consumer surplus which may be less than equal to, or greater than that of the proposed measure

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
Rejected Measure 4		
a. Commercial	Loss in revenue; possible increase in operational cost	Gain in producer surplus which may be less than that of the proposed measure; possibly more equitable than the proposed measure
b. Recreational	Loss in consumer surplus;possibly low compliance	Gain in consumer surplus which may be less than that of the proposed measure; possibly more equitable than the proposed measure
Rejected Measure 5		
a. Commercial	Loss in revenue of $7.9 M; Total impacts: output= $17.3 M income= $ 5.5 M emplymnt= 415.5 jobs	Net present value of revenue loss is $51.3 M
b. Recreational	Significant gain in consumer surplus	Significant gain in consumer surplus
1.2. Other Snappers		
Rejected Measure 1		
a. Commercial sector	No impact	Loss in producer surplus when compared with the proposed measure
b. Recreational sector	No impact	Loss in consumer surplus when compared with the proposed measure

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
Rejected Measure 2		
a. Commercial sector	Revenue loss of $3.7 M	Gain in producer surplus which may be less than, equal to, or greater than that of the proposed measure
b. Recreational sector	Consumer surplus loss of $1.9 M	Gain in consumer surplus which may be less than, equal to, or greater than that of the proposed measure
Rejected Measure 3		
a. Commercial sector	Loss in producer surplus which may be greater than that of the proposed measure	Possible gain in producer surplus but may be less than that of the proposed measure
b. Recreational sector	Loss in consumer surplus which may be greater than that of the proposed measure	Possible gain in consumer surplus but may be less than that of the proposed measure
1.3. Groupers		
Rejected Measure 1		
a. Commercial sector	No impact	Loss in producer surplus when compared with the proposed measure
b. Recreational sector	No impact	Loss in consumer surplus when compared with the proposed measure

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
Rejected Measure 2		
a. Commercial sector	Revenue loss of $11.7 M	Gain in producer surplus which may be less than, equal to, or greater than that of the proposed measure
b. Recreational sector	Consumer surplus loss of $6 M to $11.3 M	Gain in consumer surplus which may be less than, equal to, or greater than that of the proposed measure
Rejected Measure 3		
a. Commercial sector	Loss in producer surplus which may be greater than that of the proposed measure	Possible gain in producer surplus but may be less than that of the proposed measure
b. Recreational sector	Loss in consumer surplus which may be greater than that of the proposed measure	Possible gain in consumer surplus but may be less than that of the proposed measure
Rejected Measure 4		
a. Commercial sector	Possible revenue loss	Impact is not known
b. Recreational sector	Possible loss in consumer surplus	Impact is not known
1.4. Amberjack and Sea Bass		
Rejected Measure 1		
a. Commercial sector	No impact	Possible loss in producer surplus when compared with the proposed measure

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
b. Recreational sector	No impact	Possible loss in consumer surplus when compared with the proposed measure
Rejected Measure 2		
a. Commercial sector	Revenue loss of $362 thousand	Gain in producer surplus which may be less than, equal to, or greater than that of the proposed measure
b. Recreational sector	Loss in consumer surplus of $ 752 thousand	Gain in consumer surplus which may be less than, equal to, or greater than that of the proposed measure
Rejected Measure 3		
a. Commercial sector	Loss in producer surplus which may be greater than that of the proposed measure	Possible gain in producer surplus but may be less than that of the proposed measure
b. Recreational sector	Loss in consumer surplus which may be greater than that of the proposed measure	Possible gain in consumer surplus but may be less than that of the proposed measure
2. Gear Restrictions		
2.1. Fish Traps		
Rejected Measure 1	No impact	Relatively not known
Rejected Measure 2	Some reduction in revenue	Positive or negative impact

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
Rejected Measure 3	Some reduction in revenue	Positive or negative impact
Rejected Measure 4	May have significant reduction in revenue; cost will increas	Positive or negative impact
Rejected Measure 5	No impact	May have negative net effect
Rejected Measure 6	Gain in revenue and possibly producer surplus	Possible gain in producer surplus
Rejected Measure 7	Revenue loss of $1.3 M	Net present value of foregone revenues of $13 M; possible loss in producer surplus
2.2. Trawls		
Rejected Measure 1	No impact	Negative net effect
Rejected Measure 2	Revenue loss	Positive or negative net effect
Rejected Measure 3	Revenue loss	Positive or negative net effect
Rejected Measure 4	Revenue loss	Positive or negative net effect
Rejected Measure 5	Revenue loss	Positive or negative net effect

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
2.3. Longlines		
Rejected Measure 1	Revenue loss of about $5.3 M; industry profitability declines	Possibly negative net effect
Rejected Measure 2	Revenue loss of about $9.6 M	Net present value of foregone revenue is $96 M; negative net effect
Rejected Measure 3	Not known	Positive or negative net effect
Rejected Measure 4	No impact	Possibly positive net effect
2.4. Additional Gear Restrictions		
Rejected Measure 1	Possible loss in revenue; additional cost	Likely negative net effect
Rejected Measure 2	No impact	Positive or negative net effect
Rejected Measure 3	Possible loss in revenue	Net loss in producer surplus, but the net overall effect may be positive or negative depending on the magnitude of an increase in angler consumer surplus

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
3. Fishing Year		
Rejected Measure 1	Positive or negative effect	Positive or negative effect
4. Stressed Area Boundaries		
Rjectd Measures 1,2,& 3	Likely gain in revenue	Possibly positive net effect
5. User Group Conflict Resolution		
Rejected Measure 1	Positive or negative	Positive or negative
Rejected Measure 2	Positive or negative	Positive or negative over-all impact, but can be less costly than status quo
6. Closed Seasons/Areas		
Rejected Measure 1	Positive or negative	Positive or negative, but has some features better than the quota
7. Permits and Gear Identification		
Rejected Measure 1		
a. Commercial sector	Permit cost of about $23 per permittee	Possibly positive in the sense of enforcing other measures
b. Recreational sector	Minimal effect	Possibly positive in the sense of enforcing other measures

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
Rejected Measure 2		
a. Commercial sector	Permit cost to full-timers; revenue loss to part-timers; gain in producer surplus to full-timers outweigh loss in producer surplus to part-timers; has lesser effect compared to the proposed measure	Improves enforcement of other measures
b. Recreational Sector	Loss in revenue to part-timers; loss in consumer surplus to part-timers outweighs gain in consumer surplus to full-timers	Enhances enforcement of other measures
Rejected Measure 3		
a. Commercial sector	Minimal effect	Minimal effect
b. Recreational sector	Permit cost of about $23 per permittee or a total of $21,390	Enhances data collection effort
Rejected Measure 4		
a. Commercial sector	Enforces state permitting laws	Cost to the harvest sector is likely to increase
b. Recreational sector	Minimal effect	Minimal effect

Table 7.2.1. (cont'd)
Summary of Individual Effects of the
Rejected Management Measures

Management Measures	Short-run	Long-run
Rejected Measure 5		
a. Commercial sector	Minimal effect	May decrease the profitability of the industry
b. Recreational sector	Minimal effect	May result in gain in consumer surplus
8. Statistical Reporting		
Rejected Measure 1	Entails more cost	Enables collection of good data for management purposes

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