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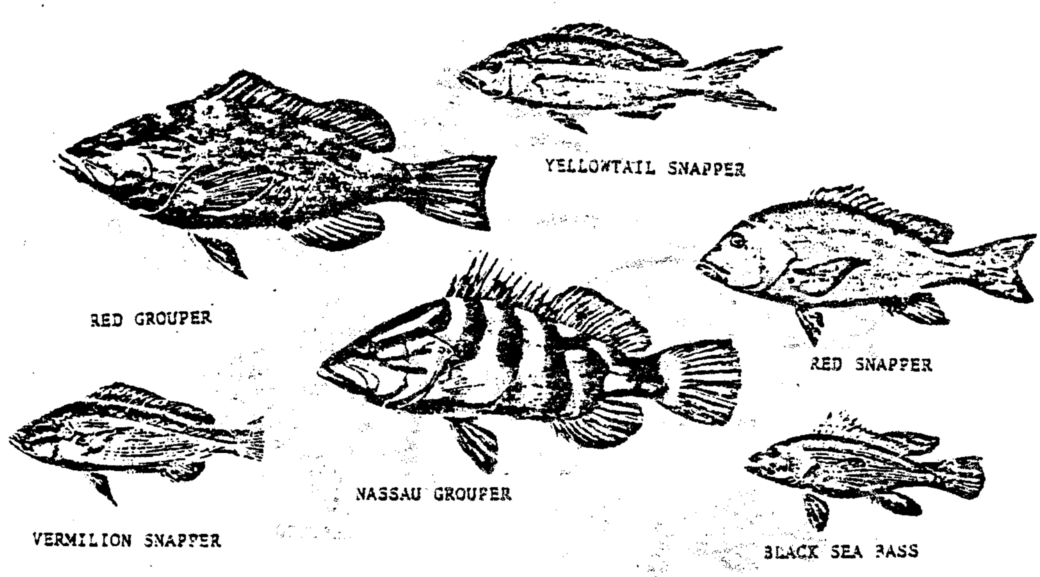
FISHERY MANAGEMENT PLAN, REGULATORY IMPACT REVIEW, AND FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE SNAPPER-GROUPER FISHERY OF THE SOUTH ATLANTIC REGION

MARCH 1983



PREPARED BY THE

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IN COOPERATION WITH

NATIONAL MARINE FISHERIES SERVICE

FISHERY MANAGEMENT PLAN,
REGULATORY IMPACT REVIEW,
AND FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR THE

SNAPPER-GROUPER FISHERY
OF THE
SOUTH ATLANTIC REGION

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South Atlantic Fishery Management Council

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Financial assistance for producing this document was provided by grant funds from the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, under Public Law 94-265, the Magnuson Fishery Conservation and Management Act.

1.0 INTRODUCTION

This document presents a combined fishery management plan (FMP) for the snapper-grouper fishery of the South Atlantic Region, regulatory impact review (RIR) of the economic consequences of the proposed management measures, and final environmental impact statement (FEIS) describing the possible effects on the environment of implementing the plan. The table of contents for the RIR and FEIS elements are provided separately to aid in referencing corresponding sections of the FMP. The FMP is based on a source document which contains the detailed scientific, technical, and other supportive documentation on which the management regime proposed for the snapper-grouper fishery is based. The numbering system in both the source document and the FMP are the same in Section 5.0 through Section 8.0. This source document is available for review at the following locations:

South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407-4699

National Marine Fisheries Service
Southeast Regional Office
Duval Building, 9450 Koger Boulevard
St. Petersburg, Florida 33702

National Marine Fisheries Service
Southeast Fisheries Center
75 Virginia Beach Drive
Miami, Florida 33149

U.S. Department of Commerce, NOAA
National Marine Fisheries Service
3300 Whitehaven St., N.W.
Washington, D.C. 20235

Definitions of Terms

Age liable to capture: Age or size at which fish are first vulnerable to specific fishing gear.

Catch-per-Unit Effort (CPUE): The total number or weight of fish harvested by a defined unit of fishing effort.

Domestic Annual Harvest (DAH): The capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield.

Environmental Impact Statement (EIS) is required by the National Environmental Policy Act of 1969 whenever major Federal actions may significantly affect the quality of the environment, including the human environment. A draft (DEIS) and a final (FEIS) environmental impact statement are prepared.

Executive Order 12291 (E.O.) directs agencies to develop or revise informal rulemaking procedures to ensure that regulations are necessary, appropriate, and cost effective.

Fishery Conservation Zone (FCZ) is the area in which the United States asserts exclusive fishery management authority, established and defined by the Magnuson Fishery Conservation and Management Act of 1976: "The inner boundary of the FCZ is a line coterminous with the seaward boundary of each of the coastal states, and the outer boundary of such zone is a line drawn in such a manner that each point on it is 200 nautical miles from the baseline from which the territorial sea is measured."

Fishing effort: Also fishing pressure; the amount of fishing activity as measured by fishing mortality in yield-per-recruit analyses.

Fishing mortality (F): Instantaneous rate of fishing mortality calculated in yield-per-recruit analysis is that portion of total mortality attributable to fishing. It is equal to total mortality (Z) minus natural mortality (M). F is the measure of "fishing pressure" for stock assessment and management considerations in this FMP.

Fishing pressure: The quantitative estimate of fishing pressure is fishing mortality (F).

Growth overfishing: The harvesting of a fish stock to the point that the harvest is less than the maximum possible (by weight). Growth overfishing can be controlled by limiting fishing mortality on all size fish (e.g. time/area closures or quotas) and/or by reducing the range of sizes that are liable to capture (impose minimum sizes). Growth overfishing is defined in this FMP as an existing combination of fishing pressure (F) and age liable to capture such that an increase in age liable to capture (minimum sizes) or a decrease in fishing pressure will significantly increase YPR. Growth overfishing is an established scientific definition measured by YPR analyses but is not considered to be "overfishing" in the context of National Standard One of MFCMA.

Incidental catch: The catch of species other than the target species. Also called bycatch.

Internal rate of return (IRR): The discount rate (i) that produces a present value of zero for a stream of values over a number of years.

Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 <u>et seq</u>.) (MFCMA): Established the FCZ and eight regional fishery management councils to prepare, monitor, and revise fishery management plans.

Marine Resources Monitoring Assessment and Prediction (MARMAP): A program, initiated by NMFS, that sponsors research on adult fish stocks and ichthyoplankton.

Maximum sustainable yield (MSY): The largest quantity (by weight) of fish that can be harvested annually from a resource without reducing its long-term productive potential.

Maximum Yield-Per-Recruit (YPR): Maximum YPR is comparable to maximum yield (MY) for the purposes of management which is comparable to MSY if there is constant recruitment.

National Marine Fisheries Service (NMFS): A division of the National Oceanic and Atmospheric Administration, Department of Commerce, responsible for conservation and management of fisheries.

Natural Mortality (M): Instantaneous rate of natural mortality calculated in yield-per-recruit analysis is equal to total mortality (Z) minus fishing mortality (F) or that portion of total mortality attributable to all causes except fishing.

Optimum Yield (OY) (defined by MFCMA): "the amount of fish A) which will provide the greatest overall benefit to the Nation, with particular reference to food production and recreational opportunities; and B) which is prescribed as such on the basis of the maximum sustainable yield from such fishery as modified by any relevant economic, social, or ecological factors." The optimum yield for each species with a minimum size is the yield that results from the recommended minimum size.

Plan Development Team (PDT): Consists of professionals chosen to gather data, perform quantitative analyses, and submit recommendations to a Steering Committee for a particular fishery management plan.

Present value (PV): The results of discounting a stream of numbers (v) for a specified number of years (n) by a specific discount rate (i):

$$PV = \sum_{t=1}^{n} \frac{V_{(t)}}{(1+i)^t}$$

Recruitment: Number of fish growing into the smallest harvestable size category each year.

Recruitment overfishing: The harvesting of a stock to the point that reproduction by the remaining brood stock is inadequate to produce as many fish as the habitat can support. Recruitment overfishing is an established scientific definition that is not measured by YPR analyses. Recruitment overfishing is considered to be overfishing in the context of National Standard One of MFCMA.

Regional Director (RD): Southeast Regional Director of the National Marine Fisheries Service.

Regulatory Impact Review (RIR): An assessment of the economic impacts of proposed government regulations.

Secretary: Secretary of Commerce.

Steering Committee: Committee of a regional fishery management council.

Stock: A group of fish manageable as a unit.

Total Allowable Level of Foreign Fishing (TALFF): The portion of optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States.

Total Length (TL): Measurement of a fish, from the most anterior tip of the head (snout) to the most posterior tip of the tail (caudal fin), which is the measurement length for the minimum sizes in this FMP (see diagram on page v).

Total mortality (Z): Instantaneous rate of mortality calculated in yield-per-recruit analysis is equal to the sum of natural mortality (M) and fishing mortality (F). Z represents the total instantaneous mortality from both natural causes and fishing.

Yield-per-recruit (YPR): A theoretical calculation based on known growth and natural mortality rates that allows an estimate of relative yield from a fishery without knowing landings. It does not permit a calculation of total landings but it is possible to calculate the relative amount of fishing pressure and landings if recruitment is constant.

A Short Primer on YPR:

Two major approaches exist for the problem of determining yield from a fishery: (1) surplus production models and (2) yield-per-recruit analysis.

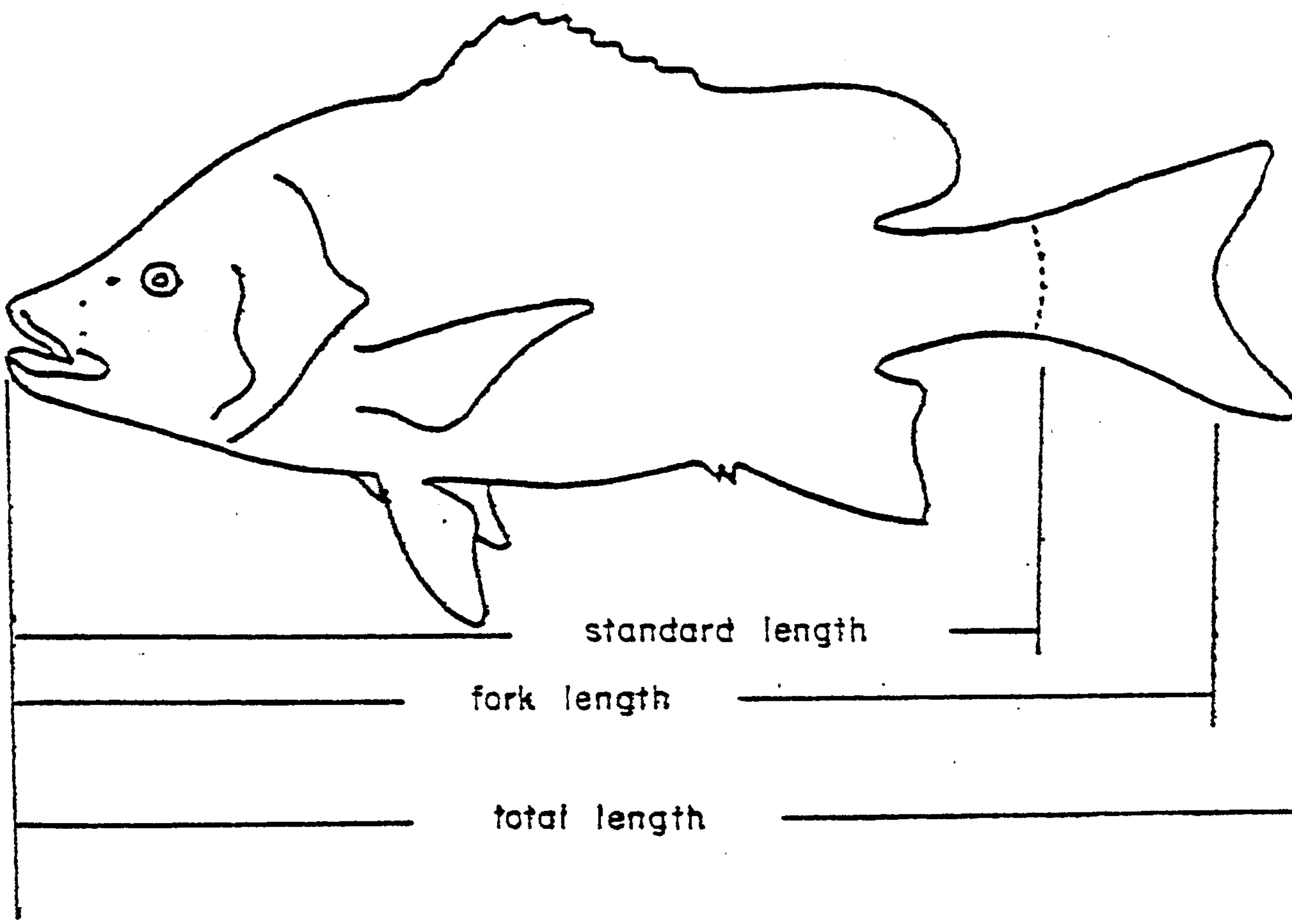
Surplus production models are descriptive. They are based on population growth curves that assume the rate of population growth is related to population size and that catch-per-unit effort (CPUE) is a valid index of population size. Catch and effort data are used to derive a yield curve from which maximum sustainable yield (MSY) can be calculated.

The major shortcoming of this approach for management is that only one datum point can be generated each year. Approximately 10 years of data are required which can result in a post-mortem of the fishery by the time enough knowledge exists to implement regulations. Even when historical catch records exist, they are often available for only a portion of the range of the fishery and there are further problems with the accurate estimation of fishing effort, particularly for recreational fishing.

Yield-per-recruit analysis is based on an analytical rather than a descriptive model. This approach predicts yield according to the growth pattern of individual fish rather than the growth of the entire population. The only prerequisite information is ages of fish at different lengths and natural mortality. Yield is not calculated in terms of total weight per year from the fishery. Instead, an index of yield, rather than an absolute total weight is calculated. This index is called yield-per-recruit.

The advantage of YPR analysis is that it can be a more rapid method of assessment than surplus production modeling and does not require catch-per-unit effort data. It allows a quick assessment of the stock using basic biological information (see diagram on page vi).

All mathematical abstractions designed to simulate natural phenomena are at the mercy of their imperfectly met assumptions, and neither of the two approaches is exempt from this imperfection. YPR analysis is not subject to some of the delays imposed by surplus production models but fulfills the basic management task of monitoring the stock and estimating the relative yield from a fishery under various proposed regulations.



Length measurements. All minimum sizes specified in this FMP are measured as total length.

HOW YIELD PER RECRUIT ANALYSIS IS DONE*

INFORMATION

PREREQUISITE:

Determine how old fish are at different sizes.

MONITORING;

Sample representative size composition of the catch. No measure of fishing effort, CPUE, or total landings is necessary.

ANALYSIS

Construct a model describing growth of the species over its lifespan. The most common method, and the one used in this FMP, is the Von Bertalanffy growth equation. From this is estimated maximum size of the species(L_{oo}), growth (K), and several other mathematical parameters necessary for estimating the yield model.

Derive an independent estimate of natural mortality rate(attrition due to predation, disease, environmental factors, old age), M. Observed or calculated maximum age or size(L_{oo}) can be used, or a representative sample of the size composition of the catch for an unexploited stock.

Based on the relative number of fish in each size category in the catch, total mortality rate (attrition due to both fishing & natural causes), Z, is calculated.

A representative sample of the size of fish in the harvest documents the average size, and therefore age, that the fish becomes liable to capture, t_c, another parameter necessary for estimating the yield model.

By definition, instantaneous total mortality rate(Z) is equal to instantaneous natural mortality rate(M) plus instantaneous fishing mortality rate(F). Therefore, fishing mortality(F) is equal to total mortality(Z) minus natural mortality(M):

$$F = Z - M$$

RESULT

The yield model is estimated, resulting in the total yield per fish of all the fish that entered (were recruited to) one year class (generation) which is referred to as yield-per-recruit(YPR):

$$YPR = \frac{yield}{recruits}$$

If there is a constant number of fish entering each new generation (constant recruitment) then the denominator is constant:

$$YPR = \frac{yield}{unknown\ constant}$$

Whenever YPR changes it is because yield changes. Maximum YPR is also equivalent to maximum yield.

*The estimated YPR parameters and the results of the YPR analysis are in the yield-per-recruit appendix (Appendix A).

2.0 SUMMARY

This fishery management plan establishes a management regime for the fishery for snappers, groupers and related demersal species of the Continental Shelf off the southeastern United States in the fishery conservation zone (FCZ) under the area of authority of the South Atlantic Fishery Management Council and the territorial seas of the states, extending from the North Carolina/Virginia border through the Atlantic side of the Florida Keys to 83° W longitude. In the case of the sea basses, the management regime applies only south of Cape Hatteras, North Carolina. Regulations apply only to Federal waters.

Plan objectives and management measures are directed toward alleviating the following problems:

1. Thirteen species in the complex are in a documented state of growth overfishing. Corrective action: Impose minimum sizes on six species to control growth overfishing.
2. Many of the species south of Cape Canaveral will likely experience growth overfishing in the near future. Corrective action: NMFS Regional Director is authorized to impose minimum sizes on additional species in the management unit according to evaluation procedures in this FMP. For species where minimum sizes are not beneficial because the survival of released fish is too low, the Council will amend the plan to include time/area closures, quotas, or other appropriate measures.
3. Data necessary to quantitatively document growth overfishing in other species or recruitment overfishing are very limited. Corrective action: Authorize data collection and analysis to monitor the status of the stocks.

Management objectives designed to solve the above problems are:

1. Prevent recruitment overfishing in all species and prevent growth overfishing of each species except where growth overfishing is justified by social and economic considerations. Method of achieving objective: Minimum sizes will control growth overfishing and prevent recruitment overfishing. The Secretary is authorized to take whatever emergency action is necessary in the unlikely event of recruitment overfishing.

2. Collect the necessary data to monitor the fisheries. Method of achieving objective: Authorize data collection and analysis to monitor the status of the fishery.

3. Promote orderly utilization of the resource. Method of achieving objective: Restrictions on fish traps and prohibitions on poisons, explosives, and spearing jewfish.

Optimum yield (OY) for species with minimum sizes is the yield that results from the recommended minimum size:

		NUMERICAL ESTIMATE OF OY	
	MINIMUM SIZE	OPTIMUM YIELD (YPR WITH MINIMUM SIZE)	DAH PREVAILING YIELD (YPR WITHOUT MINIMUM SIZE)
Vermilion snapper	12 inches	177.19	132.37
Red snapper	12 inches	540.64	501.37
Yellowtail snapper	12 inches	450.10	335.87
Black sea bass	8 inches	100.30	52.60
Red grouper	12 inches	263.83	190.76
Nassau grouper	12 inches	263.83	190.76
Jewfish		19,000 lb	19,000 lb

The numerical value for domestic annual harvest (DAH) is the best estimate of the prevailing yield-per-recruit (YPR) for each species regulated. There is no allowable foreign fishing for any species in this fishery.

Management measures include establishment of trawl mesh size for vermilion snapper; size limits for black sea bass, red snapper, yellowtail snapper, Nassau grouper, and red grouper; restrictions on fish traps; prohibitions on poisons, explosives, and spearing jewfish; and data collection for stock assessment and to monitor the status of the fishery.

A number of alternative management measures were considered and rejected: 1) no action; 2) 12 inch minimum size on vermilion snapper for hook and line gear; 3) 12 inch minimum size for vermilion snapper for trawls; 4) minimum sizes for gray snapper, 7 serranids (groupers), red porgy, white grunt and tomtate; 5) allowing only hand operated reels and handlines within 300 yards of permitted artificial reefs; 6) establishing a zoning restriction for artificial reefs to permit spearfishing north of

Canaveral and prohibit spearfishing south of Canaveral; 7) prohibit the use of "powerheads" for spearfishing; 8) limiting vessels to 200 traps; 9) limiting fish traps to a maximum of 54 cubic feet; 10) prohibiting roller trawls throughout the entire area of jurisdiction; 11) prohibiting roller trawls in specified areas; 12) prohibiting taking of organisms characteristic of live bottoms; 13) time/area closures or quotas; 14) requiring permits for all snapper-grouper vessels; 15) permitting commercial vessels and surveying recreational vessels; and 16) placing a moratorium on entry.

High research priorities are: 1) Evaluation of the impacts of snapper-grouper trawling, 2) yield-per-recruit analysis or other stock assessment techniques to estimate growth overfishing of other species, 3) determination of the survival rate of released fish for evaluating future minimum sizes, 4) assessment of population abundance with and without catch and effort statistics, 5) evaluation of the impacts of snapper-grouper trapping in south Florida, and 6) determination of value for fish by size. Medium research priorities are identification and quantification of factors influencing the demand for recreational fishing. Low research priorities are: 1) investigation of factors affecting fish abundance and ecological relationships, 2) economic characteristics, and 3) sociological characteristics.

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3.0 REGULATORY IMPACT REVIEW (RIR)

This integrated document contains all elements of the FMP, RIR and FEIS. To aid the reviewer, a table of contents for the RIR elements is provided separately referencing sections of the FMP.

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4.0 FINAL ENVIRONMENTAL IMPACT STATEMENT

( ) Draft

(X) Final Environmental Statement

Responsible Agencies

South Atlantic Fishery
Management Council
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Executive Director
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Charleston, South Carolina 29407-4699
803/571-4366

National Marine Fisheries Service
Southeast Region
Contact: Jack Brawner,
Regional Director
9450 Koger Blvd.
St. Petersburg, Florida 33702
813/893-3141

Name of Action: (X) Administrative ( ) Legislative

Abstract:

The proposed action is to adopt and implement a fishery management plan for the snapper-grouper fishery within the area of authority of the South Atlantic Fishery Management Council extending from the North Carolina/Virginia border through the Atlantic side of the Florida Keys to 83° W longitude. The objectives of the plan are to prevent recruitment overfishing in all species and prevent growth overfishing of each species except where growth overfishing is justified by social and economic considerations, collect the necessary data to monitor the fishery and promote orderly utilization of the resource. Minimum sizes are proposed to prevent overfishing. Certain conditions for fish traps, trawl mesh size restriction, gear restrictions, and data collection are also proposed.

Comments requested by: September 19, 1983

FINAL ENVIRONMENTAL IMPACT STATEMENT

This integrated document contains all elements of the FMP, RIR and FEIS. To aid the reviewer, a table of contents for the FEIS elements is provided separately, referencing corresponding sections of the FMP.

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List of Preparers

The FMP, RIR and FEIS were prepared by the South Atlantic Fishery Management Council with principal input from Council staff.

South Atlantic Council Staff

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Applicable Experience: Marine resource economics
Plan Monitor

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Applicable Experience: Technical writing

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The source document, which contains the detailed scientific, technical and other supportive documentation on which this management regime is based, was prepared by staff of the South Atlantic Fishery Management Council, a Plan Development Team, and other fishery experts.

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Maury Wolff, Ph.D.
Applicable Experience: Fishery biology

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Applicable Experience: Fishery biology and population dynamics

Jim Waters, M.S.
Applicable Experience: Economics and dynamic YPR analysis

Robert Low, Ph.D.
Applicable Experience: Fishery biology and population dynamics

List of Agencies, Organizations, and Persons to Whom Copies of the Statement are Sent

- U.S. Army Corps of Engineers
- U. S. Department of Commerce
  - Office of Coastal Zone Management
- U.S. Department of the Interior
  - Bureau of Land Management
- U.S. Department of State
- U.S. Department of Agriculture
- U.S. Department of Transportation
  - Coast Guard
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- Center for Environmental Education
- Fishery Management Councils
- Florida League of Anglers
- Atlantic States Marine Fisheries Commission
- State Resource Agencies:
  - Florida
  - Georgia
  - South Carolina
  - North Carolina
- Southeast Fisheries Association
- N.C. Fisheries Association, Inc.
- Sea Grant Advisory Services
  - Florida
  - Georgia
  - South Carolina
  - North Carolina
- Organized Fishermen of Florida
- State Coastal Zone Management Agencies
  - Florida
  - South Carolina
  - North Carolina
- Marine Mammal Commission
- Sport Fishing Institute
- National Coalition for Marine Conservation

Draft Statement to EPA:	Final Statement to EPA:
August 13, 1982	August 12, 1983

5.0 THE FISHERY MANAGEMENT UNIT

5.1 Description of the Species

The fish community referred to as the snapper-grouper fishery consists of demersal tropical and subtropical species which generally occupy the same type of habitat and are caught by common fishing methods on the Continental Shelf off the southeastern United States. This fishery includes the families of snappers (Lutjanidae), sea basses and groupers (Serranidae), porgies (Sparidae), tilefishes (Malacanthidae), grunts (Pomadasyidae), triggerfishes (Balistidae), wrasses (Labridae), and jacks (Carangidae) (Table 5-1). In this fishery there are 8 families consisting of 69 species. Of these 69 species, yield-per-recruit analysis has been performed on the 17 species for which adequate biological data exist. There is justification to impose minimum size limits on six species (Table 5-1).

Snappers generally have a long triangular face with upper margin sloping more strongly than the lower; jaws are equal or the lower slightly projecting. Nearly all species have some enlarged canine teeth. Coloration varies widely among species, but deeper water species tend to be more red.

Groupers and sea basses are characterized by a robust body, large mouth with lower jaw often projecting slightly beyond the upper jaws, bands of slender sharp depressible teeth and usually a few stout fixed canines; body scales are small. Some species are strikingly colored, others are drab, and many have considerable ability to alter the density of their color to match surroundings; deeper water species tend to have more red.

Porgies are deep bodied and compressed with a small horizontal mouth placed low on the head. The sides of the jaws are broad and blunt. Teeth are stout; low and molariform laterally, canines or incisors anteriorly. Several species are barred or striped, but generally porgies have a bright silvery appearance. They have a single continuous dorsal fin.

In grunts the mouth is low on the head, the upper jaw projects slightly in front of the lower, and no prominent canine teeth are present. The tail is generally deeply notched.

Tilefishes are elongate with long dorsal and anal fins.

Table 5-1. Common and scientific names of species in the management unit.

		MINIMUM SIZES EVALUATED	PROPOSED MINIMUM SIZES
Snappers - Lutjanidae			
Black snapper	Apsilus dentatus		
Queen snapper	Etelis oculatus		
Mutton snapper	Lutjanus analis		
Schoolmaster	Lutjanus apodus		
Blackfin snapper	Lutjanus buccanella		
Red snapper	Lutjanus campechanus	12 inches	12 inches
Cubera snapper	Lutjanus cyanopterus		
Gray snapper	Lutjanus griseus	12 inches	none; distributional impacts unknown
Mahogany snapper	Lutjanus mahogoni		
Dog snapper	Lutjanus jocu		
Lane snapper	Lutjanus synagris		
Silk snapper	Lutjanus vivanus		
Yellowtail Snapper	Ocyurus chrysurus	12 inches	12 inches
Vermilion snapper	Rhomboplites aurorubens	12 inches	12 inches (accomplished with a 4" trawl mesh size)
Sea Basses - Serranidae			
Bank sea bass	Centropristis ocyurus		
Rock sea bass	Centropristis philadelphica		
Black sea bass	Centropristis striata	8 inches	8 inches
Groupers - Serranidae			
Rock hind	Epinephelus adscensionis		
Graysby	Epinephelus cruentatus	9 inches	none; no growth overfishing
Speckled hind	Epinephelus drummondhayi	18 inches	none; minimal growth overfishing
Yellowedge grouper	Epinephelus flavolimbatus		
Coney	Epinephelus fulva		
Red hind	Epinephelus guttatus	18 inches	none; no growth overfishing
Jewfish	Epinephelus itajara		
Red grouper	Epinephelus morio	12 inches	12 inches
Misty grouper	Epinephelus mystacinus		
Warsaw grouper	Epinephelus nigritus		
Snowy grouper	Epinephelus niveatus		
Nassau grouper	Epinephelus striatus	12 inches	12 inches
Black grouper	Mycteroperca bonaci	18 inches	none; release survival unknown
Yellowmouth grouper	Mycteroperca interstitialis		
Gag	Mycteroperca microlepis	18 inches	none; release survival unknown
Scamp	Mycteroperca phenax	14 inches	none; minimal growth overfishing
Tiger grouper	Mycteroperca tigris		
Yellowfin grouper	Mycteroperca venenosa	18 inches	none; release survival unknown

		MINIMUM SIZES EVALUATED	PROPOSED MINIMUM SIZES
Porgies - Sparidae			
Sheepshead	*Archosargus probatocephalus*		
Grass porgy	*Calamus arctifrons*		
Jolthead porgy	*Calamus bajonado*		
Saucereye porgy	*Calamus calamus*		
Whitebone porgy	*Calamus leucosteus*		
Knobbed porgy	*Calamus nodosus*		
Red porgy	*Pagrus pagrus*	14 inches	none; minimal growth overfishing
Longspine porgy	*Stenotomus caprinus*		
Scup	*Stenotomus chrysops*		
Grunts - Pomadasyidae			
Black margate	*Anisotremus surinamensis*		
Porkfish	*Anisotremus virginicus*		
Margate	*Haemulon album*		
Tomtate	*Haemulon aurolineatum*	6 inches	none; no growth overfishing
Smallmouth grunt	*Haemulon chrysargyreum*		
French grunt	*Haemulon flavolineatum*		
Spanish grunt	*Haemulon macrostomum*		
Cottonwick	*Haemulon melanurum*		
Sailors choice	*Haemulon parrai*		
White grunt	*Haemulon plumieri*	10 inches	none; no growth overfishing
Blue striped grunt	*Haemulon sciurus*		
Tilefishes - Malacanthidae			
Blueline tilefish	*Caulolatilus microps*		
Tilefish (Golden)	*Lopholatilus chamaeleonticeps*		
Sand tilefish	*Malacanthus plumieri*		
Triggerfishes - Balistidae			
Gray triggerfish	*Balistes capriscus*		
Queen triggerfish	*Balistes vetula*		
Ocean triggerfish	*Canthidermis sufflamen*		
Wrasses - Labridae			
Hogfish	*Lachnolaimus maximus*		
Puddingwife	*Halichoeres radiatus*		
Jacks - Carangidae			
Yellow jack	*Caranx bartholomaei*		
Blue runner	*Caranx crysos*		
Crevalle jack	*Caranx hippos*		
Bar jack	*Caranx ruber*		
Greater amberjack	*Seriola dumerili*		
Almaco jack	*Seriola rivoliana*		

Triggerfishes are relatively deep-bodied and moderately compressed with a long, unattenuated snout, highly placed eye, and usually terminal mouth; jaws are short and strong and contain protruding incisiform teeth. The skin is tough and covered with modified plate-like scales.

Two very distinct wrasses occur in the complex. The hogfish is deep-bodied like a snapper. The first three dorsal spines are long and streamer-like, tail is lunate, and males have larger snouts and mouths. Color is highly variable but most often uniform or mottled gray to reddish brown, almost always with a black spot at the rear base of the dorsal fin. The puddingwife is much more slender-bodied and elongate. Coloration is bright. The tail is lunate, teeth are small to moderate in size.

Jacks are silvery fishes, darker dorsally, and typically have two detached spines in front of the anal fin. They are compact, and strong-swimming. Scales are small, caudal fin is deeply forked or lunate, teeth are small to moderate in size.

5.2 Range of the Fishery

The snapper-grouper fishery extends from the North Carolina-Virginia border to the end of the Florida Keys in the FCZ under authority of the South Atlantic Fishery Management Council and the territorial seas of the States. The range of the black sea bass stock included in the management unit is from Cape Hatteras south to Cape Canaveral. Another stock of sea bass occurs north of Cape Hatteras and will be addressed by a Mid-Atlantic Fishery Management Council FMP.

5.2.1 Snappers

Red, silk, blackfin, and vermilion snapper are important components of the catch in the deeper shelf waters (20 m; 66 ft or more). Red snapper are not common off southeastern Florida; south of Cape Canaveral they are largely replaced by mutton snapper, a similar species.

Important shallowwater (less than 20 m; 66 ft) snapper fisheries occur primarily in Florida and include yellowtail, gray and mutton snapper. Aggregations of large (30-60 cm; 12-24 in) yellowtail snapper are the basis for an important summertime fishery in southeastern Florida at 20-36 m (66-118 ft). Mutton snapper are commonly caught in 20-61 m (66-200 ft).

5.2.2 Sea Basses and Groupers

Important recreational and commercial fisheries for sea basses exist inshore and offshore from Cape Hatteras to Cape Canaveral. Black sea bass comprise by far the largest proportion of the commercial and recreational sea bass catch.

Yellowedge, misty, Warsaw, snowy groupers and speckled hind occur throughout the FCZ. Commercial and recreational fishermen take these species almost exclusively in deep water, usually not less than 46 m (150 ft) and mostly much deeper. Red grouper are caught mostly in relatively deep offshore waters (20-61 m; 66-200 ft). Nassau grouper usually frequent more shallow areas (31 m; 100 ft and less). Jewfish juveniles sometimes appear in inshore catches; large adults occur offshore on wrecks and reefs and are not often caught. However, on occasion in certain areas large adult jewfish do occur in inshore waters.

Gag, black, and yellowfin groupers are usually caught at depths between 6 and 46 m (20-150 ft). Gag are important from Cape Hatteras to Cape Canaveral, occasionally to Key West. Black and yellowfin grouper are more predominant below Cape Canaveral. Black grouper are caught more frequently than yellowfin grouper.

Scamp and yellowmouth grouper are most often caught in moderately deep water (18-46 m; 60-150 ft). Scamp are more common from Cape Hatteras to Cape Canaveral. Yellowmouth grouper are relatively common on deeper reefs south of Cape Canaveral but are seldom caught by hook and line.

5.2.3 Porgies

Red porgy are the most important porgy in recreational and commercial catches in the FCZ. They occur on offshore shelf areas primarily from Cape Hatteras to Cape Canaveral. Sheepshead occurs primarily in inshore waters from Cape Hatteras to Key West and are the subject of considerable recreational hook and line effort.

5.2.4 Grunts

Grunts are common in the FCZ from Cape Hatteras to Key West. Cottonwick often inhabit deeper water as adults. They are sometimes caught incidentally by snapper fishermen, particularly with vermilion snapper. White grunt and tomtate are the major grunt species in catches north of Cape Canaveral. White grunt are usually most prevalent south of this point as well, but may be joined in the catch by a number of other species. These grunt species are most common from shore to approximately 37 m (120 ft).

5.2.5 Tilefishes

Tilefish are an important commercial and to a lesser extent recreational fish caught mostly in deep water, not less than 61 m (200 ft) and usually over 91 m (300 ft). Most commercial effort is north of Cape Canaveral. Golden tilefish account for the largest proportion of the catch, with blueline tilefish second. Sand tilefish are caught incidentally by recreational fishermen south of Cape Canaveral in shallow water (6-46 m; 20-150 ft).

5.2.6 Triggerfishes

Gray triggerfish occur throughout the FCZ. They are vulnerable to a variety of fishing gears and may comprise a large proportion of commercial and recreational incidental catches. They occur inshore and offshore. Ocean triggerfish are common in Florida, primarily in outer reef and offshore areas. Queen triggerfish occur primarily in southern Florida and the Florida Keys and are not often caught.

5.2.7 Wrasses

Exploitable wrasses in the FCZ are limited to Florida waters. Puddingwife are an occasional component of the incidental catch of a number of different gears. Hogfish are highly sought after by spear fishermen in southern Florida and the Florida Keys and are not frequently caught by other types of gear.

5.2.8 Jacks

Jacks are not often subjected to directed effort, with the exception of the greater amberjack which frequents offshore reefs and wrecks from Cape Hatteras to Key West. It is an important component of recreational and to a lesser extent commercial interest.

5.3 Management Unit

The fishery management unit for the snapper-grouper fishery is the stocks within the FCZ in the area of authority of the South Atlantic Fishery Management Council and the waters within the seaward boundary of the states from North Carolina through the east coast of Florida. The FCZ extends from the North Carolina/Virginia border through the Atlantic side of the Florida Keys to 83° West longitude. The inner boundary of the FCZ is a line coterminous with the seaward boundary of each of the coastal states, and the outer boundary of such zone is a line drawn in such a manner that each point on it is 200 nautical miles from the baseline from which the territorial sea is measured. In the case of black sea bass, the management regime applies only south of Cape Hatteras. Regulations apply only to the management area in Federal waters.

5.4 Rationale for Choosing This Unit

The snapper-grouper fishery in the area of authority of the South Atlantic Fishery Management Council can be managed as a unit because the fishery is subtropical/tropical in distribution and therefore mostly limited to south of Cape Hatteras on the eastern coast of the United States.

Species within the management unit occur in both the Gulf of Mexico and South Atlantic. However, it has been concluded that separate fishery management plans are appropriate. The unit comprises the overlapping ranges of a large multi-species fishery, which reduces the cost of plan preparation through development of a single, comprehensive plan for the South Atlantic Region.

Cape Hatteras is the boundary between two distinct stocks of sea bass. Furthermore, black sea bass are taken north of Hatteras by trawls and south of Cape Hatteras primarily by trap, constituting different fisheries. The Mid-Atlantic Fishery Management Council is developing a plan for sea bass north of Cape Hatteras.

6.0 PROBLEMS IN THE FISHERY

1. Thirteen species in the complex are in a documented state of growth overfishing. Corrective action: Impose minimum sizes on six species to control growth overfishing.
2. Many of the species south of Cape Canaveral will likely experience growth overfishing in the near future. Corrective action: NMFS Regional Director is authorized to impose minimum sizes on additional species in the management unit according to evaluation procedure in this FMP. For species where minimum sizes are not beneficial because the survival of released fish is too low, the Council will amend the plan to include time/area closures, quotas, or other appropriate measures.
3. Data necessary to quantitatively document growth overfishing in other species or recruitment overfishing are very limited. Corrective action: Authorize data collection and analysis to monitor the status of the stocks.

7.0 MANAGEMENT OBJECTIVES

1. Prevent recruitment overfishing in all species and prevent growth overfishing of each species except where growth overfishing is justified by social and economic considerations. Method of achieving objective: Minimum sizes will control growth overfishing and prevent recruitment overfishing. The Secretary is authorized to take whatever emergency action is necessary in the unlikely event of recruitment overfishing.
2. Collect the necessary data to monitor the fisheries. Method of achieving objective: Authorize data collection and analysis to monitor the status of the fishery.
3. Promote orderly utilization of the resource. Method of achieving objective: Restrictions on fish traps and prohibitions on poisons, explosives and spearing jewfish.

8.0 DESCRIPTION OF THE FISHERY

8.1 Description of Stocks

8.1.1 Distribution

8.1.1.1 Snappers

Mutton, gray, red, and yellowtail snapper and schoolmaster have been recorded from New England to southeastern Brazil, including the Gulf of Mexico. Red snapper occur only as far south as Yucatan. All are rare north of Cape Hatteras.

Lane, mahogony, silk, blackfin, and vermilion snapper have been recorded from the Carolinas to at least the northern coast of South America. Blackfin snapper reportedly occur only as far south as the Lesser Antilles.

Cubera snapper have been recorded from South Florida to Brazil, including the Central American Coast. Black snapper have been reported from the Florida Keys, Cuba, and various West Indies Islands, and Queen snapper from deep tropical waters off southernmost Florida and the Bahama Banks.

8.1.1.2 Sea Basses and Groupers

Black sea bass are the most widely distributed of the listed sea basses, occurring from Maine to Florida and the eastern Gulf of Mexico with the greatest numbers between Cape Cod and Cape Canaveral. Two distinct populations of black sea bass have been identified, one north of Cape Hatteras and one between Cape Hatteras and Cape Canaveral.

Red, snowy, Warsaw, and black grouper, as well as gag and rock hind have been reported from New England to southeastern Brazil, including Bermuda and the Gulf of Mexico. Gag reportedly do not occur in the West Indies. These species are not common north of Cape Hatteras.

Scamp have been recorded from Massachusetts to Yucatan. However, it may be easily confused with yellowmouth grouper which appear to be common in the southern part of this range through Central America.

Speckled hind occur from North Carolina through Florida. Nassau grouper and red hind extend southward to Brazil. Other tropical groupers in the complex include jewfish, misty grouper, Coney, yellowedge grouper, graysby, yellowfin grouper and tiger grouper, all of which have been reported from Bermuda and Florida to southeastern Brazil.

8.1.1.3 Porgies

Porgies are more temperate than other families of the snapper-grouper fishery. They are also well represented in the tropics. Red porgy have been reported from New York to Argentina, including the Gulf of Mexico. They are quite common in the South Atlantic Bight. Whitebone and longspine porgy have also been reported from this South Atlantic region. Scup reportedly occur from Nova Scotia to Florida. Sheepshead are also limited to near-shore waters, occurring from New England to Brazil, including the Gulf of Mexico. Jolthead porgy occur in this range and around Bermuda. Saucereye porgy have a similar range except they occur northward only to North Carolina. Knobbed porgy occur from North Carolina to Yucatan.

8.1.1.4 Grunts

The majority of grunts listed in the management unit are tropical species, ranging from southern Florida to Brazil, as well as Bermuda. These include margate, cottonwick, Spanish grunt, and sailors choice. Smallmouth grunt, porkfish and black margate are similarly distributed except they occur further north on the Florida coast. French and blue striped grunts occur as far north as South Carolina. White grunt and tomtate range northward to Virginia and New England respectively.

8.1.1.5 Tilefishes

Golden tilefish occur from Nova Scotia to Key West and throughout the Gulf of Mexico. Blueline tilefish, also a continental species, have been reported from Virginia to Florida and in the eastern Gulf of Mexico. Sand tilefish are most abundant in subtropical and tropical waters, but range from Cape Lookout, North Carolina southward throughout the Gulf of Mexico and Caribbean.

8.1.1.6 Triggerfishes

Gray triggerfish occur from Nova Scotia to Argentina and the Gulf of Mexico. Queen triggerfish have been recorded from New England to southeastern Brazil, including the Gulf of Mexico. These two species occur on both sides of the Atlantic. Ocean triggerfish are distributed from New England to the Lesser Antilles and the Gulf of Mexico. They also occur in Bermuda.

8.1.1.7 Wrasses

Puddingwife range from North Carolina to Brazil, and also occurs in Bermuda. Hogfish are known from North Carolina to the northern coast of South America, including Bermuda, the Gulf of Mexico, and the coast of Central America.

8.1.1.8 Jacks

Greater amberjack are known from New England to Brazil, including the Gulf of Mexico. Almaco jack are similarly distributed, ranging north to New Jersey and south to Buenos Aires, Argentina. These two species occur on both sides of the Atlantic.

Blue runner occur from Nova Scotia to southeastern Brazil, barjack from New Jersey to the Lesser Antilles. Crevalle jack have been recorded from Nova Scotia to Uruguay, and yellowjack from New England to Brazil. These four species also inhabit the Gulf of Mexico.

8.1.2 Reproduction

8.1.2.1 Snappers

Snappers are heterosexual with spawning occurring during the summer and fall in Florida. Sizes at sexual maturity are shown below (TL = total length; FL = fork length; SL =standard length) (Note 1 in = 25.4 mm):

SPECIES	MALES	FEMALES	AGE
Vermilion snapper	14-16 in (TL)	14-16 in (TL)	4
	8 in (TL)	8 in (TL)	2
Red snapper	12-15 in (FL)	12-15 in (FL)	2
Silk snapper	22-24 in (FL)	20-22 in (FL)	
Mutton snapper	16 in (FL)	16 in (FL)	
Schoolmaster	10 in (FL)	10 in (FL)	
Lane snapper	7 in (TL)	8 in (TL)	1
Blackfin snapper	10-15 in (FL)	8-10 in (FL)	
Yellowtail snapper	10 in (FL)	11-12 in (FL)	
Gray snapper	7 in (SL)	8 in (SL)	

8.1.2.2 Sea Basses and Groupers

Most members of this group are protogynous hermaphrodites (they function as a female first and later as a male) and sex cannot be accurately determined macroscopically unless the gonads are ripe. Spawning usually occurs between early winter and late spring. Sizes at sex reversal and sexual maturity are shown below (Note 1 in = 25.4 mm):

SPECIES	AGE/SIZE AT SEX REVERSAL	EARLIEST MATURE FEMALES	EARLIEST MATURE MALES
Black sea bass	1-8 yr	2 yr	1 yr
Red grouper	11-20 in (SL)	18 in (SL)	
Nassau grouper	12-31 in (SL)	19 in (TL)	
Cony	11 in (TL)	6 in (TL)	
Red hind	14 in (TL)	9 in (TL)	11 in (TL)
Gag	10-11 yr	5-6 yr	13-15 yr
Graysby	8-9 in (TL)	6-10 in (TL)	5-7 yr

8.1.2.3 Porgies

Evidence suggests that red and whitebone porgies are protogynous hermaphrodites, while no evidence of hermaphroditism has been found for sheepshead. The longspine porgy is heterosexual and sufficiently different to distinguish the sexes at a length of 90 mm (3.5 in). Red porgy spawn from January through April and sheepshead spawn from March through June. Sizes at sex reversal and maturity for red porgy and whitebone porgy are (Note 1 in = 25.4 mm):

SPECIES	AGE/SIZE AT SEX REVERSAL	EARLIEST MATURE FEMALES
Red porgy	13-17 in (TL)	2 yr
Whitebone porgy	7-10 in	
	2-4 yr	

8.1.2.4 Grunts

No evidence of hermaphroditism exists for white grunt and there is no evidence of sexual dimorphism or hermaphroditism for tomtate. Female white grunt mature at age 3 and spawn once a year between April and July. Tomtate males mature at 6 in (152 mm) fork length and females at 5 in (127 mm) fork length (ages 1 and 2); spawning occurs between January and June.

8.1.2.5 Tilefishes

Golden and blueline tilefish are hermaphroditic. For blueline tilefish, females mature and spawn by the fourth or fifth year (16-20 in; 406-508 mm TL) and males mature by the sixth year (18-22 in; 457-559 mm TL); spawning occurs from March through October. For golden tilefish, sex reversal is likely based on a disproportionate ratio of females to males in smaller (less than 35 in; 889 mm) fish and a preponderance of males in larger size fish (over 35 in). Females mature at 28 in (711 mm) and the smallest mature male measured 23 in (584 mm); spawning occurs from March through August.

8.1.2.6 Triggerfishes

Gray triggerfish is the only member of this group whose reproduction is known. Sexual dimorphism is not apparent although distinct pairs have been observed. Spawning occurs from June through September.

8.1.2.7 Wrasses

The hogfish is a dichromatic, protogynous hermaphrodite in which transformation of sex, color, and morphology coincide. Peak spawning occurs in February and March with some spawning occurring from September to April.

8.1.2.8 Jacks

Greater amberjack spawn from March through June with peak activity in April and May. Females mature at 31 in (787 mm) FL and males at 37 in (940 mm) FL. Almaco jacks mature at 21 in (533 mm) FL.

8.1.3 Age, Growth, Mortality and Other Parameters

Information about age, growth, and mortality for species of the snapper-grouper fishery form the basis for yield-per-recruit (YPR) models. These models are used in this FMP for stock assessment to determine whether or not a species is undergoing growth overfishing, and if growth overfishing is occurring, estimate the potential gain in yield from a minimum size limit. All YPR parameters, primary sources of these parameters, and YPR calculations are presented in the YPR appendix (Appendix A) for each species.

8.1.3.1 Snappers

Parameters for YPR analysis were available for red snapper, gray snapper, yellowtail snapper, and vermilion snapper.

8.1.3.2 Sea Basses and Groupers

Parameters for YPR analysis were available for black sea bass, red grouper, speckled hind, red hind, graysby, gag, and scamp. Yellowfin and black grouper are expected to be similar to gag grouper. Nassau and red grouper are sufficiently similar to expect YPR for Nassau to be the same as for red groupers by analogy.

Similarities between species for which YPR analysis is possible and those for which analysis is not (due to lack of data) are important for management. Lack of information which precludes direct YPR modeling does not preclude evaluation by analogy when there are strong reasons to believe that similar species (usually members of the same taxonomic genus) exhibit similar biology and population dynamics.

8.1.3.3 Porgies

YPR analysis was conducted only on the red porgy.

8.1.3.4 Grunts

YPR analysis was conducted on white grunt and tomtate.

8.1.3.5 Tilefishes

Insufficient data are available to perform YPR analysis on tilefish. Age and growth are known for blueline tilefish off North Carolina. Age and growth of golden tilefish are not known, but there is some evidence that they may live more than 20 years.

8.1.3.6 Triggerfishes

Age, growth, and mortality of triggerfishes have not been studied.

8.1.3.7 Wrasses

Age and growth have been estimated for hogfish, but natural mortality and fishing pressure are not known. There are no estimates for puddingwife.

8.1.3.8 Jacks

Greater amberjack have been aged, but other data are not available for YPR analysis on jacks.

8.1.4 Migration, Movement and Differential Distribution

8.1.4.1 Snappers

As red snapper grow they move offshore to deeper water. There is some evidence of offshore-inshore seasonal movement. Fishermen have reported schooling concentrations. Eggs and larvae are pelagic (occur in open ocean). Juveniles are often found inshore of adult fish. The Carolina population is either self sustaining or larvae spawned to the south are carried north by the Gulf Stream.

Gray snapper feeding movements occur at night over rather short distances. Schooling behavior is strongest in adult fish and is greatest in areas with minimum habitat. Eggs and larvae are pelagic; however, the planktonic life of larvae is very short. Juveniles have frequently been recorded from inshore areas. Grass beds form the most important inshore nursery grounds. Adults generally occur offshore of juveniles.

Silk snapper eggs and larvae are believed to have a rather short pelagic stage. Juveniles have been taken in inshore waters as shallow as 30 m (98 ft). Adults occur in 75-100 m (246-328 ft) off the Carolinas.

Mutton snapper is more of a roving species than many other snappers. Eggs and larvae are pelagic; juveniles occur inshore of adults in tidal creeks, bights surrounded by mangroves, and on grass beds. Adults are found on the ocean bottom and generally occur in deeper water than juveniles.

The schoolmaster does not move extensively from its home reef. They form schools of several hundred to several thousand individuals over rocky bottom and on the reef top. Daytime schools disperse at night and forage individually. Small schoolmasters are found around mangrove roots and in turtle grass beds. They seem to be more confined to reefs than other snappers. Eggs and larvae are pelagic; juveniles tend to occur in shallower water than adults.

Lane snapper are reported to occur in a number of habitats, from coral reefs in clear waters to murky brackish waters over mud bottom. They school with grunts and move off the reef at dusk to feed on the algal flats. Eggs and larvae are pelagic. They spend most of their juvenile life in shallow mangrove and grass flats and are not recruited to the reef habitat until a size of 130-200 mm (5-8 in) FL. Adults usually occur in deeper water than juveniles.

Blackfin snapper eggs and larvae are pelagic. Young or juvenile fish occur in shallower water than adults. Adults occupy a wide horizontal and vertical range and do not occur in water as shallow as juveniles.

Yellowtail snapper are semi-pelagic wanderers on reef habitats. They travel in large schools and are found on patch reefs to the outer edges of deep reefs. Eggs and larvae are pelagic. Juveniles commonly occur on shallow grass flats with larger juveniles inhabiting shallow reef areas. This species spends most of its juvenile life in shallow mangrove and grass flats and is not recruited to the reef fisheries until a size of 12-20 cm (5-8 in) FL.

No evidence of migration exists for vermilion snapper but schooling behavior has been observed. Eggs and larvae are pelagic. Juveniles occur inshore of adults, but inshore occurrence is probably short-lived. Adults occupy a wide horizontal and vertical range, preferring hard substrate, both low and high profiles, and do not display marked seasonal movements. Adults do not occur in water as shallow as larvae and juveniles.

Cubera snapper occupy a wide range of habitats, preferring deep channels, ledges, and coral patches. Eggs and larvae are pelagic. Adults assume a demersal mode and appear to occupy a somewhat narrow vertical range.

8.1.4.2 Sea Basses and Groupers

Black sea bass do not appear to move extensively. Young, smaller fish (mostly females) are found in shallow inshore waters (less than 20 m; 66 ft) while older, larger fish are caught in deeper water. They immigrate to reefs searching for shelter. Eggs and larvae are pelagic. Larvae are transported inshore to estuarine areas in temperatures above 10°C (50°F); juveniles leave when the temperature drops, usually in December. Black sea bass do not school but hover above bottoms individually or in loose aggregations.

Red grouper move offshore from shallower reef environments as sexual maturity is attained (at about age 5; 40 cm, 16 in SL). There is extensive movement of adults but patterns of migration, if any, are unknown. Young do not move during their residence on nearshore reefs. Schooling or group movement among adults is suspected. Eggs and larvae are pelagic. Juveniles are distributed in low densities over rocky bottom in depths as great as 37 m (121 ft) and are often taken inshore of adult populations. Young leave the nearshore reef environment between 4 and 6 years of age and at about 450 mm (18 in) SL (corresponding with sexual maturity) and migrate to deep offshore waters (greater than 37 m; 121 ft).

Eggs and larvae of Warsaw grouper are pelagic. Juveniles have been captured inshore by seining. Adults are demersal and occupy a wide horizontal and vertical range.

Nassau grouper display a strong home-reef specificity. Smaller individuals are found in the shallow reef environment, while larger and older individuals move into deeper water. This species has been described as moving mainly during daytime and twilight; they do not usually go far from cover. Spawning aggregations have been observed; eggs and larvae are pelagic. Juveniles are common in seagrass beds. Adults are demersal and occupy a wide horizontal and vertical range.

No long range, extensive movements have been documented for gag; however, some seasonal movement is known. Eggs and larvae are believed to be pelagic. Juveniles often occur inshore of larger fish, even extending up into estuaries. Gag tend to concentrate just above irregular bottoms, particularly ledges.

There is some evidence that scamp may migrate to deeper water during the winter off the Carolinas. This species does not usually go far from cover. Eggs and larvae are pelagic. Adults are demersal and occupy a fairly wide horizontal and vertical range.

8.1.4.3 Porgies

Red porgy do not undergo long range migrations and local movements are not extensive. They do occur in schools. Larval and post-larval phases undergo vertical migration; there is a shift from planktonic to benthic existence at lengths above 20 mm (0.8 in). Eggs and larvae are transported inshore probably for long distances. Adults occupy a wide horizontal and vertical range, preferring hard substrate, both low and high profiles. Adults do not occur in waters as shallow as larvae and juveniles.

Sheepshead show some seasonal movements. Eggs and larvae are pelagic. Larvae and juveniles are found in eelgrass beds in the summer. Adults do not occur in waters as shallow as juveniles.

8.1.4.4 Grunts

No evidence exists for extensive large scale migration in the grunts; however, there is some evidence of offshore movement by the white grunt during cold weather. Large, mixed, resting schools of juvenile white and French grunts congregate on inshore patch reefs; movement to nighttime feeding grounds on grass beds occurs each evening. Margate are usually solitary or occur in small groups; the black margate is solitary. Eggs and larvae of white and French grunts are pelagic. Young white grunts are especially abundant in grass beds at the edge of sand flats. Adults probably occur a little offshore of juveniles, particularly in late spring, summer and fall. Pelagic eggs and larvae are carried into waters largely uninhabited by adults. Tomtate eggs and larvae are probably pelagic. Juveniles are often found inshore in grass beds.

8.1.4.5 Tilefishes

The blueline tilefish is possibly territorial. The extent of migrations, if any, would be a localized slope movement over the shelf edge for feeding purposes or seasonally to seek preferable temperature regimes. Schooling is unlikely. Eggs and larvae are pelagic. Adults are found over rugged, high relief areas and sudden drop offs, but also on gently sloping bottoms.

It is unlikely that golden tilefish migrate extensively; however, some local movement is indicated. There is no evidence of schooling behavior, although they occur in clusters. Adults usually occur in depths greater than 110 m (361 ft). As they become larger, they move to deeper depths.

Prejuvenile sand tilefish are pelagic. Sand tilefish are primarily shallowwater benthic fish, found most abundantly between 10 and 50 m (33-163 ft).

8.1.4.6 Triggerfishes

No movement or migration has been documented. The ocean triggerfish is an open water fish, while the Queen triggerfish is a near-shore reef dweller. As an adult the gray triggerfish is more common off the Carolinas, Georgia, and northern Florida than it is in more tropical waters of the management unit.

8.1.4.7 Wrasses

Puddingwife do not move extensively or migrate. Juveniles are found in greater abundance in more shallow, rocky areas in southern Florida while adults occur on offshore reefs.

Juvenile hogfish are found extensively in inshore grass beds. They recruit to shallow patch reefs (less than 6 m; 20 ft) at 200 mm (8 in) and continue seaward as they grow larger. Adults are common from 8 m (25 ft) to 31 m (110 ft) and occur at least to a depth of 46 m (150 ft).

8.1.4.8 Jacks

Migration and movement has been documented for the greater amberjack. They move southward during December-May and northward during June-November; migrations occur over the range of the management unit. Adults are widely distributed, occurring from inshore inlets and over shallow reefs, down to depths exceeding 350 m (1,150 ft).

Juvenile yellow and crevalle jacks have been encountered in association with flotsam in reef areas and open water. Apparently the eggs and larval stages are pelagic; preadults inhabit more shallow areas.

8.1.5 Ecological Relationships

8.1.5.1 Snappers

Snappers are usually primary, secondary, or tertiary carnivores (flesh eaters). They feed opportunistically on fishes, crustaceans, and other invertebrates. Predators include almost any of the large carnivorous fishes in grass beds and other inshore areas where young snappers reside. Jacks, groupers, sharks, barracudas, and morays are examples. Large sea mammals and turtles are other potential predators. Adults of the larger species remain vulnerable to top level carnivores, such as large sharks, groupers, and amberjacks. Snappers compete for food and space primarily with other fishes in the highly diverse, subtropical to tropical habitat that they normally occupy. Porgies, sea basses and groupers, grunts, and jacks comprise the major groups whose diet and/or habitat preference may at various times and localities result in competitive interaction with snappers.

8.1.5.2 Sea Basses and Groupers

Smaller sea basses and groupers tend to be primary and secondary carnivores. Larger species are more often secondary, tertiary, or quaternary carnivores. All members of this group are unspecialized and opportunistic. They generally engulf their prey whole by opening the mouth, dilating the gill covers, and rapidly drawing in a current of water, effectively inhaling the food item. Foods include fishes, crustaceans, cephalopods, and other invertebrates.

Smaller species are subject to the same predators as snappers. Adults of larger species are subject only to large sharks and conceivably large carnivorous marine mammals.

Interspecific competition is probably more prevalent between sea basses and groupers than snappers because of the high degree of similarity in food habits, habitat, distribution, and size between family members. Various snappers, jacks, and to some extent, sharks, probably comprise the majority of other competitors with overlapping diet preferences.

8.1.5.3 Porgies

Porgies are largely carnivores, although several species not listed in the management unit are omnivorous and eat more plant than animal material. The species in the management unit are almost always primary or secondary carnivores. They are extremely generalized and opportunistic, feeding on a wide variety of benthic invertebrates and some small fishes.

Porgies generally occupy a lower trophic level (one of the hierarchial strata of a food web) than many snappers and seabasses and groupers. They have the same predators as listed for snappers, but in some cases may remain an important prey species rather than grow out of that phase as do larger snappers.

Sea basses and groupers, snappers, and grunts are the major food competitors of the porgies. The diet of porgies in general probably overlaps more with grunts than other groups, particularly in the more southern area of the management unit. Porgies are primarily diurnal feeders.

8.1.5.4 Grunts

Grunts are carnivores. They feed primarily on benthic invertebrates and most in turn serve as important prey items for a wide variety of predators throughout their lifespan. Sea basses and groupers, jacks, and some snappers are prominent among these. Sharks and morays also eat grunts.

Porgies, snappers, and smaller sea basses and groupers compete with grunts for food. Some additional competition for daytime resting space may occur between grunts and some snappers.

8.1.5.5 Tilefishes

Tilefishes are very generalized foragers. They feed on a large variety and size range of benthic organisms, mostly invertebrates but some fishes, crabs, and shrimp. Conger eels, hakes, sea robins, goosefish, and various sharks, sea basses and groupers, snappers, and grunts compete with tilefish for food. At least some species are highly cannibalistic.

Shallow water species such as the sand tilefish are vulnerable to most of the same predators as snappers, porgies, and smaller sea basses and groupers. Deepwater species are preyed upon mainly by large, bottom dwelling sharks and large groupers. Juveniles are preyed upon by dogfish, conger eels, and adults of the same species.

8.1.5.6 Triggerfishes

Triggerfishes are carnivores that rely on large teeth and powerful jaws to break apart and crush relatively large, well-armored invertebrates. Foods include crabs, mollusks, echinoderms, and even coral.

Little information on specific competitors or predators is available. Some groupers, snappers, grunts, porgies, and wrasses occur in similar habitats and have overlapping diets. Triggerfishes are vulnerable to some of the larger predators of other snapper-grouper species. They may not be preferred, however, due to their tough, leathery skin and prominent, interlocking dorsal spines.

8.1.5.7 Wrasses

Wrasses are primary and secondary carnivores. They possess prominent canine teeth and well developed pharyngeal teeth which they use to grasp and crush hard shelled invertebrates. Their trophic level is comparable to porgies and grunts and they are subject to most of the same predators as these two families. Wrasses compete for food with porgies, grunts, snappers, and some groupers.

8.1.5.8 Jacks

Jacks are carnivores; their trophic level varies depending on species. Extremes among species included in the management unit are the largely plankton eating bar jack and greater amberjack, a top level fish eater.

Predators and competitors vary accordingly. Jacks fall prey to predators not usually encountered by the more demersal families of the snapper-grouper fishery. In addition to large groupers, morays, sharks, and sea mammals, jacks are consumed by various mackerels, billfishes, dolphin fish, and pelagic shark species. Competitors for food vary widely with groupers, grunts, snappers, morays, sharks, and mackerels all competing to some extent.

8.1.6 Abundance and Present Condition

The status of the 17 species where there are data for YPR analysis is shown in Table 8-1. Estimates of theoretical maximum YPR and maximum YPR at existing F levels have been calculated (Table 8-2). Domestic annual harvest and optimum yield YPR values and the evaluation of minimum size limits are shown later (Tables 10-1 and 10-2).

From Table 8-1, YPR analysis indicates that 14 of the 17 species are likely in the range of growth overfishing. Three species are not likely in the range of growth overfishing.

For species other than the 17 species in Table 8-1, either age and growth or mortality has not been estimated. It is anticipated that most of the other snapper and grouper species are in or near the range of growth overfishing. Porgies and grunts are not as likely experiencing growth overfishing. Tilefish, triggerfish, and jacks are probably not yet in growth overfishing. Fishing pressure is increasing rapidly on tilefish and they will likely soon be in the range of growth overfishing. There is

Table 8-1. Status of 17 species where some or all of the YPR parameters are available.

	Age and Growth Estimates	Natural Mortality (M) Estimates	Fishing Pressure (F) Estimates	YPR Indicates
Vermilion	In lit+	X	X	growth overfishing
Red snapper	In lit	In lit	In lit	growth overfishing
Gray snapper	In lit	X	X	growth overfishing
Yellowtail snapper	In lit	In lit	X	growth overfishing
Black sea bass	In lit	In lit	In lit	growth overfishing
Speckled hind	In lit	In Lit	In lit	growth overfishing
Scamp	In lit	X	X	growth overfishing
Red grouper	In lit	In lit	In Lit	growth overfishing
Nassau grouper		by analogy with red grouper++		growth overfishing
Gag grouper	In lit	In Lit	X	growth overfishing
Yellowfin grouper		by analogy with gag++		growth overfishing
Black grouper		by analogy with gag++		growth overfishing
Red hind	In lit	In lit	X	no growth overfishing
Graysby	In lit	In lit	X	no growth overfishing
Red porgy	In lit	In lit	X	minimal growth overfishing
White grunt	In lit	In lit	X	no growth overfishing
Tomtate	In lit	X	X	no growth overfishing
Other species*				unknown

+ See the Source Document for complete literature references. The primary references for YPR are indicated in the YPR appendix (Appendix A).

++ "By analogy" means analagous population parameters that produce similar YPR values.

* Age, growth, or fishing pressure has not been estimated for other species in the fishery.

X = Assumed values for the purpose of analysis based on the ranges of values documented for other species in the YPR Appendix (Appendix A).

Table 8-2. Theoretical maximum YPR and maximum YPR at existing F levels.

	VALUES THAT MAXIMIZE YPR				VALUES THAT MAXIMIZE YPR AT EXISTING "F" LEVELS			
Species	Fishing Pressure (F)	Age Liable to Capture	Size Liable to Capture	YPR	Fishing Pressure (F)	Age Liable to Capture	Size Liable to Capture	YPR
Vermilion snapper	0.67	4.5	14.3	201.41	0.37*	4.0	13.2	177.70
Red snapper	0.60	4.5	19.7	667.98	0.30	4.0	18.1	592.63
Gray snapper	0.80	5.0	14.8	211.51	0.39*	4.0	13.0	196.48
Yellowtail snapper	1.10	4.0	16.8	571.58	0.50*	4.0	16.8	549.36+
Black sea bass (inshore)	0.63	4.0	7.9	103.02	0.53	4.0	7.9	100.30
Black sea bass (offshore)	0.63	4.0	7.9	103.02	0.30	3.5	7.9	85.39
Speckled hind	0.61	4.9	19.6	1,131.71	0.42	4.9	19.6	1,114.73+
Scamp	0.80	5.0	19.3	619.66	0.25*	4.0	17.7	555.22
Red grouper	0.80	8.0	21.6	359.15	0.35	7.0	19.8	335.39
Nassau grouper	0.80	8.0	21.6	359.15	0.35*	7.0	19.8	335.39
Gag	0.60	4.0	23.6	894.01	0.30*	3.5	21.9	792.15
Yellowfin grouper	0.60	4.0	23.6	894.01	0.30*	3.5	21.9	792.15
Black grouper	0.60	4.0	23.6	894.01	0.30*	3.5	21.9	792.15
Red hind	1.00	4.9	12.6	232.77	0.20*	3.0	9.5	137.17
Graysby	0.80	4.9	8.7	87.10	0.20*	3.5	7.2	60.99
Red porgy	0.60	5.0	14.5	298.43	0.40*	5.0	14.5	287.67+
White grunt	1.10	2.0	7.0	53.75	0.40	2.0	7.0	44.80
Tomtate	1.10	4.0	5.5	6.47	0.40*	3.0	3.8	5.09

* Age, growth, and natural mortality estimated, but fishing pressure (F) is not documented. F values are assumed for the purpose of making the comparison with maximum YPR.

+ Values are approximate because they are truncated by the computer program format.

less fishing pressure on triggerfish and jacks. For the wrasses, fishing pressure on hogfish is primarily restricted to spearing. There is a growing commercial fishery for puddingwife. It is not known if either wrass is in or near growth overfishing.

8.1.7 Maximum Yield (MY) for Individual Species

No surplus production models have been produced to estimate maximum sustainable yield for individual species. Such models are unlikely in the near future because of the difficulties of obtaining accurate landings data, particularly from the recreational fisheries which are large and varied for a number of the species.

Based on known age, growth, and natural mortality estimates, theoretical maximum yield has been estimated for 17 species (Table 8-2) two different ways. First are the point estimates of the unique combination of fishing pressure (F) and age liable to capture that produces the theoretical maximum yield-per-recruit. This unique combination which produces maximum yield cannot occur without regulations and would not likely occur with regulations because both fishing pressure and age liable to capture would have to be precisely regulated.

Second, maximum yield is estimated as the maximum YPR that could exist for any minimum size for an assumed fishing pressure (F). This is more likely because the plan responds to assumed fishing pressure with a minimum size; it does not directly control fishing pressure.

8.1.8 Maximum Sustainable Yield (MSY) for Individual Species

Maximum yield is comparable to maximum sustainable yield if recruitment is constant. Until scientific evidence about recruitment patterns indicates otherwise, MY by YPR analysis is the best available proxy for MSY for individual species. There are no estimates of MY or MSY for the whole multi-species fishery.

8.1.9 Probable Future Conditions

Increasing fishing effort will result in most species in the fishery experiencing growth overfishing. Inshore locations will continue to be more intensively fished than offshore locations. For most species it is likely that more smaller fish are encountered inshore than offshore. Therefore, there will remain intense and growing fishing pressure on smaller fish. There will be particularly intense competition between user groups on the narrowing shelf south of Cape Canaveral which is close to growing population centers. Without regulations, growth overfishing will significantly reduce potential yield and recruitment failures could occur.

Recommendations to the states are contained in Section 13.0. Without State cooperation to control fishing pressure within State waters, future snapper-grouper stocks may not be at their optimum levels as specified in this plan.

8.1.10 Marine Mammal/Endangered Species Interaction

The Endangered Species Act of 1973 (P.L. 93-205) is for the conservation of endangered and threatened species. The South Atlantic Fishery Management Council initiated the Section 7 procedure with the National Marine Fisheries Service and prepared a biological assessment on interactions of endangered and threatened species and the snapper-grouper fishery. Marine mammals occur within the geographic area of the FMP. However, they are not in any way impacted by association with or impacted by prosecution of the snapper-grouper fishery. The National Marine Fisheries Service concurred with Council determination that endangered/threatened species under their purview would not be affected by the proposed management measures.

8.2 Description of Habitat

Adjacent to the States of North Carolina, South Carolina, and Georgia, all known natural habitat for mature snappers and groupers is located within the FCZ; however, artificial reefs are in State waters of North and South Carolina. Adjacent to the State of Florida, both natural and artificial reef areas occur in State waters, as well as in the FCZ.

8.2.1 Habitat Description

The principal snapper-grouper fishing areas are located in the live-bottom and shelf-edge habitats, and, to a lesser extent, the lower-shelf habitat. Temperatures range from 11° to 27° C (52° to 80° F) over the Continental Shelf and shelf-edge due to the proximity of the Gulf Stream, with lower-shelf habitat temperatures varying from 11° to 14° C (51° to 57° F). Depths range from 16 to 27 m (54 to 90 ft) or greater for the live-bottom habitats, from 55 to 110 m (180 to 360 ft) for the shelf-edge habitat, and from 110 to at least 183 m (360-600 ft) for the lower-shelf habitat.

The exact extent and distribution of productive snapper-grouper habitat on the Continental Shelf north of Cape Canaveral is unknown. Current data suggest that from 3 to 30 percent of the shelf is suitable bottom. These hard, live-bottom habitats may be low relief areas supporting sparse to moderate growth of sessile invertebrates, moderate relief reefs from 0.5-2.0 m (1.6-6.6 ft), or high relief ridges at or near the shelf break consisting of outcrops of rock that are heavily encrusted with sessile invertebrates such as sponges and sea fans. Live-bottom habitat is scattered irregularly over most of the shelf north of Cape Canaveral, but is most abundant off northeastern Florida.

South of Cape Canaveral the Continental Shelf narrows from 56 km to 16 km (35 miles to 10 miles) and less off the southeast coast of Florida and the Florida Keys. The lack of a large shelf area, presence of extensive, rugged, living and fossil coral reefs, and dominance of a tropical Caribbean fauna are distinctive characteristics. The coral rock reefs from 9 to 14 m (30 to 46 ft) at the shallowest lines between West Palm Beach and Miami and from 24 to 38 m (80 to 125 ft) for the deepest, most rugged reef, are natural habitat for tropical fish types (e.g., basses, snappers, groupers, and porgies) comprising from 20 to 30 percent of the shelf area south of Canaveral.

8.2.2 Habitat Areas of Particular Concern

Large numbers of juvenile snappers and some groupers are found in grass and algae beds. Estuarine areas and mangrove swamps in southern Florida harbor young of other members of the complex. These areas are under the jurisdiction of State marine management and protection programs.

8.3 Fishery Management Jurisdiction, Laws, and Policies

8.3.1 Management Institutions

The U.S. Department of Commerce, acting through the South Atlantic Fishery Management Council, pursuant to the Magnuson Fishery Conservation and Management Act (MFCMA; P.L. 94-265), has authority to manage snapper-grouper stocks throughout the FCZ in the South Atlantic.

The States (North Carolina, South Carolina, Georgia, and Florida) have authority to manage the snapper-grouper stocks within their territorial seas.

8.3.2 Treaties and International Agreements

There are no treaties or international agreements applicable to the management unit.

8.3.3 Federal Programs, Laws, and Policies

The Federal law relating to management of the South Atlantic snapper-grouper fishery is the MFCMA. Other Federal laws that relate indirectly to the fishery are: (1) Coastal Zone Management Act of 1972;

(2) The National Environmental Policy Act of 1969; (3) The National Ocean Pollution Research and Development and Monitoring Planning Act of 1978; (4) The Marine Protection, Research and Sanctuaries Act of 1972; (5) Reefs for Marine Life Conservation; (6) The Endangered Species Act of 1973; and (7) The Marine Mammal Protection Act of 1972. Information pertaining to these Acts may be found in the Source Document.

8.3.4 State Programs, Laws, and Policies

The coastal States have regulatory jurisdiction and authority in their territorial seas and internal waters.

8.3.4.1 North Carolina

In addition to a federally approved Coastal Zone Management Program, the State of North Carolina provides for establishment of research sanctuaries and protection of nursery areas for economically important seafood species (15 N.C. Admin. Code 38/.0111 and 313/.1401, respectively). Other laws having indirect impact on snapper-grouper habitat include the regulation of dredge and fill activities in estuarine areas (N.C. Gen. Stat. 113-229(e)(5)) and the regulation of discharges of oil and wastes into ocean waters (143-215.84 and 215.90). North Carolina General Statutes (113-262) also prohibit the use of poisons, drugs, explosives, or electricity for taking fish within State waters.

8.3.4.2 South Carolina

Under South Carolina's Coastal Zone Management Program, a permit or certification is required from the South Carolina Coastal Council for all dredge and fill activities. Regulations controlling the pollution of State territorial seas by oil, gas, or other wastes (S.C. Code 48-1-13(b)) and prohibiting the use of poison, electricity, or explosives to take fish (S.C. Code 50-13-1420 and 1440) may also provide protection to snapper-grouper habitat.

8.3.4.3 Georgia

Georgia Code 43-120 requires that a permit be obtained before dredge and fill activities are conducted. Georgia Water Quality Criteria require that certain standards of water quality sufficient for the survival of fish and other aquatic life be met in specified areas. The use of firearms, electricity, explosives, or poisons for taking fish is prohibited (Ga. Code 45-711).

8.3.4.4 Florida

Florida Statutes, Section 370.08, prohibit the use of explosives or firearms for the purpose of killing food fish.

Florida Statutes, Section 370.11, prohibit the taking of red grouper, jewfish, Nassau grouper, black grouper, and gag grouper less than 31 cm (12 in) fork length (measured from the tip of the nose to the rear center edge of the tail).

Florida Statutes, Section 370.172, prohibit spearfishing in State waters from the Dade-Monroe County line southward to Long Key.

Section 370.110 of the Florida Statutes prohibits the taking of certain species of corals.

The Florida legislature has passed a bill (Section 370.1105 of the Florida Statutes) prohibiting the use and possession of fish traps as a means for taking saltwater finfish, with the following exceptions: 1) crab, crawfish or shrimp traps permitted under Statutes 370.13, 370.135, 370.14 or 370.15; 2) pinfish traps of specified sizes; and 3) black sea bass traps, north of 27° N. latitude, of specified sizes with degradable panels.

Chapter 81-267 of the Laws of Florida (Senate Bill No. 285) states that there is a moratorium on roller net trawl fishing except shrimp, within State waters until the Department of Natural Resources has adequate data on the effects of trawls. This Act took effect July 1, 1981.

The Florida Aquatic Preserves Act of 1975 (Fla. Stat. 258.35) authorizes the permanent preservation of submerged lands of exceptional biological, aesthetic, or scientific value. Three areas of the Florida Keys, which contain coral habitat, have been designated as Aquatic Preserves.

Other statutes which may provide indirect protection to snapper-grouper habitat areas include ocean water contamination regulations (Section 370.09), and regulation of dredge and fill activities (Section 370.03).

8.3.5 Fishery Management Plans

Coral reefs provide shelter and habitat for fishes of the snapper-grouper fishery. The Fishery Management Plan for Coral and Coral Reef Resources (April 1982), was jointly prepared by the Gulf of Mexico and South Atlantic Fishery Management Councils. It includes measures designed to minimize adverse human impacts on these resources. The Coral Plan prohibits the use of toxic chemicals in taking fish and other marine organisms which inhabit coral reef areas except under permit as may be specified in the Coral Plan or any other plan. It establishes a permit system for the use of toxic chemicals in taking fish or other marine organisms which inhabit coral reefs. The Coral Plan also proposes measures for coral habitat areas of particular concern (HAPC). One HAPC is the Oculina Bank, a 4 by 23 nm strip containing banks and thickets of the ivory tree coral, *Oculina varicosa*, bounded by latitude 27° 30' N to 27° 53' N and longitude 79° 56' W to 80° 00' W. Within the HAPC the use of bottom longlines, dredges, bottom trawls, and fish traps and pots is prohibited.

The Gulf of Mexico Fishery Management Council has prepared a Fishery Management Plan for Reef Fish Resources of the Gulf of Mexico. The plan includes snappers, groupers, and sea basses in the Gulf of Mexico management unit and proposes the following management measures:

1.0 Stressed Area (Area Subject to Special Management)
Establish a stressed area in waters of the Gulf of Mexico as specified in the plan.

2.0 Fishing Gear

2.1 Prohibit the use of powerheads for the taking of reef fish within the stressed area.

2.2 Prohibit the use of roller trawls in the stressed area.

2.3 Prohibit the use of fish traps in the stressed area. Further, provide for seizure of such gear illegally deployed in the stressed area.

2.4 Require degradable or other self-destructing panels or access door hinging devices on fish traps and which are constructed as follows:

2.4.1 Require the opening covered by the panel (or the access door) be 144 square inches or larger with one dimension of the area equal to or larger than the largest interior axis of the throat (funnel).

2.4.2 Require that one panel or access door be located opposite each of the sides that has a funnel.

2.4.3 Require that one year after the implementation of this Plan, all fish traps within the FCZ be constructed of material with mesh size of 1 x 2 inches or larger, and there shall be a minimum of two 2 x 2 inch escape windows on each of two sides of the trap.

2.4.4 All fish traps fished shoreward of the 300-foot contour within the FCZ shall be 33 cubic feet or smaller.

2.5 Require that each vessel fishing traps in the FCZ be limited to no more than 200 traps.

2.6 Prohibit the use of poisons and explosives for the taking of reef fish.

2.7 Prohibit the willful pulling of another person's traps and the pulling or harvesting of traps after sundown or before sunrise.

3.0 Bag and Size Limits

3.1 Prohibit the possession of red snapper (Lutjanus campechanus) less than 12 inches in fork length subject to the following exceptions and conditions: (1) an allowance of incidentally harvested red snapper less than 12 inches in fork length is established at five fish per person in possession, and (2) any domestic vessel fishing trawls in the FCZ with the exception of roller trawl vessels fishing in the stressed area are excluded from the possession limit.

The Gulf FMP also requires permits and gear identification.

8.4 Description of Fishery Activities

8.4.1 History of Exploitation

Commercial fishing for snappers and groupers in the South Atlantic Bight has occurred since the late 19th century, with the first recorded landings in 1880. In North and South Carolina, annual landings were rarely more than a few thousand pounds, until 1956. In recent years landings have increased with improved electronic navigation, depth recording equipment, and power reels. Georgia reported larger early landings, but the trend since 1930 has been similar to that of the Carolinas.

The recreational offshore head boat fishery began in the early 1900's and by the early 1930's head boats were fishing with handlines for black sea bass on nearshore reefs. The historical fishing effort by private recreational vessels is unknown but it is expected to have increased along with the dramatic increases in the number of pleasure boats.

8.4.2 Participating User Groups

The commercial snapper-grouper fishery is composed of four gear types: 1) hook and lines, 2) traps, 3) trawls (seasonal), and 4) bottom longlines. Additional minor commercial activities include spearfishing by divers and a gill net (locally called "stab net") fishery off the east coast of Florida.

In 1979, 17 hook and line vessels landing catches of snappers and groupers were based in South Carolina. An estimated 20 North Carolina vessels and 2 Georgia vessels were engaged in the hook and line fishery. A total of 1,071 hook and line vessels and boats fished along the east coast of

Florida, including Monroe County, in 1979. However, the number engaged in the snapper-grouper fishery is unknown.

The trap fishery north of Cape Canaveral is directed primarily at black sea bass, although there is an incidental catch of other species. There were approximately 50 vessels engaged in the South Carolina sea bass fishery in 1982.

The wire trap fishery off the east coast of Florida and the Florida Keys targeted mainly large groupers, particularly red and black groupers, with significant catches of gray and mutton snappers and some yellowtail snappers. In 1980, there were about 108 vessels fishing approximately 4,000 traps in the Dade-Broward-Monroe County area. There is now a Florida law banning the use of fish traps.

Most of the vessels operating in the snapper-grouper trawl fishery are shrimp boats, whose owners seek to supplement their income during the off-season. These vessels, numbering up to 30, generally fish north of Cape Canaveral.

Some snapper-grouper hook and line vessels were converted to bottom longlines during the latter half of 1981. In South Carolina, 3 to 5 vessels were using bottom longlines. On the east coast of Florida, there were about 25-35 vessels in the 36 to 50 foot range which converted to bottom longlines during the same period. In North Carolina, only a few fishermen have added longlines to their vessels.

In the recreational fishery there are head boats, charter boats, and private boats. Approximately 46 head boats operated between Cape Hatteras and Cape Canaveral, and approximately 49 head boats operated between Cape Canaveral and Key West in 1979.

In 1979, there were 134 charter boats operating in North Carolina, 49 in South Carolina, 30 in Georgia, and approximately 428 along the east coast of Florida. Only about 11 percent of the total effort of the North Carolina charter boat fleet in 1979 was bottom fishing. In 1976, 8 percent of the Dade County, Florida charter boat fleet consisted of bottom fishing for snapper-grouper species.

An estimated 133,449 private recreational boats fish offshore in the South Atlantic Region which includes Florida east and west coasts. Species in the management unit accounted for approximately 20 percent of the catch of South Carolina private boat anglers surveyed in 1977.

8.4.3 Description of Vessels and Gear Employed

Commercial hook and line vessels range between 26 and 70 feet in length, are wood or fiberglass and are mostly diesel powered. Most boats are equipped with loran, white-line recorders, VHF, and CB radio. In addition, an increasing number of boats have a scope (CRT) scale expander used in conjunction with the white-line fathometer.

Hook and line gear, with hand-powered, electric, hydraulic, or pneumatic reels, is the most frequently used on commercial vessels. Vessels use 4 to 8 reels with 5 or more baited hooks per reel.

Bottom longlines have been installed on some vessels, with a hydraulic pump to power the reel. Short gangions 12 to 18 inches long are connected by longline clips to the line and 500 to 600 tuna circle hooks are attached to each longline which range from 1-5 miles in length.

In the sea bass trap fishery, the principal gear is the Chesapeake Bay wire crab trap (38 mm or 1.5 in hexagonal mesh), which has a minimum retention size of about 203 mm (8 in). A small vessel can handle 15-20 traps a day, and a 5-crew vessel can haul up to 40 traps daily. The fish traps employed off south Florida for snappers and groupers are most commonly constructed of welded steel with wire mesh 1x2 inches or larger. Internal volumes are between 25 and 55 cubic feet. An 8-12 inch diameter opening slopes downward and narrows to 3-4 inches. Some traps are equipped with a degradable hinge to prevent continuing entrapment of fish if the trap is lost.

High-rise bottom trawls with roller sweeps designed for rolling nets over rough bottom are employed by some of the larger trawlers.

Stab nets are used on reefs off the east coast of Florida, primarily during the snapper spawning season. These are heavily weighted monofilament gill nets about 4-5 ft high and 100 ft long.

The majority of the head boats in the South Atlantic region are wooden hulled and diesel powered. Some offshore vessels have aluminum or steel hulls with twin diesel engines. Most of these vessels have depth recorders and loran. Capacity varies between 30 and 75 anglers.

Surveys of charter boats in North and South Carolina, and Florida show the following characteristics:

	North Carolina	South Carolina	Florida
Average length	42 ft	38 ft	45 ft
Average age	16 yr	7 yr	15 yr
Diesel engine(s)	85 %	75 %	86 %
Loran equipped	50 %	80 %	
Radar equipped	2 %	25 %	

There is very little information available on vessels and gear used by private boat anglers in the snapper-grouper fishery. Most are 18-28 feet, gas engine powered, and equipped wth radios and depth finders.

8.4.4 Employment in Commercial and Recreational Sectors

There were approximately 3,700 primary jobs in the snapper-grouper fishery in 1979; additional employment is generated in support industries.

8.4.5 Fishing and Landing Areas

Approximately 98 percent of 1980 commercial landings are from the FCZ. Approximately 1.5 percent of North Carolina's commercial landings, 0.1 percent of South Carolina's, 0.6 percent of Georgia's and 4.1 percent of Florida's commercial 1980 landings are from State waters.

Approximately 42.3 percent of 1979 recreational landings are from the FCZ, 33.3 percent from State waters, 6.9 percent from inland waters and 16.4 percent is of unknown origin.

The majority of head boats and private boats fish inshore, live-bottom habitat and artificial reefs, some of which are located in State waters. A small number of recreational vessels fish offshore, live-bottom habitat and even out to the shelf edge.

Commercial fishermen are more mobile than recreational fishermen, and utilize a wider range of inshore and offshore waters out to the shelf edge and beyond. The inshore fishery (37 to 73 m; 120 to 240 feet) catches red and vermilion snappers, gag, scamp, porgies, and grunts. The deepwater (91 to 219 m; 300 to 720 feet) fishery concentrates on snowy and yellowedge groupers and tilefishes. The sea bass trap fishery occurs primarily in inshore waters (12-30 m; 40-100 feet). South of Cape Canaveral commercial and recreational vessels fully utilize the narrow shelf from inshore to drop-off at the Gulf Stream.

Recreational fishermen land their catch at numerous ports. Commercial fishermen use a small number of major ports: Morehead City and Southport, N.C.; Georgetown and Charleston, S.C.; Mayport, Miami, Marathon, and Key West, Florida.

8.4.6 Conflicts Among Domestic Fishermen

Fish traps have generated a great deal of controversy in south Florida. Fish traps were generally deployed in inshore waters, less than 150 ft depth, adjacent to areas of relief. These areas are also utilized by both recreational and commercial hook and line fishermen.

Trawling has increased during the last few years, leading to competition between trawlers and hook and line fishermen. Trawlers take large quantities of small fish, reducing the future amount of larger fish. There are also allegations that bottom trawling damages live bottom and disrupts schooling activity so that fish do not return to areas that have been heavily trawled. There are also concerns that trawls are not selective in their catch.

Conflicts among commercial hook and line, head boat, charter boat, and private boat fishermen center around competition for productive sites. Recreational fishermen who sell their catch influence commercial market price by quantity and quality of fish.

8.4.7 Commercial Landings

8.4.7.1 Snappers

In 1980, bottom trawlers took 83 percent of the vermilion snapper catch in South Carolina. Vermilion snapper taken by trawls are much smaller than those taken by hook and line (Table 8-3). Total regional landings of vermilion snapper in 1980 were about 616,000 pounds, an increase of about 243,000 pounds over the 1979 figure of 373,000 pounds. Preliminary 1981 landings dropped to 543,000 pounds.

Red snapper commercial landings peaked in 1968 at 1.1 million pounds and have gradually decreased to 0.4 million pounds in 1979. Gray snapper landings have changed very little from 1967 to 1979. Landings of yellowtail snapper have decreased from 0.9 million pounds in 1968 to 0.5 million pounds in 1979.

8.4.7.2 Sea Basses and Groupers

Black sea bass landings have increased over the last three years, from 0.3 million pounds in 1978 to 1.3 million pounds in 1981.

Grouper landings, historically, have not been broken into species except in South Carolina where gag landings increased from 155,000 pounds in 1977 to 323,000 pounds in 1981. Other grouper species have fluctuated without apparent trends. For the region, grouper landings have increased from the low of 750,000 pounds in 1967 to the high in 1978 of 2.8 million pounds.

Table 8-3. Vermilion snapper taken by hook and line gear and trawl gear in 1979 in South Carolina (Robert Low, S.C. Marine Resources Center; pers. comm.).

Hook and Line

TL		WT		%	Cumulative %
(cm)	(in)	(kg)	(lb)		
25-29	9.8-11.4	0.250	0.55	11	11
30-34	11.8-13.4	0.412	0.91	26	37
35-39	13.8-15.4	0.632	1.39	23	60
40-44	15.7-17.3	0.917	2.02	9	69
45-49	17.7-19.3	1.278	2.82	7	76
50-54	19.7-21.3	1.721	3.74	15	92
55-59	21.7-23.2	2.255	4.97	8	99

Trawl

TL		WT		%	Cumulative %
(cm)	(in)	(kg)	(lb)		
15	5.9	0.044	0.10	19	19
20	7.9	0.103	0.23	50	69
25	9.8	0.199	0.44	17	86
30	11.8	0.341	0.75	5	91
35	13.8	0.536	1.18	3	94
40	15.7	0.795	1.75	3	97
45	17.7	1.124	2.48	3	100

8.4.7.3 Porgies

Porgy landings have fluctuated, but began to increase in 1979. From 1979 landings of 1.1 million pounds, 1981 landings were 1.8 million pounds. Sheepshead landings averaged about 224,000 pounds from 1967 to the present.

8.4.7.4 Grunts

Landings of grunts have gradually increased over the years, from 66,000 pounds in 1967 to 149,000 pounds in 1981, but there were a few years in which poundage dropped below 40,000 pounds.

8.4.7.5 Tilefishes

Tilefish landings have shown a very large increase in a few years. In 1969, landings were 6,000 pounds. By 1974, landings had increased to 102,000 pounds, and by 1981, landings were 1.2 million pounds.

8.4.7.6 Triggerfishes

Triggerfish landings have shown an upward trend. Total landings in 1979 were 46,000 pounds compared with 2,000 pounds reported for 1969.

8.4.7.7 Wrasses

Hogfish landings fluctuated between 8,000 and 17,000 pounds from 1967 to 1976. Landings averaged 24,000 pounds from 1977 to 1979.

8.4.7.8 Jacks

Amberjack landings have increased some over the years. In 1968, 26,000 pounds were landed on the Florida east coast; by 1979, Florida landed 32,000 pounds and landings were 38,000 pounds for the region.

8.4.8 Recreational Landings

8.4.8.1 Snappers

Total recreational landings of vermilion snapper are estimated to be 19,000 pounds for 1979, all caught in the FCZ. Head boat landings were 288,600 pounds in 1978 and 214,200 pounds in 1979.

Total recreational landings of red snapper in 1979 were estimated to be 1 million pounds. Head boat landings were 245,400 pounds in 1979.

Gray snapper head boat landings were 86,500 pounds in 1978 and 24,700 pounds in 1979. Yellowtail snapper head boat landings were 163,600 pounds in 1978 and 340,600 pounds in 1979.

8.4.8.2 Sea Basses and Groupers

Total recreational landings of black sea bass in 1979 were reported to be 1.9 million pounds. Head boat landings were 547,900 pounds in 1978 and 588,400 pounds in 1979. Grouper landings by head boats were 294,200 pounds in 1978 and 585,500 pounds in 1979. Non-head boat landings were 2.2 million pounds.

8.4.8.3 Porgies

Porgy landings, including sheepshead, were 2.4 million pounds. Head boat landings were 591,600 pounds in 1978 and 417,700 pounds in 1979.

8.4.8.4 Grunts

Total grunt landings were 1.6 million pounds for 1979. Head boat landings were 212,200 pounds in 1978 and 217,700 pounds in 1979.

8.4.8.5 Tilefishes

Head boat landings were 9,000 pounds in 1978 and 2,900 pounds in 1979.

8.4.8.6 Triggerfishes

Regional head boat landings of triggerfish were 126,100 pounds in 1979. The 1979 non-headboat recreational catch was 364,000 fish.

8.4.8.7 Wrasses

No hogfish were reported in the recreational catch although it is a popular species for spearfishermen in south Florida.

8.4.8.8 Jacks

Total jack recreational landings were recorded as 3.4 million pounds in 1979.

8.4.9 Foreign Fishing Activities

There has been no documented foreign fishing in the management area covered by this plan.

8.4.10 Interactions Between Domestic and Foreign Participants in the Fishery

There is no record of any interaction between domestic and foreign participants in the fishery.

8.5 Economic Characteristics of the Fishery

For both the commercial and recreational sectors, all species in the management unit are sought as food fish. As food fish, larger fish are generally valued higher per pound than smaller fish. Prices also vary as a result of seasonal landing trends and the importation of substitute products.

8.5.1 Domestic Harvesting and Processing Sectors

8.5.1.1 Commercial Sector

Ex-vessel prices of commercial landings have generally increased since 1968. The total regional economic impact has been estimated to be

$23.7 million in 1981. Red and yellowtail snappers, black sea bass, and groupers have accounted for the major share of ex-vessel value over this period.

Ex-vessel prices of commercially important species are primarily determined by: (1) amount of total landings, (2) imports of substitutes, and (3) sizes of fish.

A number of commercially important species have well documented price differentials by size. Ex-vessel prices of vermilion snapper by size in 1981 were:

Grade-Size		Average Price
Small	3/4-1 lb	$1.40
Medium	1-2 lb	$1.65
Large	2-4 lb	$1.80

Ex-vessel prices of red snapper in 1982 were in the range of $2.50 to $3.25 per pound. Price variation by size is about $0.25.

Ex-vessel prices of black sea bass by size were:

	Grade-Size	Average Price 1980	Average Price 1981
Small	0.25-0.75 lb	$0.35	$0.33
Medium	0.75-1.25 lb	0.72	0.65
Large	≥1.25 lb	1.18	1.31
Ungraded		0.70	0.49

For most species, larger fish are more valuable per pound in the common size ranges. Uncommonly large fish (e.g., red snapper over 12 pounds and large jewfish and groupers) bring less per pound. The fact that larger fish are preferred is important because the purpose of minimum sizes is to increase total yield through increasing the sizes of individual fish harvested.

8.5.1.2 Recreational Sector

The direct economic impact in 1975 of recreational fishing for species in the management unit was estimated to be $135 million, approximately 30 percent of the total economic impacts of $457.8 million estimated to be associated with marine recreational fishing in the South Atlantic Region.

The species in the management unit are sought almost exclusively as food fish. Recreational fishermen prefer larger fish not only for food value, but angling experiences. Minimum sizes are designed to increase the yield of both commercial and recreational landings through increasing the size of individual fish harvested by both sectors.

8.5.2 International Trade

Imports of snappers and groupers are important in determining U.S. ex-vessel price. Imports of snappers in 1972 were almost 2.0 million pounds, while grouper imports amounted to 3.1 million pounds. Snapper imports increased to 3.9 million pounds in 1976 and 1978, but have decreased in recent years. Nineteen eighty-one imports were 3.4 million pounds. Grouper imports have fluctuated since 1972, reaching a high of 4.0 million pounds in 1976 and then decreasing. In 1981, grouper imports were 325,600 pounds. These figures include all forms in which snappers and groupers are imported, such as fillets, throats, and tails.

Minimum sizes specified in this plan will not put domestic fishermen at a competitive disadvantage because larger fish are more valuable than smaller fish and there is a ready market for the size fish resulting from the minimum sizes.

8.6 Description of the Businesses, Markets, and Organizations Associated with the Fishery

8.6.1 Relationship Among Harvesting, Brokering, and Processing Sectors

Snappers and groupers enter commercial channels from both the commercial and recreational sectors of the fishery. Fish caught by the commercial sector are generally eviscerated, washed and iced on board, then sold to fish houses at the port of landing. These primary wholesalers in turn sell to fresh fish markets, restaurants, freezer companies, and secondary wholesalers. The primary wholesale products are generally fresh, whole, gutted fish which are packed in ice. Fish houses sometimes head and fillet larger fish for special customers and restaurants. Fish caught by recreational fishermen that are sold are normally sold directly to restaurants or other final consumers.

8.6.2 Fishery Cooperatives and Associations

There are approximately 13 major associations and 6 cooperatives representing commercial and recreational fishermen in the region. There are also numerous local recreational fishing, diving, and boating clubs throughout the region whose members utilize the snapper-grouper resource.

8.6.3 Labor Organizations

There are no known labor organizations involved in the harvesting or processing sectors of the snapper-grouper fishery.

8.6.4 Foreign Investment

There is no known foreign investment in any aspect of the snapper-grouper fishery.

8.7 Description of Social and Cultural Framework of Domestic Fishermen and Their Communities

8.7.1 Ethnic Character, Family Structure, and Community Organization, Age and Education Profiles of Fishermen

In the South Florida and Florida Keys area, significant numbers of fishermen of Cuban-American heritage participate in both the harvesting and processing sectors of the fishery.

Commercial fishermen surveyed in Florida in 1974 were an average age of 48 years, had average fishing experience of 17 years, and an average formal education of 11.3 years.

Recreational fishermen who fished artificial fishing reefs were surveyed in South Carolina. These private boat anglers tended to have a high family income, were in their thirties or forties, were professional, managerial or self-employed, and had been actively engaged in offshore fishing for over 10 years.

8.7.2 Economic Dependence on Commercial or Marine Recreational Fishing and Related Activities

A survey of Florida commercial fishermen estimated that 52 percent derived part of their income from employment in occupations other than fishing, with 30 percent of these earning over half their income from non-fishing employment. About 17 percent of these fishermen were employed in marine related activities, as tug boat captains, marine operators, and boat builders.

9.0 CAPACITY DESCRIPTORS

9.1 Optimum Yield for Species with Minimum Sizes

OY for each species is the yield that results from the recommended minimum size. The numerical estimate of OY is the estimated numerical value of yield-per-recruit (measured in grams) derived from the best estimate of population parameters available. At this time, OY is the yield-per-recruit that occurs with the population parameters specified in the YPR Appendix (Appendix A) for each species regulated by a minimum size:

NUMERICAL ESTIMATE OF OY

	MINIMUM SIZE	OPTIMUM YIELD (YPR WITH MINIMUM SIZE)
Vermilion snapper	12 inches	177.19
Red snapper	12 inches	540.64
Yellowtail snapper	12 inches	450.10
Black sea bass	8 inches	100.30
Red grouper	12 inches	263.83
Nassau grouper	12 inches	263.83

Optimum yield will change when minimum sizes are added on other species or changed. The Regional Director is authorized to make the necessary adjustments to OY through regulatory amendments at the same time he is authorized to add or change minimum sizes (Management Measure #2, Section 10.2.3).

9.2 Optimum Yield for Jewfish

Optimum yield for jewfish is all jewfish harvested by U.S. fishermen utilizing lawful gear. Historically powerheads have been prohibited in Florida where all recorded landings of jewfish occur (jewfish are included in grouper landings in North Carolina and Georgia and no jewfish are reported from South Carolina). Therefore, the numerical estimate of OY is equal to the most recent (1981) recorded catch of 19,000 pounds.

9.3 Optimum Yields Considered and Rejected

Various forms of quota management by subareas were considered that would maintain total fishery landings at approximately the 1979 level. No quota on total landings of all species was considered sufficient to assure that individual species were not overfished (Rejected Management Measure #23: Time/Area Closures or Quotas, Section 10.19.23).

9.4 Expected Domestic Annual Harvest (DAH) for Species with Minimum Sizes

DAH is always larger than OY for species that are regulated by minimum sizes (6 species at this time that comprise approximately 26 percent by weight of total fishery landings). Only when a species experiences growth overfishing, which by definition indicates that DAH is greater than OY, is that species regulated by a minimum size and then included in the calculation of OY. The numerical estimate of DAH is the best estimate of prevailing YPR:

	MINIMUM SIZE	PREVAILING YIELD (YPR WITHOUT MINIMUM SIZE)
Vermilion snapper	12 inches	132.37
Red snapper	12 inches	501.37
Yellowtail snapper	12 inches	335.87
Black sea bass	8 inches	52.60
Red grouper	12 inches	190.76
Nassau grouper	12 inches	190.76

9.5 Expected Domestic Annual Harvest (DAH) for Jewfish

DAH for jewfish is the most recent (1981) recorded catch of 19,000 pounds.

9.6 Expected Domestic Annual Processing (DAP)

The United States has the capacity and intent to process all snappers, groupers, and related fishes that are harvested. Traditionally, snappers and groupers are sold by fishermen to the primary wholesale market as fresh, whole, gutted fish. Many are retailed in the same form. The primary wholesalers may sell to freezer companies and secondary wholesalers for processing which consists of cutting the fish into fillets or other pieces such as grouper "fingers" and throats. Such processing is done largely or exclusively by hand. The resulting products may be sold fresh or frozen.

9.7 Total Allowable Level of Foreign Fishing (TALFF)

The TALFF for all species regulated by minimum sizes is zero because only species that are in a state of growth overfishing (by definition DAH is greater than OY) are regulated (See OY, Section 9.1; and the criteria for imposing minimum sizes, Section 10.2.2). TALFF for jewfish is zero because DAH is equal to OY.

Only those species that are regulated enter into the calculation of OY. Other species in the fishery that are not regulated and do not enter into the calculation of OY will never likely qualify for a TALFF for two reasons. First, while the data are not available to document growth overfishing, it is anticipated that most of the species are in or near the range of growth overfishing. This FMP will result in the collection of data to monitor the status of all species in the future. It would be premature to consider a TALFF on these species until data are available on the status of the stocks.

Second, it is impossible to selectively harvest any one species in the fishery without a bycatch of other species. Even if a surplus existed (DAH was less than OY) for an individual species, a TALFF could not be justified because of the inevitable bycatch of other species that are in the range of growth overfishing.

A numerical estimate of TALFF (which is zero) can be demonstrated by comparing optimum yield with domestic annual harvest*:

	MINIMUM SIZE	OPTIMUM YIELD (YPR WITH MINIMUM SIZE)	DAH PREVAILING YIELD (YPR WITHOUT MINIMUM SIZE)	TALFF
Vermilion snapper	12 inches	177.19	132.37	0
Red snapper	12 inches	540.64	501.37	0
Yellowtail snapper	12 inches	450.10	335.87	0
Black sea bass	8 inches	100.30	52.60	0
Red grouper	12 inches	263.83	190.76	0
Nassau grouper	12 inches	263.83	190.76	0
Jewfish		19,000 lb	19,000 lb	0

10.0 MANAGEMENT MEASURES AND REGULATORY IMPACT REVIEW

10.1 Introduction

Executive Order 12291 "Federal Regulation" 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 to society; (3) regulatory objectives shall be chosen to maximize the net benefits to society; (4) among alternative approaches to any given regulatory objective, the alternative

*Note that with YPR, when the numerical YPR value of DAH is equal to or less than the numerical YPR value of OY, then no TALFF exists. This is because when landings increase, YPR decreases in the range of growth overfishing.

involving the least net cost to society shall be chosen; 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 effect 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 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 will serve as the basis for determining whether the proposed regulations implementing the fishery management plan or amendment are major/non-major under Executive Order 12291, and whether or not the proposed regulations will have a significant economic impact on a substantial number of small entities under the Regulatory Flexibility Act (P.L. 96-354).

10.2 Management Measure #1: Methods of Evaluating Growth Overfishing of Individual Species

Growth overfishing is defined in this FMP as an existing combination of fishing pressure (F) and age liable to capture such that an increase in age liable to capture or a decrease in fishing pressure will significantly increase YPR. Fishing pressure is treated as a given because at this time there are no quotas, bag limits, or limited entry; therefore, the determination of overfishing is the determination that any increase in age liable to capture (minimum sizes) will significantly increase YPR. If a minimum size will not increase YPR then the species is not in the range of growth overfishing.

Since there are numerous species taken by common fishing methods, in common locations, minimum sizes are considered to be the preferred method of preventing overfishing. If the survival rate of fish released below a minimum size is so low that a minimum size is not effective, then other methods such as time/area closures or quotas will be considered as "second line" alternatives through FMP amendments if these species must be managed. At this time there is no justification for individual species management other than minimum sizes.

There is a uniform procedure established to evaluate minimum sizes to prevent growth overfishing of individual species in the fishery. This includes a definition of ranges of yield that trigger decisions and methods of evaluation used to determine if minimum sizes are justified (Figure 10-1).

10.2.1 Ranges of Yield that Trigger Council and Future Regional Director Decisions on Individual Species

All species in the management unit where YPR analysis has been done, or data exist to perform YPR analysis, have been evaluated. There are 69 species in the management unit. Data exist for conducting YPR analyses on 17 species. When data become available to evaluate other species (Section 12.1) the Regional Director is authorized to establish minimum sizes on other species in conformance with the ranges of yield and methods of evaluation specified in Section 10.2.3. There are four ranges of yield:

1. Unknown range of yield. Whenever data do not exist to perform YPR analysis (52 of the 69 species), species are placed in this category until stock assessment can be done (See Figure 10-1 and Monitoring Section 12.1). While YPR cannot be performed on the majority of species by number, most of these are the least important (by weight or value; Table 10-4).

2. Acceptable range of yield. Whenever the catch indicates that a species is not in or closely approaching the range of growth overfishing no minimum size is required.

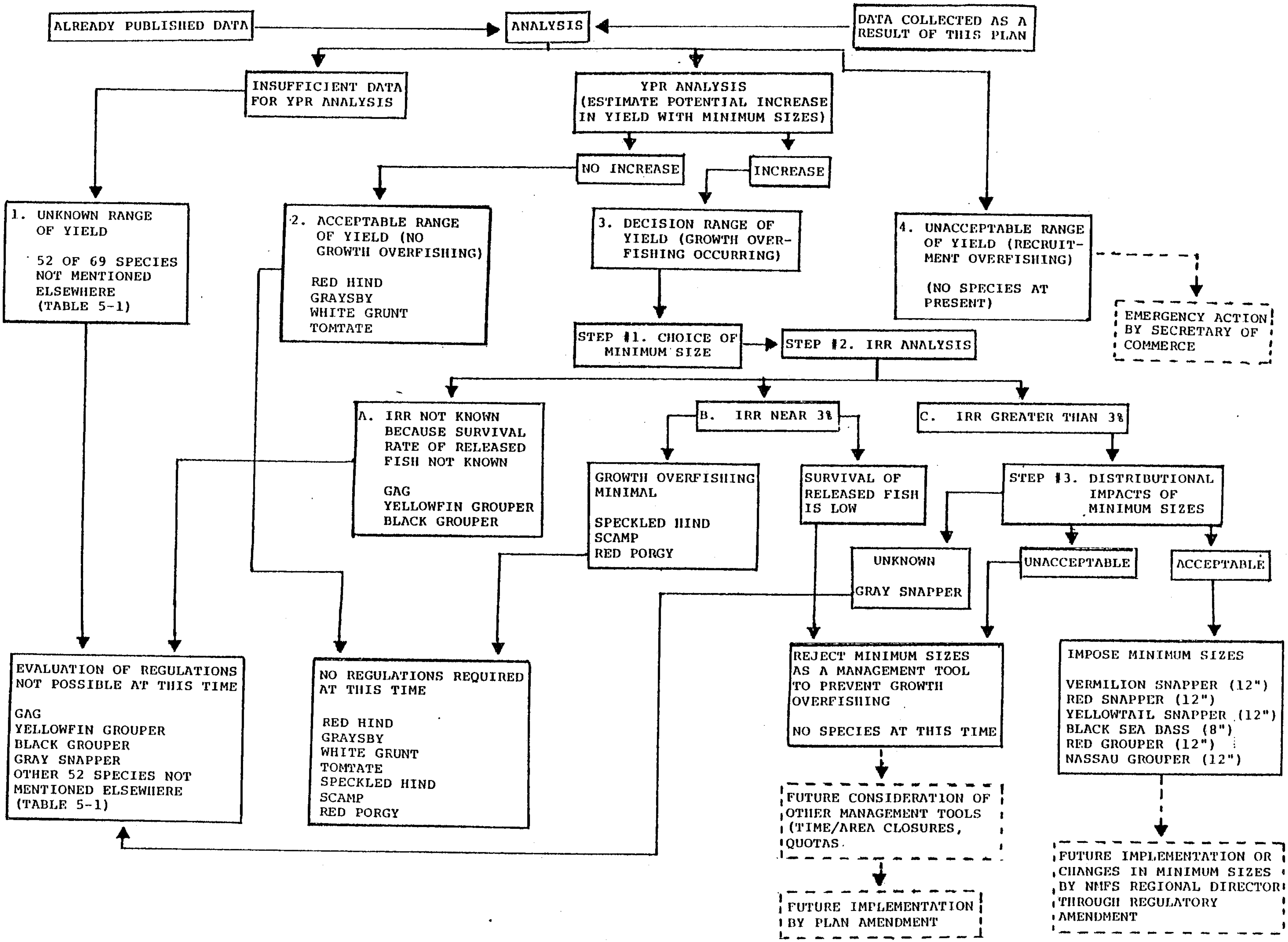

Figure 10-1. Summary of methods to evaluate management measures for individual species to control growth overfishing.

Evaluation of 17 species (Figure 10-1) indicates that red hind, graysby, white grunt, and tomtate are not in the range of growth overfishing.

3. Decision range of yield. Whenever the catch indicates that a species is in or nearing the range of growth overfishing the Council will decide (or Regional Director by Regulatory Amendment) if growth overfishing is justified by the methods established in Section 10.2.2. Growth overfishing is an established scientific definition measured by YPR analysis (see Definition of Terms), but growth overfishing is not "overfishing" in the context of National Standard One of MFCMA. The primary quantitative technique used for this decision is the calculation of an internal rate of return (IRR) for minimum sizes.

   Thirteen species are estimated to be in a range of growth overfishing: Vermilion snapper, red snapper, gray snapper, yellowtail snapper, black sea bass, speckled hind, scamp, red grouper, Nassau grouper, gag grouper, yellowfin grouper, black grouper, and red porgy.

   The IRR (and distributional impacts) justify minimum sizes on six species now: Vermilion snapper, red snapper, yellowtail snapper, black sea bass, red grouper, and Nassau grouper.

   The IRR does not justify minimum sizes on three species because there is minimal growth overfishing: speckled hind, scamp, and red porgy.

   The IRR cannot be calculated for three species because the survival rate of released fish is not known: gag, yellowfin, and black grouper (no minimum sizes recommended at this time).

   The IRR is favorable for gray snapper, but the distributional impacts of a minimum size are not known (no minimum size recommended at this time).

4. Unacceptable range of yield. Whenever recruitment overfishing is detected, the Secretary will restrict harvest of that species by whatever method is appropriate (Monitoring, Section 12.3). Recruitment overfishing is "overfishing" in the context of

National Standard One of MFCMA. None of the species in the fishery are believed to be in this range and none are expected to enter this range as long as growth overfishing is controlled.

10.2.2 Method of Evaluating Minimum Sizes

For those species in the "decision range of yield" there are three steps in the evaluation of minimum sizes. The results of these three steps are presented under the "impact and rationale" of the proposed (or rejected) minimum sizes.

STEP #1: Choice of the minimum size

For any species to be in the decision range of yield, growth overfishing is already occurring such that there are a number of alternative minimum sizes that will potentially increase yield. There are four criteria that can be used to choose the minimum size for complete evaluation: (1) the minimum size that maximizes YPR for a theoretical point estimate of fishing mortality, (2) the minimum size that stabilizes yield over a likely range of fishing mortality, (3) the minimum size that maximizes present value, and (4) the minimum size that maximizes the internal rate of return (Step #2 of the evaluation).

(1) Minimum size that maximizes YPR:

The minimum size that maximizes YPR for a point estimate of fishing mortality is more theoretical than practical. There is seldom, if ever, a point estimate of fishing mortality for a species that will accurately reflect fishing pressure at different locations throughout the management unit.

For any given point estimate of theoretical fishing mortality (F) there is a unique minimum size that will maximize YPR for that level of fishing pressure (Table 8-2). This minimum size can be found in the YPR Appendix (Appendix A) for each species by finding the age liable to capture that maximizes YPR for a given point estimate of fishing mortality.

(2) Minimum size that stabilizes YPR:

There is a minimum size that will stabilize YPR for a range of fishing pressure (range of F values).

In most cases this minimum size is less than the minimum size that will maximize YPR for a point estimate of fishing mortality (Table 8-2). The minimum size that stabilizes YPR can be found in the YPR Appendix for each species by finding the minimum size (age liable to capture) that results in a relatively stable YPR over a wide range of fishing pressures.

This minimum size was chosen for all species evaluated because it is the most applicable when fishing pressure is expected to vary throughout the management unit and/or fishing pressure is not well documented but there is enough information to suggest that it is within the range.

(3) Minimum size that maximizes present value

This method is most appropriate when there is agreement on a specific "discount rate" (see definition of present value). If the Council selects a "discount rate" the minimum size can be treated as an investment problem similar to the calculation of the internal rate of return (Step #2). The higher the discount rate, the smaller is the minimum size that maximizes present value. The lower the discount rate, the larger is the minimum size that maximizes present value.

Coincidentally, the minimum sizes that maximize present value at a 10 percent discount rate are close to the minimum sizes that were picked based on stabilizing yield over a range of fishing pressure (Criterion 2).

(4) Minimum size that maximizes the internal rate of return

In situations where there is minimal growth overfishing the internal rate of return (Step #2) will always be low. Since the internal rate of return is the controlling threshold criterion, when there is minimal growth overfishing the size that produces the highest IRR may be used for the evaluation to conclusively demonstrate that no minimum size can be justified at the time.

STEP #2: Internal rate of return (IRR) analyses

When the chosen minimum size (Step #1) is applied to conventional YPR analysis ("age liable to capture" becomes the minimum size; YPR Appendix, Appendix A) the potential percent increase in yield that will occur at some unspecified time in the future (when the stock reaches equilibrium) can be calculated. How long it will take for this increase in yield to occur (and interim loss in yield) depends on the natural growth rate of the species and the degree of growth overfishing.

Step #2 estimates the change in yield (by weight) in each year from the time the minimum size is implemented until the stock reaches equilibrium. These amounts are presented as a stream of losses and gains (always negative in the first years after the minimum size is implemented and positive in later years). From this stream of losses and gains an internal rate of return (IRR) is calculated that compares the short term loss (by weight) against the long-term gain (by weight) for 20 years or when the stock reaches equilibrium (whichever is longer).

The survival rate of released fish is taken into account in Step #2. Since actual survival rates are not known (only likely ranges are known for each species), an IRR was calculated at 100, 90, 80, 70, and 60 percent release survival rates (equivalent to zero, 10, 20, 30, and 40 percent mortality when undersized fish are released after encountering the fishing gear) (see Source Document). Two IRR computer runs are presented in the YPR Appendix (Appendix A). One is the IRR with 100 percent survival of released fish; the other is the assumed survival rate. If the survival rate is not known, the IRR with 60 percent release survival or the lowest survival rate that still produces at least a 3 percent IRR is presented.

If the IRR is less than 3 percent in the range of expected release survival then the minimum size is rejected. The IRR can be less than 3 percent because either growth overfishing is minimal or the survival of released fish is low (Figure 10-1). If growth overfishing is minimal, increasing fishing pressure may justify the minimum size at a later time. If the IRR is low because of low release survival, other management measures (e.g. time/area closures or quotas) may be justified in the future.

If the IRR is greater than 3 percent then the evaluation proceeds to step three.

STEP #3: Distributional Impacts

Distributional impacts refer to minimum sizes resulting in one group of fishermen being forced to forego small fish and then having these fish harvested later (when they are larger) by another group of fishermen. Distributional impacts do not refer to the ability or willingness of one group to forego smaller fish for the same group to catch larger fish later. It is presumed that if the IRR is larger than 3 percent, fishermen are willing to make the "investment". Public hearings verified that all user groups approved of the proposed minimum sizes after they were told what would be the short term losses and long term gains as long as there were no substantial distributional impacts.

There is no way the quantitative techniques developed for Step #1 and Step #2 can be applied to evaluating distributional impacts. One of the most reliable indicators is the unanimity of approval or disapproval of minimum sizes at public hearings.

Distributional impacts will occur if fish migrate outside the fishing range of a user group while they are growing to a minimum size. For many of the species in the fishery it is expected that fish move further away from shore as they become larger. This can have differential impacts on stationary (bridge/pier) fishermen compared to boat fishermen and inshore (most frequently recreational) compared to offshore (most frequently commercial) fishermen. These situations are discussed for each species that reaches Step #3 of the evaluation procedure.

<u>Impact and rationale for this method of evaluation</u>

All measures to prevent overfishing of individual species are minimum sizes. The evaluation of releasing fish below a minimum size is treated as an investment problem. Fishermen are "forced" to make an investment in the form of catching fewer smaller fish now in return for catching fish when they are bigger in the future. The IRR analysis quantitatively estimates if that "investment" is worthwhile for the fishermen. The internal rate of return (IRR) is calculated on the "investment" of releasing fish until they reach a minimum size. The internal rate of return must be greater than 3 percent for the "investment" (minimum size) to be justified.

The IRR is the discount rate (i) that results in the present value of a stream of values (YPR in weight over time) being equal to zero.* The choice of an acceptable IRR to justify the minimum size depends on the "opportunity cost" of the investment. In the case of "investing" a physical product (foregone landings by weight) for future returns in the same form (future landings by weight) an IRR of 3 percent is considered appropriate. Three percent is chosen because it is recognized in public investment literature that the required real rate of return on an investment is approximately 3 percent. The opportunity cost of money is approximately 3 percent plus the expected rate of inflation because the

*The internal rate of return is the value (i) that produces a present value (PV) equal to zero for a stream of values (v) in each time period (t). This will always produce a unique numerical solution as long as there is only one sign change (negative to positive) in the stream of values. This is always the case when a minimum size is imposed during growth overfishing.

$$PV = \sum_{t=1}^{20} \frac{V_{(t)}}{(1+i)^{t}}$$

inflation rate is the expected loss in the value of money. Since this investment does not involve investing money (only foregone fish "invested"for future fish) compensation for a decreased value of money in the future is not necessary. The 3 percent minimum is for a "risk free" investment (100 percent predictability of the management measure). Since every management measure has some risk, the IRR should be higher than 3 percent to be justified. Tables 10-1 and 10-2 are summaries of the YPR and IRR analyses.

This IRR analysis by weight does not take into consideration the fact that larger fish are more highly valued per pound by both commercial and recreational fishermen (Section 8.5.1). If the IRR is favorable by weight (no adjustment for increased value for larger fish) then the IRR is always more favorable by value because minimum sizes increase total weight landed by increasing the size of individual fish harvested.

The IRR analysis should incorporate the fact that larger fish are more valuable than smaller fish (or vice-versa). This will be done in the future when values by size are better established (Monitoring, Section 12.1). At this time the dynamic YPR model that calculates the IRR cannot handle "weighted values" (see the Source Document for a technical description of the model). By the time data on values by size are available, the model will be adapted. In the meantime, the IRR criterion by weight is a conservative approach to the problem. The IRR by value will always be greater than the IRR by weight as long as larger fish are preferred.

A 3 percent IRR (Step #2) is considered to be a necessary but not sufficient condition to impose a minimum size. Distributional impacts are also considered (Step #3).

10.2.3 Management Measure #2: Future Minimum Sizes on Other Species or Changes in Minimum Sizes

In the course of continuing review, a Point of Concern occurs when the catch indicates that a species is in or near the range of growth overfishing.

Once a Point of Concern is identified:

1. The Monitoring Team* will choose, for the purpose of evaluation, a minimum size that conforms to the criteria in Section 10.2.2.

*Monitoring Team - The Team will be comprised of members of Council staff, Fishery Operations Branch (Southeast Region, NMFS), and the NMFS Southeast Fisheries Center.

Table 10-1. Domestic annual harvest, optimum yield, and minimum size evaluations.

	DOMESTIC ANNUAL HARVEST OR PREVAILING YIELD (YPR WITHOUT MINIMUM SIZES)					OPTIMUM YIELD (YPR WITH MINIMUM SIZES)			EVALUATION OF MINIMUM SIZES	
SPECIES	DOCUMENTED FISHING PRESSURE (F)	ASSUMED F FOR EVALUATION	PREVAILING AGE LIABLE TO CAPTURE	PREVAILING SIZE LIABLE TO CAPTURE (INCHES; 1 in = 25.4 mm)	YPR WITHOUT MINIMUM SIZE (GRAMS)	PROPOSED MINIMUM SIZE (INCHES; 1 in = 25.4 mm)	AGE LIABLE TO CAPTURE WITH MINIMUM SIZE	YPR** WITH MINIMUM SIZE/% GAIN (GRAMS)	IRR WITH 100% SURVIVAL	SURVIVAL RATE THAT PRODUCES 3% IRR OR 60% SURVIVAL, WHICHEVER IS LESS
Vermilion snapper	U*	.37	1.5	5.9	132.37	12	3.5	177.19/ 34%	26.1%	80%=10.8% IRR
Red snapper	.30	.30	2.0	10.5	501.37	12	2.4	540.64/8%	42.6%	60%=6.1% IRR
Gray snapper	U*	.39	1.0	6.3	141.37	8	1.7	157.11/11%	43.1%	60%=6.1% IRR
Yellowtail snapper	U*	.50	1.0	7.4	335.87	12	2.2	450.10/34%	>49.5%	60%=14.1% IRR
Black sea bass(inshore)	.53	.53	1.0	2.3	52.60	8	4.1	100.30/91%	32.4%	80%=13.9% IRR
Black sea bass(offshore)	.30	.30	1.0	2.3	61.15	8	4.1	84.25/38%	17.3%	80%=3.1% IRR
Speckled hind	.42	.42	3.0	15.3	982.25	18	4.2	1,070.72/ 9%	8.0%	80%=<1.0% IRR
Scamp	U*	.25	1.0	12.0	498.54	14	2.0	532.94/ 7%	5.9%	80%= <1.0% IRR
Red grouper	.35	.35	2.0	7.1	190.76	12	3.6	263.83/38%	43.6%	60%=13.7% IRR
Nassau grouper	U*	.35	2.0	7.1	190.76	12	3.6	263.83/38%	43.6%	60%=13.7% IRR
Gag grouper	U*	.30	1.0	11.6	650.01	18	2.5	774.51/19%	19.4%	80%= 6.8% IRR
Yellowfin grouper	U*	.30	1.0	11.6	650.01	18	2.5	774.51/19%	19.4%	80%= 6.8% IRR
Black grouper	U*	.30	1.0	11.6	650.01	18	2.5	774.51/19%	19.4%	80%= 6.8% IRR
Red hind	U*	.20	2.0	7.3	131.80	12	4.5	122.96/ -7%	N/A	N/A
Graysby	U*	.20	3.0	6.5	60.45	9	5.2	57.82/ -4%	N/A	N/A
Red porgy	U*	.40	3.0	11.2	259.37	14	4.7	285.00/10%	3.5%	90%=<1.0 IRR
White grunt	.40	.40	2.0	7.0	44.80	10	3.7+	39.78/-11%	N/A	N/A
Tomtate	U*	.40	3.5	4.7	5.02	6	4.4++	4.95/ -1%	N/A	N/A

*Age, growth, and natural mortality estimated, but fishing pressure (F) is not documented. F values are assumed for the purpose of making the comparison with maximum, prevailing, and optimum YPR values.
**Optimum YPR values are for ages liable to capture rounded off to the nearest half year to conform with the computer output format.
+YPR value for age liable to capture = 3.0 due to computer output format. The YPR value for 3.7 yr would be less than this value.
++YPR value for age liable to capture = 4.0 due to computer output format. The YPR value for 4.4 yr would be less than this value.

Table 10-2. Summary of the minimum size evaluation of 17 species.*

	Acceptable Range of Yield		Decision Range of Yield (Growth Overfishing)	Unacceptable Range of Yield (Recruitment Overfishing
	(No Growth Overfishing Or YPR Unknown)	Minimum Size Limit Is Justified	IRR Appears Favorable But More Information Is Needed. Reject Minimum Size at This Time	IRR Is Not Known Because Survival Rate of Released Fish Is Not Known
Vermilion snapper		12 inches		
Red snapper		12 inches		
Gray snapper			8 inches	
Yellowtail snapper		12 inches		
Black sea bass		8 inches		
Speckled hind			18 inches	
Scamp			14 inches	
Red grouper		12 inches		
Nassau grouper		12 inches		
Gag grouper				18 inches
Yellowfin grouper				18 inches
Black grouper				18 inches
Red hind	X			
Graysby	X			
Red porgy			14 inches	
White grunt	X			
Tomtate	X			

*See summary of YPR and IRR analysis in the YPR Appendix (Appendix A) for the quantitative calculations.

2. The Team will estimate the IRR in conformance with Section 10.2.2.
3. The Team will evaluate distributional impacts among user groups.
4. If the Team concludes that growth overfishing is not justified by criteria established in Section 10.2.2, they will prepare a report containing:
    a. Information supporting the determination that the species is in or near the range of growth overfishing;
    b. A recommendation and supporting rationale for a minimum size that best resolves the overfishing problem consistent with the objectives of the FMP; and
    c. Reasons why other measures were not recommended.

    Since OY is defined as the yields of individual species that result from minimum sizes, incorporating additional minimum sizes will require modification of estimates of OY, DAH, and TALFF. The Team's report will, therefore, also include recommendations for the adjustment of these parameters.

    An environmental assessment of the proposed action and alternatives will also be prepared by the Team and will accompany the report. A supplemental environmental impact statement and/or regulatory impact review will be prepared, if necessary.
5. At the request of the Steering Committee, the Council Chairman may schedule meetings of the Advisory Panel (AP) and/or Scientific and Statistical Committee (SSC) to review the report and associated documents and to advise the Council. The Council Chairman may also schedule public hearings.
6. The Council, following review of the Team's report, supporting data, public comments, and other relevant information, may recommend to the Southeast Regional Director of the National Marine Fisheries Service (RD) that a minimum size be imposed and OY, DAH, and TALFF be adjusted accordingly. Such a recommendation would be accompanied by all relevant background data.
7. The RD will review the Council's recommendation, and if he concurs in the recommendation, will propose regulations in

accordance with the recommendations. He may also reject the recommendation, providing written reasons for rejection.

8. If the RD concurs in the Council's recommendations, he shall publish proposed regulations in the Federal Register and shall afford a reasonable period for public comment which is consistent with the urgency of the need to implement the management measure(s).

Nothing in this section shall be interpreted to derogate from the authority of the Secretary of Commerce to take emergency action under Section 305(e) of the MFCMA. Future management measures other than minimum sizes are discussed in Section 12.2 (other measures to control growth overfishing) and Section 12.3 (measures to prevent recruitment overfishing).

Impact and Rationale

When the monitoring program (Section 12.1) is in place, data will become available to perform complete evaluations of minimum sizes according to the criteria in Section 10.2. The Regional Director, in consultation with the Council, will be able to have a more timely response through Regulatory Amendment than the Council could have through a formal Plan Amendment.

10.3 Management Measure #3: Four Inch Trawl Mesh Size to Achieve a Twelve Inch Minimum Size for Vermilion Snapper

A minimum of four inch stretch mesh is required for all trawl nets that target species in the management unit, (those where 25 percent or more of the catch by weight is comprised of species in the management unit). This mesh size is to be installed within 12 months of the FMP's implementation. This is the only minimum size in this FMP that is indirectly accomplished by imposing a gear restriction (minimum mesh size for trawls). All other minimum sizes are accomplished directly by requiring fish under the minimum size to be released by all types of fishing gear.

Shrimp trawls, rock shrimp trawls and calico scallop trawls are exempt from this mesh size restriction.

There is no prohibition on keeping vermilion snapper of any size that are retained by a four inch mesh trawl (or other fishing gear). However, when a trawl is used, one must comply with the minimum sizes on all other species.

Impact and rationale

Vermilion snapper are in the decision range of yield. YPR analysis (Appendix A1.0) indicates that a 12 inch minimum size will increase YPR from 132 gm to 177 gm which is equivalent to a 34 percent increase in yield if recruitment is constant.

Step #1: Choice of 12 inch minimum size

This minimum size will both maximize YPR for the point estimate of fishing mortality (F=0.37) and stabilize YPR over the likely range of fishing pressure.

Step #2: Internal rate of return

It is likely that the release survival rate of vermilion snapper that encounter the net on the bottom and escape through the 4 inch stretch mesh is greater than 80 percent. The IRR is 26 percent with 100 percent survival of released fish (Appendix A1.1). With 80 percent survival the IRR is still 11 percent (Appendix A1.2).

Years after implementation of 12" minimum size for vermilion snapper (through a 4" mesh size)	Percent change in yield with 80 percent release survival	
1	-34	
2	-27	losses (by weight landed)
3	-15	
4	-3	
5	+ 5	breakeven (4-5 years)
6	+10	gains (by weight landed)
7	+13	
8	+15	stock stabilizes
9	+15	annual gain in the future (over no minimum size)

Step #3: Distributional impacts

The minimum size would be imposed only on the primary harvesting method (trawls) that catch fish less than 12 inches. Hook and line catch almost no vermilion snapper below 12 inches (Section 8.4.7.1).

Since age liable to capture by hook and line is already approximately 12 inches (age 3.5) there is no gain from imposing the minimum size on hook and lines. Furthermore, even if there was a potential gain it would not be realized because of the low survival rate of hooked vermilion brought to the surface and released. Recent estimates from experimental hook and line fishing indicate that the survival of released vermilion that are brought to the surface is no higher than 70 percent. The internal rate of return is only 1 percent with 70 percent release survival.

The minimum mesh size will only impact fish trawling. Based on catch composition, the four inch mesh regulation will significantly reduce the catch of vermilion snapper smaller than 12 inches. Experimental fishing showed that removing a 2 and 3/4" bag liner (which results in 3 and 1/2" stretch mesh) reduced the catch from 185 pounds/trawl to 13.4 pounds/trawl (93 percent reduction). On another occasion, removing a small mesh bag liner (resulting in 3 and 1/2" mesh) reduced the catch from 263.3 pounds/trawl to 62.1 pounds/trawl (76 percent reduction).

Based on commercial catch composition, the expected reduction of the small vermilion snapper component of the trawl catch (at least 50 percent) and reduction in other species will reduce the total landings of the bottom trawls (as presently operated) by at least 50 percent in the short run until vermilion grow to a larger size:

Species	Actual landings lb	Projected landings lb	Weight loss %
Red snapper	8,290	8,290	
Vermilion snapper	56,361	27,617	51
Mangrove snapper	1,057	1,057	
Groupers	15,500	15,500	
Red porgy	60,780	57,437	6
Scup	23,921	23,921	
Sea Bass	3,483	2,960	15
Triggerfish	1,359	1,359	
Grunts	1,600	1,600	
Bigeye	1,220	0	100
Miscellaneous (Tomtate, sand perch, drum, bank sea bass, etc.)	5,325	2,663	50

In addition to vermilion snapper, there is a minimal effect on red porgy (6 percent). The 15 percent reduction in sea bass is justified because a separate size limit of eight inches is justified for sea bass (Section 10.6). Experimental fishing in 1981 indicated that of 153 black sea bass retained by a bottom roller trawl with 3 and 1/2" mesh only one was below eight inches. The likely elimination of small bigeye from the trawl catch is of no commercial importance.

This trawl fishing is not a year round activity and there are other fisheries (e.g. calico scallop) that could absorb some of the displaced effort.

Costs to replace trawl codends are approximately $400 to $500 per net. However, nets normally must be replaced because of wear every 6 to 18 months. Therefore, replacement of codends will usually be done as a part of the normal cost of maintaining gear.

There are minimal distributional impacts by requiring a minimum mesh size on trawls but not imposing a minimum size on hook and line caught fish. Trawls are the predominant gear (83 percent of the vermilion snapper catch in South Carolina, Section 8.4.7.1). Only approximately 11 percent of the hook and line fish are below 12 inches whereas approximately 91 percent of the trawl caught fish are below 12 inches (Table 8.3).

10.4 Management Measure #4: Twelve Inch Minimum Size for Red Snapper

All red snapper taken by any fishing method that are less than 12 inches total length must be returned to the sea immediately with a minimum amount of injury in such a manner as to ensure maximum probability of survival.

Impact and rationale

Red snapper are in the decision range of yield. YPR analysis (Appendix A2.0) indicates that a 12 inch minimum size will increase YPR from 501 gm to 541 gm which is equivalent to an 8 percent increase in yield if recruitment is constant.

Step #1: Choice of a 12 inch minimum size

This minimum size will stabilize yield over the range of expected fishing pressure. A larger size (approximately 18 inches) would maximize YPR but was not chosen because: (1) fishing pressure is variable over the management unit, and (2) distributional impacts are more likely.

Step #2: Internal rate of return

Survival is expected to be between 60 and 80 percent. At the lower boundary of 60 percent the IRR is still 6 percent (Appendix A2.2).

Years after implementation of 12" minimum size for red snapper	Percent change in yield with 60% release survival	
1	-4.0	
2	-2.8	
3	-1.6	losses (by weight landed)
4	-0.7	
5	0	
6	+0.5	breakeven (5-6 years)
7	+0.8	gains (by weight landed)
8	+1.0	
9	+1.2	
10	+1.2	
11	+1.3	stock stabilizes
12	+1.3	annual gain in the future (over no minimum size)

Step #3: Distributional impacts

There is likely some migration from inshore to offshore as red snapper grow larger. Therefore, to some extent, the minimum size will be more restrictive on inshore than offshore fishermen, but increases in yield will accrue to all users. It is anticipated that movement offshore to where they would be less accessible to inshore fishermen will not be significant up to 12 inches. One reason a larger minimum size was rejected at this time was because it might reduce inshore availability.

Testimony at public hearings indicated that all user groups unanimously favored at least a 12 inch minimum size.

10.5 Management Measure #5: Twelve Inch Minimum Size for Yellowtail Snapper

All yellowtail snapper taken by any fishing method that are less than 12 inches total length must be returned to the sea immediately with a minimum amount of injury in such a manner as to ensure maximum probability of survival.

Impact and rationale

Yellowtail snapper are in the decision range of yield. YPR analysis (Appendix A4.0) indicates that a 12 inch minimum size will increase YPR from 336 gm to 450 gm which is equivalent to a 34 percent increase in yield if recruitment is constant.

Step #1: Choice of a 12 inch minimum size

This minimum size will stabilize yield over the range of expected fishing pressure.

Step #2: Internal rate of return

Survival is expected to be at least 80 percent which produces an IRR of 36 percent. At 60 percent survival, the IRR is still 14 percent.

Years after implementation of 12" minimum size for yellowtail snapper	Percent change in yield with 80% release survival	
1	-20	losses (by weight landed)
2	-10	breakeven (2-3 years)
3	+ 2	gains (by weight landed)
4	+11	
5	+16	
6	+19	
7	+21	
8	+22	
9	+23	stock stabilizes
10	+23	annual gain in the future (over no minimum size)

Step #3: Distributional Impacts

Yellowtail snapper are primarily caught by all user groups (private boat, head boat, commercial) in Southern Florida at similar locations (outer reef edge) by similar methods (hook and line frequently chumming fish near the surface). The minimum size will impact all these user groups equally. Testimony at public hearings indicated that all user groups favored the minimum size.

10.6 Management Measure #6: Eight Inch Minimum Size for Black Sea Bass

All black sea bass taken by any fishing method that are less than eight inches total length must be returned to the sea immediately with a minimum amount of injury in such a manner as to ensure maximum probability of survival.

Impact and rationale

Black sea bass inshore (less than 100 ft, 30 m depth) and offshore (over 100 ft, 30 m depth) are in the decision range of yield. YPR analysis (Appendix A5.0) indicates that an 8 inch minimum size for black sea bass will increase YPR from 53 gm to 100 gm which is equivalent to a 91 percent increase in yield inshore. Offshore, where fishing pressure has been estimated to be less, YPR will increase from 61 gm to 84 gm which is equivalent to a 38 percent increase in yield if recruitment is constant.

Step #1: Choice of an 8 inch minimum size

This minimum size will stabilize yield over the anticipated range of fishing pressure inshore and offshore. There is no single minimum size that would maximize yield for both the inshore and offshore fisheries.

Step #2: Internal rate of return

Black sea bass are expected to have one of the highest survival rates among reef fishes when they are released, at least 80 percent. The IRR for 100 percent survival is 32 percent inshore (Appendix A5.2) and 17 percent offshore (Appendix A5.1). The IRR for 80 percent survival is 14 percent inshore (Appendix A5.4) where fishing pressure is the highest (F=0.53) but only 3 percent offshore where fishing pressure is less (F=0.30) (Appendix A5.3). Considering the areas separately, the conclusion might be that the 8 inch minimum size is justified inshore where fishing pressure is the highest, but marginal offshore where the fishing effort is lower. However, fishing pressure is expected to increase offshore which will increase the benefits of the minimum size. Furthermore, while value (commercial and recreational preference) by size cannot be quantitatively incorporated into the IRR at this time (Section 10.2.2), it is documented that there is a substantial preference for larger fish (Section 8.5.1.1) that would considerably increase the IRR by value if this differential could be incorporated. There is no way to enforce a minimum size in one area and have no minimum size in an adjacent area. The conclusion is that the inshore justification, value differential by size for all user groups, and increasing pressure offshore are sufficient reasons to justify the regulation offshore.

Years after implementation of 8"minimum size for black sea bass	Percent change in yield (INSHORE) with 80 percent release survival	
1	-62	
2	-54	
3	-35	losses (by weight landed)
4	- 4	breakeven (4-5 yrs)
5	+17	
6	+28	gains (by weight landed)
7	+34	
8	+36	stock stabilizes
9	+37	annual gain in the future (over no minimum size)

Years after implementation of 8"minimum size for black sea bass	Percent change in yield (OFFSHORE) with 80 percent release survival	
1	-46	
2	-41	
3	-31	
4	-16	losses (by weight landed)
5	- 4	
6	+4	breakeven (5-6 yrs)
7	+10	gains (by weight landed)
8	+13	
9	+14	stock stabilizes annual gain in the future (over no minimum size)

Step #3: Distributional impacts

There are no distributional impacts, but inshore areas will benefit the most from the minimum size. These areas are fished by both commercial and recreational fishermen.

Offshore areas will benefit less from the minimum size restriction. These areas are primarily fished by commercial fishermen. The primary commercial gear (traps) will not be significantly influenced because they seldom retain fish below 8 inches. Length frequency data from South Carolina in 1982 show that, of a total of 3,029 black sea bass caught in traps, only about 5 percent were below 8 inches. These small fish have the lowest market value.

At the public hearings all groups supported the 8 inch minimum size.

10.7 Management Measure #7: Twelve Inch Minimum Size for Red Grouper

All red grouper taken by any fishing method that are less than 12 inches total length must be returned to the sea immediately with a minimum amount of injury in such a manner as to ensure maximum probability of survival.

Impact and rationale

Red grouper are in the decision range of yield. YPR analysis (Appendix A8.0) indicates that a 12 inch minimum size will increase YPR from 191 gm to 264 gm which is equivalent to a 38 percent increase in yield if recruitment is constant.

Step #1: Choice of a 12 inch minimum size

This minimum size will stabilize yield over the expected range of fishing pressure. The minimum size is considerably smaller than the size that would maximize yield (approximately 24 inches), but the larger size is not justified because of distributional impacts. Also, for enforcement, this minimum size corresponds with the minimum size in Florida where most of the smaller red grouper are landed (except that Florida size limits specify fork length rather than total length).

Step #2: Internal rate of return

Survival of released fish is not known but is likely to be higher than 60 percent. With only 60 percent survival the IRR is 14 percent (Appendix A8.2).

Years after implementation of 12" minimum size for red grouper	Percent change in Yield with 60 percent release survival	
1	-19	
2	-15	
3	- 9	
4	- 3	losses (by weight landed)
5	+ 1	breakeven (4-5 years)
6	+ 5	
7	+ 7	gains (by weight landed)
8	+ 9	
9	+10	
10	+11	stock stabilizes
11	+12	annual gain in the future (over no minimum size)

Step #3: Distributional impacts

Red grouper smaller than 12 inches are primarily taken by inshore recreational hook and line (a small number by spearfishing). These fish will remain accessible to inshore fishermen at least through 12 inches so that the same fishermen who "invest" in the minimum size will be the primary beneficiaries. Testimony at public hearings indicated that all user groups unanimously support at least a 12 inch minimum size for red grouper.

10.8 Management Measure #8: Twelve Inch Minimum Size for Nassau Grouper

All Nassau grouper taken by any fishing method that are less than 12 inches total length must be returned to the sea immediately with a minimum amount of injury in such a manner as to ensure maximum probability of survival.

Impact and rationale

The impact and rationale for Nassau grouper is the same as for red grouper. Age and growth have not been estimated for Nassau grouper in our geographic area, but there is evidence that their population parameters and fishing pressure are sufficiently similar to red grouper to justify the same minimum size by analogy. Nassau and red grouper are almost indistinguishable in shape and coloring when they are less than 12 inches.

Evaluating minimum sizes by analogy is obviously second best to direct analysis, but the Council recognizes that data limitations may always require "indicator species" to fill in the blanks for unknown population parameters, release survival rates, or market values when there is good evidence that these indicator species reflect similar circumstances for species where data are not available.

Testimony at public hearings unanimously supported at least a 12 inch minimum size for Nassau grouper.

Years after implementation of 12" minimum size for Nassau grouper	Percent change in yield with 60 percent release survival	
1	-19	losses (by weight landed)
2	-15	
3	- 9	
4	- 3	breakeven (4-5 years)
5	+ 1	
6	+ 5	
7	+ 7	gains (by weight landed)
8	+ 9	
9	+10	
10	+11	stock stabilizes
11	+12	annual gain in the future (over no minimum size)

10.9 Management Measure #9: The Use of Fish Traps is Prohibited Shoreward of The 100 ft Contour, South of Fowey Rocks Light (Miami, Florida)

Impact and rationale

This measure mediates competition in the Florida Keys which occurs because fish traps are set on a narrow shelf that is intensively used by both recreational and commercial hook and line fishermen. This will not significantly increase the operating costs of trap fishermen because it will only require them to move a short distance (1-3 miles) further offshore.

This measure will reduce user conflicts in this intensively fished area. The deployment of fish traps in the south Florida snapper-grouper fishery has become a highly controversial issue. Florida is presently enforcing its ban on fish traps. The traps were deployed (before being banned) primarily at inshore areas of known relief which were also intensively utilized by both recreational and commercial hook-and-line fishermen. These groups have vigorously opposed traps. Sport divers have claimed that traps set on or near shallow reefs capture and kill excessive amounts of tropical reef fish and destroy living coral although recent data showed no coral damage from traps.

Concerns have been raised that traps, because of their efficiency, may rapidly displace other fishing methods which would disrupt historical fishing activities. Traps could also significantly reduce local snapper-grouper populations if they become widely used.

The source document (Section 8.4.3.1.3) presents an overview of fish trapping and documents the conflict. The extensive newspaper coverage and testimony at public hearings held by the South Atlantic Fishery Management Council on this FMP and by the Gulf of Mexico Fishery Management Council on its reef fish plan support the fact that conflict exists in this fishery.

The Council has concluded that the documented conflicts are sufficient to warrant restrictions on fish traps. This will separate the groups in the area of greatest conflict along the narrow shelf from Fowey Light south to Key West, Florida.

10.10 Management Measure #10: Pulling Fish Traps is Prohibited Between The Period One Hour After Sunset and One Hour Before Sunrise South of Cape Canaveral

Impact and rationale

This measure would reduce poaching and theft of traps which occurs primarily at night and improve the enforceability of the other management measures pertaining to fish traps. Currently, traps are not legitimately fished at night. The measure is recommended only south of Cape Canaveral because of the differences in the way traps are fished. Black sea bass traps north of Canaveral are hauled at short intervals, while the owner waits at the site. Traps south of Canaveral fish unattended for several days.

10.11 Management Measure #11: Fish Traps Shall Have A Degradable Panel At Least As Large As The Entry Ports or Degradable Door Fasteners

Impact and rationale

This will prevent a lost (ghost) trap from continuing to catch fish. Installing and maintaining degradable components on traps will cost approximately $2 per trap per year. Lost or "ghost" traps continue to catch fish some of which die and are lost to the fishery. This waste of the resource should be prevented.

10.12 Management Measure #12: Fish Traps Shall Have a Mesh Size No Smaller Than 1x2 Inches or 1.5 Inch Hexagonal One Year After Implementation of This Plan

Impact and rationale

Preventing the entrapment of juvenile fish (some of which are lost due to trap induced mortality) will increase yield from the species affected. Costs to the fishermen are expected to be minimal because the wire presently on most traps is this size or larger. The intent of this measure is to prevent fishermen from using progressively smaller mesh sizes. One year is given for this measure to allow replacement of traps with mesh smaller than 1x2 inch or 1.5 inch hexagonal as they wear out. Any shape mesh is allowed as long as its opening is equal to 1x2 inches or a 1.5 inch hexagon.

This mesh size is not directly correlated to the minimum size restrictions proposed in this plan; however, the black sea bass minimum size of 8 inches total length is about the smallest size retained by the 1x2 inch mesh on standard black sea bass trap.

The cost of wire for traps that need to be replaced earlier than the normal yearly replacement would be the only additional cost to fishermen.

10.13 Management Measure #13: An Individual Shall Not Fish Traps Other Than His Own Without The Written Authorization of The Owner

Impact and rationale

This measure prevents trap poaching and theft. There should be no adverse economic impact associated with this measure. This will improve the enforceability of measures to prevent trap poaching and theft.

10.14 Management Measure #14: Traps And Trap Buoys Shall Be Identified With The Boat or Vessel Fishing The Traps

Impact and rationale

This measure will improve enforcement of measures designed to prevent trap poaching and theft. The cost to fishermen for materials for color coding and numbering buoys and vessels is expected to be approximately $10 per vessel. There is also the time required by fishermen to apply the identification to vessels, traps, and buoys. Fishermen frequently code buoys as an aid in distinguishing their traps from those of others. Therefore only a small part of the cost will be additional.

A licensing and marking identification system has been developed by the Florida Department of Natural Resources for the spiny lobster and stone crab fisheries. A Federal identification system will be designed in a similar manner to avoid duplication.

This measure applies when trap buoys are used, but there is no requirement that buoys be used. Traps must always be permamently identified. This measure does not apply to black sea bass traps that are not left unattended.

10.15 Management Measure #15: The Use of Poisons And Explosives For Taking Fishes Of The Snapper-grouper Fishery is Prohibited Throughout The Management Area

Impact and rationale

The prohibition on the use of poisons and explosives (excluding powerheads) in the snapper-grouper fishery will prevent direct alteration and destruction of habitat. This measure is not expected to have any adverse impacts because these items are presently prohibited in the territorial sea from North Carolina to Florida.

Poisons and explosives are wasteful in that they kill non-usable fish. Additionally, damage to habitat reduces the productive capability of the resources. Poisons and explosives are only rarely used and are already illegal in the territorial seas of the States. Florida has a strict permitting system that controls and limits the use of chemical agents used to take tropical fish. Permits for the use of chemicals are restricted to "research applications" and are reviewed on a case by case basis.

The Coral FMP has provisions whereby poisons can be permitted for certain uses. These uses are exempt from the prohibitions in this plan.

10.16 Management Measure #16: Prohibit The Spearing of Jewfish

Impact and rationale

There is a small number of commercial and recreational divers in the South Atlantic region who harvest jewfish with spearguns and powerheads. Most recreational fishermen catch smaller fish with hook and line.

The selective removal of jewfish from reefs and artificial reefs with powerheads and spearguns reduces the aesthetic enjoyment of recreational diving. There are documented cases in Georgia and Florida of large jewfish being removed with powerheads shortly after appearing at a location. Hook and line can seldom catch these large fish because the line is snagged and broken before the jewfish can be brought to the surface.

Published commercial landing statistics for Florida show a decline from 72,000 pounds in 1977 to 19,000 pounds in 1981. Some commercial divers and recreational divers feel that jewfish numbers are declining. Conversely, a group of commercial divers from Florida contend seasonal movement and diver activity have pushed jewfish away from active areas. A commercial diver in the Florida Keys reported that 1982 was his best year with landings of 19,200 pounds, none of which was recorded by NMFS due to the Florida prohibition on the use of powerheads.

10.17 Management Measure #17: Prohibition or Restraint of Specific Fishing Gear From Artificial Reefs

Upon request to the Council from the permittee (possessor of a Corps of Engineers permit) for any artificial reef or fish attraction device (or other modification of habitat for the purpose of fishing) the modified area and an appropriate surrounding area may be designated as a Special Management Zone (SMZ) that prohibits or restrains the use of specific types of fishing gear that are not compatible with the intent of the permittee for the artificial reef or fish attraction device. This will be done by regulatory amendment similar to adding or changing minimum sizes (Section 10.2.3):

1. A monitoring team* will evaluate the request in the form of a written report considering the following criteria:
   a. fairness and equity
   b. promote conservation
   c. excessive shares
2. At the request of the Steering Committee, the Council Chairman may schedule meetings of the Advisory Panel (AP) and/or Scientific and Statistical Committee (SSC) to review the report and associated documents and to advise the Council. The Council Chairman may also schedule a public hearings.
3. The Council, following review of the Team's report, supporting data, public comments, and other relevant information, may recommend to the Southeast Regional Director of the National Marine Fisheries Service (RD) that a SMZ be approved. Such a recommendation would be accompanied by all relevant background data.

*Monitoring Team - The Team will be comprised of members of Council staff, Fishery Operations Branch (Southeast Region, NMFS), and the NMFS Southeast Fisheries Center.

4. The RD will review the Council's recommendation, and if he concurs in the recommendation, will propose regulations in accordance with the recommendations. He may also reject the recommendation, providing written reasons for rejection.
5. If the RD concurs in the Council's recommendations, he shall publish proposed regulations in the Federal Register and shall afford a reasonable period for public comment which is consistent with the urgency of the need to implement the management measure(s).

Impact and rationale

The intent of a SMZ is to create incentive to create artificial reefs and fish attraction devices that will increase biological production and/or create fishing opportunities that would not otherwise exist. The drawback to "investing" in artificial reefs or fish attraction devices is that they are costly and have limited advantages that can be rapidly dissipated by certain types of fishing gear (e.g. traps harvesting black sea bass from artificial reefs). Fishing gear that offers "exceptional advantages" over other gear to the point of eliminating the incentive for artificial reefs and fish attraction devices for users with other types of fishing gear prevent improved fishing opportunities that would not otherwise exist.

10.18 Management Measure #18: Statistical Reporting and Data Collection

Data will be collected from a sample of commercial and recreational catch for YPR analysis. Those fishermen and dealers selected must make their fish available for inspection (measurement) by statistical reporting agents. Dealers will continue voluntary reporting of landings and value by species for those species reported in Fishery Statistics of the United States.

10.19 Management Measures Considered and Rejected

10.19.1 Rejected Management Measure #1: No Action Alternative

Impact and rationale

All the benefits of this plan (percent increase in yield and IRR) have been estimated on the assumption that fishing pressure (fishing mortality estimated by YPR) does not increase over time. This assumption likely produces a downward bias in the estimates of the benefits of the recommended minimum sizes. Unfortunately there is no satisfactory method to forecast increasing fishing effort and decreasing future landings (by weight) due to growth overfishing.

The best that can be done with regards to forecasting future fishing is a time-series regression of total commercial landings (all species in the fishery) from 1967 through 1981*. Total landings have increased 3.77 percent per year (1967-1981). Table 10-3 indicates the relative annual decrease in equilibrium YPR if fishing mortality (F level) increased at 4 percent per year over 10 years.

This four percent is likely a conservative estimate for two reasons: (1) total landings from 1967 to 1981 have increased at 3.77 percent annually but for this to occur fishing effort had to expand by more than this because theoretically fishing effort is always more than proportional to landings (in equilibrium), and (2) recreational fishing has probably expanded more rapidly than commercial fishing, but there are no reliable time-series data on recreational landings.

Present value benefits of six minimum size

For the purpose of benefit-cost analysis the assumption of an annual 4.0 percent increase in fishing pressure is incorporated into the streams of losses and gains used in the IRR analysis. This was done by replacing the assumed constant YPR value "without size limits" (column one in the YPR Appendix for each species) with the YPR values that would occur with an annual four percent increase in fishing pressure (YPR values in Table 10-3).

In order to convert the percentage differences in YPR with and without size limits into pounds of fish, it is assumed that 1979 recorded commercial and recreational landings correspond to the YPR values. The 1979 commercial and recreational landings were not precisely recorded by species (Table 10-4). However, for the purpose of benefit-cost analysis landings were partitioned for each species (last column, Table 10-4). The percentage losses and gains in YPR (IRR tables adjusted for increasing fishing pressure) were then multiplied by 1979 landings by species to arrive at an estimate of losses and gains (in pounds of fish) over 20 years (Table 10-5).

*ln (landings) = 8.3297 + 0.0377 (years)
R^2 = 0.5772
n = 15 (years 1967-81)

Table 10-3. Equilibrium yield-per-recruit over 10 years with fishing mortality (F level, YPR analysis) increasing at four percent per year.

	Vermilion Snapper		Red Snapper		Yellowtail Snapper		Black Sea Bass (Inshore)		Black Sea Bass (Offshore)		Red and Nassau Grouper	
	F Level	YPR Value	F Level	YPR Value	F Level	YPR Value	F Level	YPR Value	F Level	YPR Value	F Level	YPR Value
Base Year	0.37	132.37	0.30	501.37	0.50	335.87	0.53	52.6	0.30	61.15	0.35	190.76
1	0.38	131.85	0.31	500.62	0.52	331.23	0.55	51.68	0.31	61.11	0.36	188.87
2	0.40	130.80	0.32	499.86	0.54	326.58	0.57	50.76	0.32	61.08	0.38	184.36
3	0.42	129.75	0.34	498.36	0.56	321.94	0.60	49.37	0.34	60.66	0.39	182.11
4	0.43	129.23	0.35	497.61	0.58	317.29	0.62	48.45	0.35	60.29	0.41	177.91
5	0.45	128.18	0.37	496.10	0.61	310.55	0.64	47.56	0.37	59.54	0.43	174.03
6	0.47	127.13	0.38	495.35	0.63	306.34	0.67	46.28	0.38	59.16	0.44	172.09
7	0.49	126.75	0.49	494.59	0.66	300.02	0.70	45.00	0.39	58.78	0.46	168.22
8	0.51	124.38	0.41	492.11	0.68	295.81	0.73	43.84	0.41	58.03	0.48	164.34
9	0.53	123.00	0.43	488.65	0.71	289.75	0.75	43.07	0.43	57.28	0.50	160.46
10	0.55	121.63	0.44	486.92	0.74	284.18	0.78	41.91	0.44	56.81	0.52	157.30

Table 10-4. Commercial and recreational landings of fishes in the snapper-grouper fishery in the south Atlantic in 1979 (1981 for tilefish).

	Commercial Landings (thousand lb)	% Total Commercial Landings	Recreational[a] Harvest (thousand lb)	% Total Recreational Harvest	Total Commercial & Recreational (thousand lb)	% Total	% Total Fishery Landings Minimum Sizes Will Address	Approximate landings that Minimum Sizes Influence
Snappers								
Red	425	5.2	1,010[k]	7.0	1,435	6.34	6.34[d]	1,435
Vermilion	373	4.5	19	0.1	392	1.73	1.65[e]	373
Gray	247	3.0	480	3.3	727	3.21		
Unclassified	949	11.5	2,357	16.4	3,306	14.61	2.20[f]	498
Total Snappers	1,994	24.2	3,866	26.8	5,860	25.89		
Black Sea Bass	954	11.6	1,854	12.9	2,808	12.41	12.41[g]	2,808
Groupers	2,551	31.0	2,187	15.2	4,738	20.94	3.00[h]	679
Porgies	1,076	13.1	413	2.9	1,489	6.58		
Sheepshead	230	2.8	2,014	14.0	2,244	9.92		
Grunts	129	1.6	1,568	10.9	1,697	7.50		
Tilefish	1,180[b]	14.4	-	-	1,180	5.21		
Triggerfish	46	0.6	304	2.1	350	1.55		
Hogfish	26	0.3	-	-	26	0.11		
Jacks	38	0.5	2,201	15.3	2,239	9.89		
Total	8,224	100.1	14,407	100.1	22,631[c]	100.00	25.60[j]	5,793

a. Recreational fish include those landed whole and those harvested but not brought ashore whole, used as bait, filleted, or discarded dead.
b. Tilefish are 1981 landings.
c. Presumed to approximate MSY for the fishery. Landings do not necessarily represent the MSY of individual species or species groups.
d. 12 inch minimum size for all commercial and recreational red snapper.
e. 12 inch minimum size for vermilion snapper through a 4 inch trawl mesh.
f. 12 inch minimum size for yellowtail snapper (yellowtail comprise 2.20 percent of the total).
g. 8 inch minimum size for all commercial and recreational black sea bass.
h. 12 inch minimum size for red and Nassau grouper (red and Nassau grouper comprise 3.00 percent of the total).
j. While minimum sizes at this time address only 8.7 percent of the species in the fishery by number (6 of 69 species), minimum sizes cover 26 percent of the fishery by weight.
k. Concern has been expressed that this figure over-estimates red snapper harvest because red porgies were included as red snappers in some states (B. Low, S.C. Wildlife and Marine Resources Dept., Charleston, S.C.; pers. comm.).

Table 10-5 Losses and gains (in pounds of fish) over 20 years with fishing pressure increasing at 4.0 percent annually for the first 10 years assuming recorded landings (Table 10-4) correspond to YPR values.

Year	Vermilion Snapper (80% survival)	Red Snapper (60% survival)	Yellowtail Snapper (80% survival)	Black Sea Bass* (80% survival)	Red and Nassau Grouper (60% survival)	Summation
1	-126,494	-55,640	-92,788	-1,704,552	-123,548	-2,103,022
2	-96,596	-35,863	-35,541	-1,412,541	-81,262	-1,661,803
3	-47,847	-14,940	30,929	-815,708	-29,828	-877,394
4	-3,100	773	80,600	116,377	23,670	218,320
5	29,982	15,198	117,891	735,632	68,733	967,436
6	52,384	24,357	140,295	1,118,395	99,380	1,434,811
7	65,346	31,169	158,754	1,350,082	130,347	1,735,698
8	78,336	41,215	169,949	1,487,279	156,117	1,932,896
9	84,141	52,950	181,559	1,556,678	178,008	2,053,336
10	88,002	59,018	191,181	1,618,604	194,631	2,151,436
11	88,002	59,018	191,181	1,618,604	194,631	2,151,436
12	88,002	59,018	191,181	1,618,604	194,631	2,151,436
13	88,002	59,018	191,181	1,618,604	194,631	2,151,436
14	88,002	59,018	191,181	1,618,604	194,631	2,151,436
15	88,002	59,018	191,181	1,618,604	194,631	2,151,436
16	88,002	59,018	191,181	1,618,604	194,631	2,151,436
17	88,002	59,018	191,181	1,618,604	194,631	2,151,436
18	88,002	59,018	191,181	1,618,604	194,631	2,151,436
19	88,002	59,018	191,181	1,618,604	194,631	2,151,436
20	88,002	59,018	191,181	1,618,604	194,631	2,151,436
Present value (in pounds of fish) at 3% discount rate	612,845	449,678	1,953,644	12,884,741	1,685,558	20,719,283

*Black sea bass landings cannot be partitioned into "offshore" and "inshore." Therefore, all landings are assumed to be "inshore" for purposes of calculating the losses and gains.

Present value (in pounds) is calculated at a three percent discount rate. A three percent discount rate was chosen for the same reasons outlined in Section 10.2.2 for choosing three percent as the minimal acceptable IRR.

The present value of minimum sizes is 20.7 million pounds. The present value in dollars depends on the average value per pound. The minimum value (commercial and recreational) is assumed to be $0.75 per pound and the upper limit is assumed to be $1.50 per pound. This range produces the following present value estimates of the six minimum sizes (or conversely, the cost of no action). There are also unquantifiable benefits from other management measures.

Assumed per pound Value	Range of present value (in dollars) of six minimum sizes
$0.75	$15,539,462
$1.00	$20,719,283
$1.25	$25,899,104
$1.50	$31,078,925

Present value costs of six minimum sizes

Total costs equal plan development costs ($552,000) plus $120,000 annual data collection and analyses cost, plus $170,000 annual NMFS and State enforcement costs, plus $125,000 annual Coast Guard enforcement costs. The present value cost over 20 years at a 10 percent discount rate is $4,085,128. A 10 percent discount rate is used for costs because these are dollar values, while a 3 percent discount rate is used for increases in yield because these are in physical units (pounds of fish).

The cost estimate is probably low because it does not take into account that inflation will increase government costs. Also, it is anticipated that more minimum sizes will be added in the future (which will also increase benefits).

Benefit-cost analysis

The benefit/cost ratio is defined as present value benefits divided by present value costs. There are alternative benefit cost ratios depending on the assumed per pound value of the fish:

Assumed per pound Value	B/C Ratio
$0.75	$15,539,462/$4,085,128 = 3.80
$1.00	$20,719,283/$4,085,128 = 5.07
$1.25	$25,899,104/$4,085,128 = 6.34
$1.50	$31,078,925/$4,085,128 = 7.61

The above analysis leads to the conclusion that the return for government investment in six minimum sizes ranges from $3.80 for each dollar invested to $7.61 for each dollar invested.

10.19.2 Rejected Management Measure #2: 12 Inch Minimum Size for Vermilion Snapper for Hook and Line

Impact and rationale

This would not increase yield because the age liable to capture by hook and line is already near 12 inches (Section 10.3). Even if the age liable to capture for hook and lines was as small as it is for trawls, the low survival rate does not produce a favorable IRR (Section 10.3).

10.19.3 Rejected Management Measure #3: 12 inch Minimum Size for Vermilion Snapper for Trawls

Impact and rationale

A 4 inch mesh size (Management Measure #3, Section 10.3) will virtually eliminate the harvest of vermilion snapper less than 12 inches total length. This is preferable to a minimum size because the survival rate of released vermilion snapper that are brought to the surface and returned to the water is much lower than when vermilion snapper escape through the net on the bottom.

10.19.4 Rejected Management Measure #4: 8 Inch Minimum Size for Gray Snapper

Impact and rationale

Gray snapper is apparently a strong candidate for a minimum size. It is likely in the decision range of yield. An evaluation was done with an 8 inch minimum size and YPR would increase from 141 gm to 157 gm which would be an 11 percent increase if recruitment was constant.

Step #1: Choice of a minimum size

Eight inches would stabilize yield over a wide range of fishing pressure.

Step #2: Internal rate of return

The IRR appears to be favorable. At 60 percent release survival the IRR is still 6 percent (Appendix A 3.2).

Step #3: Distributional impacts

A minimum size is not recommended at this time because the distributional impacts are not known. Many gray snappers are caught inshore by stationary fishermen (bridges and around mangroves). These fishermen may be adversely impacted in favor of more mobile fishermen.

10.19.5 Rejected Management Measure #5: 18 Inch Minimum Size for Speckled Hind

Impact and rationale

Speckled hind are experiencing minimal growth overfishing. An 18 inch minimum size would increase YPR from 982 gm to 1,071 gm which is equivalent to a 9 percent increase if recruitment is constant (Appendix A 6.0).

Step #1: Choice of an 18 inch minimum size

This size nearly produces maximum YPR and was the size that produced the most favorable IRR (which was still too low).

Step #2: Internal rate of return

The IRR indicates that a minimum size of 18 inches is not justified. Survivial rates of released fish are not known, but an 80 percent survival rate, which would be optimistic, results in an IRR less than one percent (Appendix A6.2).

10.19.6 Rejected Management Measure #6: 14 Inch Minimum Size for Scamp Grouper

Impact and rationale

A 14 inch minimum size will increase YPR from 499 gm to 533 gm which is equivalent to a 7 percent increase if recruitment is constant (Appendix A 7.0).

Step #1: Choice of a 14 inch minimum size

This size nearly produces maximum YPR and was the size that produced the most favorable IRR (which was still too low).

Step #2: Internal Rate of Return

The IRR indicates that a minimum size of 14 inches is not justified. With 100 percent survival the IRR is only 6 percent (Appendix A 7.1); while at 80 percent survival the IRR is less than one percent (Appendix A 7.2).

10.19.7 Rejected Management Measure #7: 18 Inch Minimum Size for Gag Grouper

Impact and rationale

An 18 inch minimum size will increase YPR from 650 gm to 775 gm which is equivalent to a 19 percent increase if recruitment is constant (Appendix A 9.0).

Step #1: Choice of an 18 inch minimum size

This size limit will stabilize yield over a wide range of fishing pressure.

Step #2: Internal rate of return

The IRR appears to be favorable With an 80 percent survival rate there is still a 7 percent IRR (Appendix A 9.2). Release survival is not known and could be quite low. A minimum size is not recommended until release survival is established.

10.19.8 Rejected Management Measure #8: 18 Inch Minimum Size for Yellowfin Grouper

Impact and rationale

Same as gag grouper (Section 10.19.7). Age and growth have not been estimated for yellowfin grouper, but there is evidence that they are sufficiently similar to gag grouper to evaluate by analogy. Release survival is not known and could be quite low. A minimum size is not recommended until release survival is established.

10.19.9 Rejected Management Measure #9: 18 Inch Minimum Size for Black Grouper

Impact and rationale

By analogy, the same as yellowfin grouper and gag grouper.

10.19.10 Rejected Management Measure #10: 18 Inch Minimum Size on Red Hind

Impact and rationale

Not in the decision range of yield. A minimum size would reduce yield because the species is not in the range of growth overfishing at this time.

10.19.11 Rejected Management Measure #11: 9 Inch Minimum Size for Graysby

Impact and rationale

Not in the decision range of yield. A minimum size would reduce yield because the species is not in the range of growth overfishing at this time.

10.19.12 Rejected Management Measure #12: 14 Inch Minimum Size for Red Porgy

Impact and rationale

A 14 inch minimum size will increase YPR from 259 gm to 285 gm which is equivalent to a 10 percent increase if recruitment is constant (Appendix A12.0).

Step #1: Choice of a 14 inch minimum size

This size nearly produces maximum YPR and is the size that produces the most favorable IRR (which is still too low).

Step #2: Internal rate of return

The IRR indicates that the minimum size is not justified. At 90 percent survival the IRR is less than one percent (Appendix A12.2).

10.19.13 Rejected Management Measure #13: 10 Inch Minimum Size for White Grunt

Impact and rationale

Not in the decision range of yield. A minimum size would reduce yield because the species is not in the range of growth overfishing at this time.

10.19.14 Rejected Management Measure #14: 6 Inch Minimum Size for Tomtate

Impact and rationale

Not in the decision range of yield. A minimum size would reduce yield because the species is not in the range of growth overfishing at this time.

10.19.15 Rejected Management Measure #15: Allow The Use of Only Hand Operated Reels and Handlines Within 300 Yards of Permitted Artificial Reefs Which Are (Or Were) Constructed Solely For The Purpose of Recreational Fishing

Impact and rationale

This measure was rejected in favor of allowing the permittee of an artificial reef to petition to prohibit or restrain the use of specific fishing gear not compatible with the intent for which the reef was built (Management Measure #17, Section 10.17).

10.19.16 Rejected Management Measure #16: Establish a Zoning Restriction of Artificial Reefs Established Solely For Recreational Fishing to Permit Spearfishing North of Cape Canaveral and Prohibit Spearfishing South of Cape Canaveral

Impact and rationale

This measure would enhance spearfishing north of Canaveral and stop spearfishing south of Canaveral. This zoning restriction was rejected in favor of Management Measure #17 (Section 10.17) that allows permittees to petition to prohibit or restrain the use of specific fishing gear on artificial reefs.

10.19.17 Rejected Management Measure #17: Prohibit the Use of "Powerheads" for Spearfishing

Impact and rationale

Powerheads increase safety under water because speared fish attract sharks when they do not die right away. The use of powerheads allows divers to kill 95 percent of the fish they hit instantly. Approximately 30-40 percent of fish shafted without powerheads escape and die.

10.19.18 Rejected Management Measure #18: Prohibit Vessels From Fishing More Than 200 Traps

Impact and rationale

This measure unnecessarily limits the economic potential of individual trapping enterprises and discriminates against larger operations (bigger boats) that may be more efficient in some locations. This measure will not restrict total trap fishing unless there is also a limit on the number of boats that can use traps (limited entry).

10.19.19 Rejected Management Measure #19: Fish Traps Shall Not Be Larger Than 54 Cubic Feet

Impact and rationale

This measure unnecessarily impedes experimentation with different dimensions of traps. This measure will not restrict total trap fishing unless there is a limit on the total number of traps that can be used in the fishery (limited entry).

Trap fishermen tend to set traps away from coral outcrops, but lost traps can come in contact with coral. This measure was rejected after recent data showed no habitat damage from lost traps.

10.19.20 Rejected Management Measure #20: Prohibit Roller Trawls Throughout The Management Area

Impact and rationale

This would exclude roller trawls from all the existing fishing locations that range up to 40 to 50 miles off North Carolina, South Carolina, Georgia, and North Florida, and approximately 10-30 miles off the east coast of Florida. It would impact 25-30 already converted shrimpers and other vessels capable of trawling.

The rationale for preventing bottom trawling is the harvest of small fish (primarily vermilion snapper) and damage to the live bottom. The problem of taking small fish is solved with Management Measure #3 (Section 10.3) that requires a four inch mesh on bottom trawls and minimum sizes on five species other than vermilion snapper.

There is inconclusive evidence on the habitat damage caused by bottom roller trawls. There are ongoing studies of damage to live bottom by roller trawls. If these studies or other evidence conclusively documents significant habitat damage by roller trawls the Council will take appropriate action by plan amendment. If the damage is substantial the Council may request emergency action by the Secretary until the plan can be amended.

10.19.21 Rejected Management Measure #21: Prohibit Roller Trawls In Limited Areas

Impact and rationale

This would prevent roller trawls from fishing within some current fishing areas. The impact would be great on those who had invested in gear and vessel alterations. The Council decided that if there were prohibitions they should be limited to areas with known bottom habitat that would be damaged by roller trawls. These areas may be protected from roller trawls or any other habitat damaging activity in the joint Gulf of Mexico and South Atlantic Council Coral Fishery Management Plan.

10.19.22 Rejected Management Measure #22: Prohibit The Taking of Certain Specified Kinds of Organisms Characteristic of Sensitive Live Bottoms

Impact and rationale

This measure was considered as a way to protect critical habitat for the snapper-grouper fishery. Enforcement of this measure would be very difficult and costly. Sponges and corals might not necessarily be brought aboard a fishing vessel, but underwater damage to habitat could still occur. Some corals, such as Oculina, are so fragile that few pieces would be retained in a trawl dragged through a colony. Because enforcement would require the presence of an officer at the time the trawl was brought on board, this measure was rejected as being unenforceable. Areas of sensitive live bottom will be considered for protection in the joint Gulf of Mexico and South Atlantic Council Coral Fishery Management Plan.

10.19.23 Rejected Management Measure #23: Time/Area Closures or Quotas

Impact and rationale

Social and economic dislocations would occur from time/area closures. Particular difficulties would occur because this is a multi-species fishery. Closing times or areas would have uncontrollable differential impacts on different species and could prevent full utilization of some species. Time/area closures will only be considered as a necessary "second line of defense" when minimum sizes are not applicable (survivial rate of released fish is too low).

Individual quotas only work in the context of limited entry in the commercial sector. They require detailed log book reporting and enforcement of quotas on each boat. Individual quotas in the recreational sector are equivalent to bag limits. They have the same enforcement shortcomings as the commercial sector, but they would probably be a more effective constraint on that component of fishing effort without limited entry. They are considered a second line of defense after minimum sizes.

10.19.24 Rejected Management Measure #24: Permits Should Be Required For All Vessels Fishing For Snapper-Grouper in The FCZ

Impact and rationale

Permitting would increase the cost to the government without added benefit because there is an adequate voluntary reporting system included as part of this proposed plan. Administration costs would be about $10 for each permit. Total costs to the Government are estimated to be about $20,000 for the approximately 2,000 vessels in the fishery.

10.19.25 Rejected Management Measure #25: Commercial Vessels Should Be Permitted, But Recreational Vessels Should Be Subjected To Various Surveys To Collect Information

Impact and rationale

Costs associated with issuing permits would outweigh the benefits. Total Government costs for commercial permits would be about $12,480. A voluntary reporting system without permits would be more cost effective and efficient.

10.19.26 Rejected Management Measure #26: Place A Moratorium On Entry Into The Fishery (Including Charter, Head, And Commercial Vessels)

Impact and rationale

This measure would not stabilize effort without tight controls on the sizes, number, and types of boats operated in the fishery. Enforcement would require that each of the states impose a similar moratorium in its State waters.

10.20 Management Costs and Revenues

Total discounted costs over 20 years are given in Section 10.19.1.

10.20.1 Plan Development

Plan developments costs were $552,000.

10.20.2 Data Collection

Data collection and analyses costs are estimated by NMFS to be $120,000 annually.

10.20.3 Enforcement Costs

The annual cost to the government for adequate enforcement of the proposed measures is estimated to be $170,000 for NMFS and State enforcement costs and $125,000 Coast Guard enforcement costs, a total of $295,000.

10.20.4 Government Revenues

No additional revenue will accrue to the government as a result of the proposed measures.

10.21 Summary of Regulatory Impacts of Measures

A 4 inch stretch mesh imposed on trawls that target species in the management unit to achieve a 12 inch minimum size for vermilion snapper will result in a 34 percent increase in yield if recruitment is constant. Minimum sizes of 12 inches total length for red snapper and 12 inches total length for yellowtail snapper will result in increases in yield of 8 and 34 percent respectively. A minimum size of 8 inches total length for black sea bass will increase yield by 91 percent inshore and 38 percent offshore. Minimum sizes of 12 inches total length for red grouper and Nassau grouper will result in increases in yield of 38 percent.

Prohibiting the use of fish traps shoreward of the 100 foot contour south of Fowey Rocks Light will decrease conflicts without significantly increasing the operating costs of trap fishermen. Prohibiting pulling fish traps at night south of Cape Canaveral would reduce poaching and theft of traps. Requiring a degradable panel or door fasteners on traps would prevent lost traps from continuing to fish while costing the fishermen $2 per trap. Fish traps shall have a mesh size no smaller than 1X2 inches or 1.5 inch hexagonal one year after implementation. The cost of wire fish traps that need to be replaced earlier than normal yearly replacement would be the only additional cost to fishermen. An individual shall not fish traps other than his own without written permission of the owner. There should be no adverse economic impact associated with this measure and the effectiveness of enforcement should improve. Requiring traps and trap buoys be identified with the boat or vessel fishing the traps will cost approximately $10 per vessel and the time involved to apply the identification. This measure should improve the effectiveness of enforcement. Prohibiting the use of poisons and explosives (excluding powerheads) for taking fishes of the snapper-grouper complex is not expected to have any adverse impacts because these items are not currently used. Prohibiting the spearing of jewfish will protect this large reef fish, increasing the aesthetic enjoyment of recreational divers. Data will be collected from a sample of fishermen and dealers; those selected must make their fish available for measurement. Dealers will continue voluntary reporting of landings and value. Therefore, the data collection and reporting requirements should not impose an adverse economic impact on any user group.

Prohibiting or restraining specific fishing gear from artificial reefs may occur with special management zones.

11.0 RESEARCH NEEDS

Future management requirements may also include reporting on a sampling basis of information related to improved methods of determining landings for all components. Methods are now being explored and developed for improving the accuracy, reliability and content of landings data so that stock assessment other than the YPR, such as virtual population analysis, may be possible in the future. Procedures for quantifying the level and extent of misreporting and misidentification are being evaluated. An analysis of data presently being collected on recreational landings will be carried out to determine the relationships of sampling level, cost, and precision of estimation. Methods are also being examined for obtaining price by size information from the commercial fishery and size preference information in the recreational fishery on a routine or periodic basis.

The following areas of research, identified on a priority basis, are needed to develop a regime for long-term conservation and management of the fishery.

11.1 High Priority Needs

A. Evaluation of the Impacts of Snapper-Grouper Trawling

1. Determine the extent of damage and consequences of modifications to hard-bottom habitat resulting from various trawling gears and practices
2. Determine the species and size composition of trawl catches
3. Accurately document and estimate the mortality of juvenile snappers and groupers caused by trawling as now practiced
4. Determine the feasibility of reducing the catch of non-target species and juveniles through development of escape or separator panels or alterations of mesh sizes

B. Yield-per-recruit analysis or other stock assessment techniques to estimate growth overfishing of other species in the management unit. Priority should be according to the relative importance of the species by weight or value to the fishery.

C. Determination of the survival rate of released fish for the purpose of evaluating future minimum sizes. Priority should be according to those species already identified in growth overfishing but release survival rates are not known (gag, yellowfin, and black grouper, Figure 10-1) and any other species identified in growth overfishing.

D. Assessment of population abundance with and without catch and effort statistics

E. Evaluation of the impacts of snapper-grouper trapping in south Florida

1. Determine the species and size composition of trap catches
2. Determine the efficiency of traps in relation to bottom irregularities and the physical damage to habitat, if any, resulting from deployment and hauling of traps on and/or near reefs
3. Determine the relationship between trap design and sizes and yield
4. Determine the effect of mesh size on the size and species composition of the catch

F. Determination of "value" (commercial market and recreational preferences) for fish by size to be used in future IRR analyses.

11.2 <u>Medium Priority Needs</u>

Identification and quantification of factors influencing the demand for recreational fishing

11.3 <u>Low Priority Needs</u>

A. Investigation of factors affecting fish abundance and ecological relationships

1. Develop techniques for forecasting year-class strength of major species from a sub-sample of the fish population
2. Determine the location and habitat of juveniles
3. Evaluate the effects of fishing pressure on predator-prey relationships between heavily and lightly fished species

4. Determine the factors controlling the distribution and abundance of snappers and groupers

B. Investigation of Economic Characteristics

1. Cost and return budgets for the harvesting sector of the fishery by gear type and size of operation
2. Industry and firm production and cost functions
3. Product flows
4. The relationship between changes in landings, price structure, and demand

C. Investigation of Sociological Characteristics

1. Economic dependence on the fishery, by those involved in the harvesting sector and in support industries

12.0 MONITORING AND FUTURE ACTIONS AS A RESULT OF MONITORING

12.1 Monitoring

Statistical reporting and data collection. (Management Measure #18, Section 10.18) will result in the collection of data necessary to evaluate future minimum sizes or other management measures. This is primarily data for YPR analyses. Data collection and handling will be by NMFS. Actual data analysis will be by Council staff, NMFS, or other appropriate experts.

Monitoring is the ongoing evaluation of the management measures and operating procedures of the plan. Performance monitoring will be used by the Council and RD for regulatory and plan amendments. Performance monitoring will quantitatively measure the results of the regulations. This may lead to changing minimum sizes (Management Measure #2, Section 10.2.3); to creating special management zones (Management Measure # 17, Section 10.17) by regulatory amendment; and to instituting new management measures by plan amendments (Sections 12.2 and 12.3). Performance monitoring will be done by Council staff and NMFS. An annual report on performance monitoring will be prepared jointly by Council staff and NMFS.

Operations monitoring will be used by the Council and NMFS to adjust operating procedures. Operations monitoring will analyze and evaluate the administrative activities that carry out the plan. This will include administrative operations such as data reporting and enforcement difficulties, and dissemination of information. Operations monitoring will also evaluate organizational structures such as participation by the AP and SSC. Operations monitoring will be done by Council staff and NMFS. An annual report on operations monitoring will be prepared jointly by Council staff and NMFS.

12.2 Future Action Other Than Minimum Sizes to Control Growth Overfishing

Should regulations other than minimum sizes be necessary to control growth overfishing these regulations will be through plan amendments.

Minimum sizes will not work if the survival of released fish is too low. Some species still have favorable internal rates of return with release survival rates of only 60 percent, but gains drop rapidly below 60 percent survival. Fish caught in deeper water are less likely to survive after being brought to the surface. Therefore, minimum sizes for deepwater grouper (e.g. yellowedge, misty, black, and gag) and certainly deepwater tilefish are not expected to be beneficial.

There is no way to determine in advance what specific management measures other than minimum sizes would be the most appropriate to control growth overfishing of particular species. Minimum sizes were chosen as the "first line of defense" against growth overfishing primarily through a process of elimination.

Data collection and analysis specified in this FMP may suggest strategies for time/area closures, quotas, or other management measures for species that have too low a release survival rate to be candidates for minimum sizes. These measures will require detailed Council evaluation and public review that can only be accomplished through the plan amendment process.

12.3 Future Action to Prevent Recruitment Overfishing

It is anticipated that if there are timely responses to control growth overfishing (minimum sizes through regulatory amendments, other type management measures through plan amendments) that recruitment overfishing will never occur. In the unlikely event that recruitment overfishing does occur for one or more species, the Council will request emergency action by the Secretary until the plan can be amended with measures to correct recruitment overfishing and rebuild the stocks.

13.0 RELATIONSHIP OF THE RECOMMENDED MEASURES TO EXISTING APPLICABLE LAWS AND RECOMMENDATIONS TO THE STATES

13.1 Applicable Laws

Fishery management plans that could impact the snapper-grouper fishery are discussed in Section 8.3.5 in the Source Document and FMP. Other Federal laws, programs, and policies are presented in the Source Document (Section 8.3.3) and briefly touched on in the FMP (Section 8.3.3).

Florida is the only state within the management unit which has laws that directly impact snapper-grouper stocks or fishing for these stocks. However, North and South Carolina and Georgia also prohibit the use of poisons, drugs, explosives or electricity for taking fish within state waters.

The Council presents rationale for not prohibiting the use of "powerheads" for taking fish in the FMP, Sections 10.15 and 10.19.17. Instead, the Council has chosen to regulate this gear by prohibiting the taking of jewfish (FMP, Section 10.16) and minimum sizes for other species (FMP, Sections 10.4, 10.5, 10.6, 10.7, and 10.8). The Coral FMP (described in the FMP, Section 8.3.5) has provisions whereby poisons can be permitted for certain uses. These uses are exempt from the prohibitions in this FMP (Section 10.15).

The major portions of the Florida Coastal Zone Management Program that relate to the FMP are presented in FMP, Section 8.3.4.4. The roller trawl moratorium has not been codified in the Florida Statutes and hence is not one of the enforceable, mandatory policies of Florida's coastal management program. The Council discussed regulating roller trawls and has proposed a 4 inch trawl mesh size (FMP, Section 10.3). However, the best available information (Source Document, Sections 8.4.3.1.4 and 8.4.6; FMP, Sections 8.4.3, 8.4.6, 10.19.20, and 10.19.21) is not conclusive on the habitat damage caused by bottom roller trawls. There are ongoing studies of damage to live bottom by roller trawls and if these studies or other evidence conclusively documents significant habitat damage by roller trawls, the Council will take appropriate action by plan amendment.

Florida Statutes, Sections 258.35 and 370.110, are addressed in the Gulf of Mexico and South Atlantic Coral Plan. Section 10.19.22 (FMP) presents Council rationale for not regulating this type of activity in the snapper-grouper FMP.

Florida Statutes, Section 370.172, applies to State waters. The FMP does not prohibit spearfishing but regulates use of this gear by prohibiting the spearing of jewfish (FMP, Section 10.16) and establishing minimum sizes for other species (FMP, Sections 10.4, 10.5, 10.6, 10.7, and 10.8).

Criteria for evaluating growth overfishing of individual species and minimum sizes are outlined in Section 10.2 of the FMP. These criteria were utilized by the Council to evaluate each species and ensure that minimum sizes proposed in the FMP meet the legal requirement of being necessary and appropriate for conservation and management. On the other hand, these criteria provide the Council with a technique to reject minimum sizes where they are not, at this time, necessary and appropriate. Sections 8.1.3, 8.1.6, 8.1.7, 8.1.8, and 8.1.9 of the Source Document and FMP present the status of the stocks and input parameters for evaluating the various species and minimum sizes.

Florida Statutes, Section 370.11, establishes a minimum size of 12 inches (31 cm) fork length for red, black, gag, and Nassau groupers, and jewfish. The FMP does not propose a size limit for jewfish because it is in the unknown range of yield (FMP, Section 10.2.1). The FMP states that while black grouper and gag are in the decision range of yield, the internal rate of return cannot be calculated because the survival rate of released fish is not known (FMP, Section 10.2.1). Therefore, minimum sizes are not proposed at this time (FMP, Figure 10-1); however, monitoring (Section 12.0) and research needs (Section 11.1) will provide the information to evaluate these species in the future and if justified, minimum sizes will be implemented by regulatory amendment (FMP, Section 10.2.3). The FMP proposes minimum sizes of 12 inches (31 cm) total length for red grouper (FMP, Section 10.7) and Nassau grouper (FMP, Section 10.8), virtually identical to Florida regulations. The difference in total length versus fork length is not great; however, all analyses in the FMP were conducted using total length.

The snapper-grouper FMP also proposes minimum sizes for vermilion snapper, red snapper, yellowtail snapper, and black sea bass, none of which the Florida CZM program addresses. In addition, minimum sizes were evaluated but rejected for 11 other species, again none of which are addressed in the Florida CZM program.

Florida Statutes, Section 370.1105, prohibits the use and possession of fish traps. The Council deliberated this issue and the Source Document (Section 8.4.3.1.3) presents detailed information on fish traps, their use and the resulting controversy. The Council concluded that prohibiting fish traps does not meet the necessary and appropriate requirements and National Standard 2: lack of sufficient scientific evidence; National Standard #4: allocate fishing privileges by gear type and must be fair and equitable, designed to promote conservation, and not result in an excess of fishing privileges being allocated to any particular fishing group, and National Standard 7 (and Executive Order 12291): costs for at-sea enforcement of a measure to prohibit fish traps would be substantial.

Instead of total prohibition, the Council proposes to regulate this gear (FMP, Sections 10.9, 10.10, 10.11, 10.12, 10.13, and 10.14). Measures that were rejected are presented in FMP, Sections 10.19.18 and 10.19.19.

13.2 Recommendations to The States

The Council recommends that the States implement the management measures proposed in this FMP within their territorial jurisdiction, where applicable. The Council further encourages the States to assist the Secretary in addressing and supporting the research and monitoring outlined in this FMP.

APPENDIX A

YIELD-PER-RECRUIT APPENDIX

YIELD-PER-RECRUIT APPENDIX

This appendix contains the computer printouts produced at the National Marine Fisheries Service Southeast Fisheries Center, Beaufort, North Carolina Laboratory and used for the evaluation of minimum sizes described in Section 10.2.

The first printout for each species presents the YPR parameters, the primary references for these parameters, and the values associated with different fishing pressure (fishing mortality, column one) and ages liable to capture (minimum sizes) (Section 10.2.2, Step #1). The most important calculation is yield in weight per recruit (column 3) which is YPR. The mean weight (column six) and mean length (column seven) of fish in the catch is also calculated.

It can be determined from the first printout if the species is in the range of growth overfishing (decision range of yield, Section 10.2.1). Growth overfishing is occurring if, for any assumed fishing mortality and prevailing age liable to capture, it is possible to find a larger age liable to capture (impose a minimum size) that will significantly increase YPR. Growth overfishing is also occurring if it is possible to find a small fishing mortality with the prevailing age liable to capture that will increase YPR. This latter criterion is not as important because the only response this FMP has to overfishing is increasing age liable to capture (minimum sizes) not curtailing fishing effort through quotas or bag limits.

Theoretical maximum YPR can be found on the first printout by locating the unique combination of any fishing mortality and age liable to capture that results in the highest YPR (number in column three) on the printout. This value (in relative terms) is comparable to maximum yield and is comparable to MSY if recruitment is constant (Section 8.1.8).

For the purpose of choosing a minimum size, fishing mortality is treated as a given and the age liable to capture (minimum size) chosen for the evaluation is either the age liable to capture that (1) maximizes YPR for a given fishing mortality, (2) stabilizes YPR over a likely range of fishing mortality, (3) maximizes present value, or (4) maximizes the internal rate of return (Section 10.2.2).

The second printout for each species is the calculation of the internal rate of return (IRR) over 20 years (Section 10.2.2, Step #2). Printouts are presented for 100 percent survival of released fish and the assumed rate of survival. If the survival rate is not specified then the survival rate nearest 3 percent IRR or 60 percent survival, whichever is lowest, is presented.

The second printout also shows YPR in each year without the proposed size limit (column two, W/O S-L) and the transitional values for YPR with the size limit (column three, W/ S-L). Net gain (column 4) is the difference between YPR without the size limit (column 2) and YPR with the size limit (column 3). The IRR is the discount rate that makes the present value of the stream of values in the net gain column equal to zero. Columns six and seven show the average size of the catch without and with the minimum size limit. Columns eight and nine show the percent of recruits that are caught without and with the minimum size limit. While columns two and three compare the total landings by weight without and with the minimum size limit, columns eight and nine compare total landings by number of fish without and with the minimum size limit.

The final four tables present the yield-per-recruit parameters that are available for snappers, groupers, porgies, and grunts (also see Source Document).

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A1.0 YIELD-PER-RECRUIT ANALYSIS FOR VERMILION SNAPPER

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

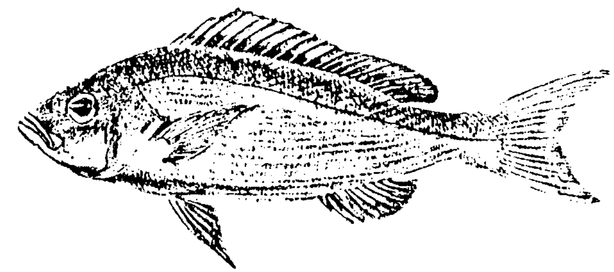
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.300000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.070000
MAXIMUM VALUE	0.770000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.370000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.500000
BEST ESTIMATE OF PREVAILING (t_c)	1.500000
MAXIMUM AGE IN FISHERY	10.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	0.127700
GROWTH PARAMETER (K)	0.198000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	2982.9355164
LENGTH (L_{oo})	626.5000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.00001722
LENGTH-WEIGHT EXPONENT (b_1)	2.9456



PRIMARY REFERENCES FOR YPR:

Grimes, C. B. 1976. Certain aspects of the life history of the vermilion snapper *Rhomboplites aurorubens* (Cuvier) from North and South Carolina waters. Ph.D. Dissertation, Univ. North Carolina, Chapel Hill. 240 p.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.0700000	0.1824175	71.1575270	2.6059646	1016.5361099	390.0805511	272.5264854
0.1700000	0.3564385	111.0070467	2.0966971	652.9826279	311.4339409	251.0651264
0.2700000	0.4708916	118.4621754	1.7440060	438.7487984	251.5752754	233.3395214
0.3700000	0.5509104	113.7288208	1.4889470	307.3751907	206.4379635	218.8035812
0.4700000	0.6097926	105.0905533	1.2974312	223.5969200	172.3381767	206.8564472
0.5700000	0.6549119	95.8398571	1.1489682	168.1401005	146.3400745	196.9602318
0.6700000	0.6906100	87.1919661	1.0307612	130.1372623	126.2535534	188.6765518
* AGE LIABLE TO CAPTURE (1.5000000)						
0.0700000	0.1558238	72.8986044	2.2260539	1041.4086456	467.8272438	304.0970840
0.1700000	0.3055893	118.8872242	1.7975841	699.3366165	389.0424919	285.4494858
0.2700000	0.4044961	132.3916874	1.4981338	490.3395844	327.3002663	269.8639755
0.3700000	0.4737180	132.3709602 ← YPR	1.2803189	357.7593498	279.4298859	256.9586220
0.4700000	0.5246121	127.1284361	1.1161960	270.4860344	242.3284454	246.2750702
0.5700000	0.5635657	120.2533417	0.9887118	210.9707756	213.3794537	237.3815079
0.6700000	0.5943535	113.2490835	0.8870948	169.0284824	190.5416145	229.9131413

AGE LIABLE TO CAPTURE (2.0000000)

0.0700000	0.1328921	73.7303658	1.8984590	1053.2909546	554.8136368	332.5713577
0.1700000	0.2617165	125.0503702	1.5395090	735.5904160	477.8084679	316.4762802
0.2700000	0.3472426	144.4032345	1.2860838	534.8267975	415.8568916	302.8545837
0.3700000	0.4071854	149.2813320	1.1005010	403.4630585	366.6176071	291.4544525
0.4700000	0.4512326	147.8177414	0.9600694	314.5058327	327.5865669	281.9384117
0.5700000	0.4849030	143.7831783	0.8507070	252.2511902	296.5194588	273.9690742
0.6700000	0.5114810	138.9077873	0.7634044	207.3250561	271.5795822	267.2493515

AGE LIABLE TO CAPTURE (2.5000000)

0.0700000	0.1131110	73.4095325	1.6158713	1048.7076111	649.0044250	358.2364311
0.1700000	0.2238389	128.8170071	1.3166997	757.7471008	575.4896927	344.4515533
0.2700000	0.2978325	153.3578053	1.1030832	567.9918747	514.9129791	332.6311302
0.3700000	0.3498090	162.8919487	0.9454297	440.2485085	465.6596756	322.6229858
0.4700000	0.3879934	165.2104416	0.8255180	351.5115776	425.8073082	314.1896324
0.5700000	0.4171438	164.1506729	0.7318313	287.9836349	393.5109825	307.0761909
0.6700000	0.4401185	161.6031342	0.6568933	241.1987076	367.1809502	301.0472603

AGE LIABLE TO CAPTURE (3.0000000)

0.0700000	0.0960400	71.8563423	1.3719994	1026.5191803	748.1921616	381.3526573
0.1700000	0.1911112	129.8764744	1.1241836	763.9792633	679.5858459	369.6522446
0.2700000	0.2551542	158.6510963	0.9450154	587.5966568	621.7852631	359.4820328
0.3700000	0.3002908	172.3001595	0.8115968	465.6761055	573.7776337	350.7627220
0.4700000	0.3334607	178.1257362	0.7094909	378.9909248	534.1730804	343.3369904
0.5700000	0.3587517	179.9242287	0.6293889	315.6565399	501.5286026	337.0203934
0.6700000	0.3786496	179.6794434	0.5651487	268.1782722	474.5269203	331.6326752

AGE LIABLE TO CAPTURE (3.5000000) ←—— MIN SIZE

0.0700000	0.0812999	69.1233301		1.1614275	987.4761505	850.2262878	402.1562424
0.1700000	0.1628048	128.2276478		0.9576752	754.2802811	787.6159439	392.3291016
0.2700000	0.2182482	160.1414814		0.8083267	593.1166000	733.7584915	383.6673279
0.3700000	0.2575091	177.1941891	←—OY YPR	0.6959705	478.9032135	688.1085281	376.1417465
0.4700000	0.2863946	186.0810089		0.6093502	395.9170380	649.7364655	369.6567574
0.5700000	0.3083984	190.4603100		0.5410498	334.1408958	617.5788651	364.0861397
0.6700000	0.3256777	192.3448944		0.4860861	287.0819321	590.5989838	359.2978477

AGE LIABLE TO CAPTURE (4.0000000)

0.0700000	0.0685645	65.3519506		0.9794932	933.5993042	953.1452255	420.8615761
0.1700000	0.1382916	124.0865736		0.8134802	729.9210205	897.2818451	412.7093277
0.2700000	0.1862857	158.0216732		0.6899470	585.2654572	848.2759781	405.4215393
0.3700000	0.2204927	177.6989288	←—MAX YPR	0.5959262	480.2673721	805.9175720	399.0005531
0.4700000	0.2457208	189.1189270		0.5228101	402.3806953	769.6497421	393.3958130
0.5700000	0.2649329	195.7181053		0.4647945	343.3650970	738.7460556	388.5273209
0.6700000	0.2799931	199.4783268		0.4179001	297.7288437	712.4401855	384.3037682

AGE LIABLE TO CAPTURE (4.5000000)

0.0700000	0.0575528	60.7322407	0.8221830	867.6034470	1055.2436981	437.6633949
0.1700000	0.1170301	117.7973127	0.6884124	692.9253693	1006.5556564	430.9990082
0.2700000	0.1585495	152.6902199	0.5872203	565.5193329	963.0446701	424.9563370
0.3700000	0.1883992	174.2158298	0.5091870	470.8535919	924.7164230	419.5547142
0.4700000	0.2105055	187.6221447	0.4478840	399.1960487	891.2933044	414.7741432
0.5700000	0.2273542	196.0539646	0.3988670	343.9543228	862.3282623	410.5693703
0.6700000	0.2405446	201.4076061	0.3590217	300.6083679	837.2985306	406.8820648

AGE LIABLE TO CAPTURE (5.0000000)

0.0700000	0.0480229	55.4711280	0.6860413	792.4446945	1155.0975952	452.7386742
0.1700000	0.0985528	109.7599840	0.5797225	645.6469650	1113.7172546	447.3853416
0.2700000	0.1344182	144.6453037	0.4978453	535.7233505	1076.0839081	442.4630051
0.3700000	0.1604955	167.2876740	0.4337717	452.1288490	1042.3199310	437.9974174
0.4700000	0.1799336	182.1534729	0.3828375	387.5605774	1012.3369980	433.9871826
0.5700000	0.1947872	192.0408783	0.3417319	336.9138222	985.9009781	430.4113274
0.6700000	0.2064127	198.7120342	0.3080787	296.5851250	962.6926727	427.2366371

A 1.1 IRR with 100 percent survival of released vermilion snapper.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUI W/O S-L	W/ S-L
1	132.37	87.57	-44.80	-44.80	279.43	670.70	0.4737	0.1306
2	132.37	100.17	-32.20	-77.00	279.43	631.62	0.4737	0.1586
3	132.37	122.13	-10.24	-87.24	279.43	613.34	0.4737	0.1991
4	132.37	143.15	10.78	-76.46	279.43	625.89	0.4737	0.2287
5	132.37	157.81	25.44	-51.02	279.43	647.14	0.4737	0.2439
6	132.37	167.29	34.92	-16.10	279.43	664.88	0.4737	0.2516
7	132.37	173.09	40.72	24.62	279.43	677.27	0.4737	0.2556
8	132.37	176.20	43.83	68.45	279.43	684.43	0.4737	0.2574
9	132.37	177.16	44.79	113.24	279.43	686.71	0.4737	0.2580
10	132.37	177.16	44.79	158.04	279.43	686.71	0.4737	0.2580
11	132.37	177.16	44.79	202.83	279.43	686.71	0.4737	0.2580
12	132.37	177.16	44.79	247.62	279.43	686.71	0.4737	0.2580
13	132.37	177.16	44.79	292.41	279.43	686.71	0.4737	0.2580
14	132.37	177.16	44.79	337.20	279.43	686.71	0.4737	0.2580
15	132.37	177.16	44.79	381.99	279.43	686.71	0.4737	0.2580
16	132.37	177.16	44.79	426.78	279.43	686.71	0.4737	0.2580
17	132.37	177.16	44.79	471.57	279.43	686.71	0.4737	0.2580
18	132.37	177.16	44.79	516.36	279.43	686.71	0.4737	0.2580
19	132.37	177.16	44.79	561.16	279.43	686.71	0.4737	0.2580
20	132.37	177.16	44.79	605.95	279.43	686.71	0.4737	0.2580

```
MORTALITY PARAMETERS
    W/O S-L    NAT MORT = 0.300    FISH MORT = 0.370
     W/ S-L    NAT MORT = 0.300    FISH MORT = 0.
               P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
     LENGTH    LMAX =  626.50      K  =  0.1980        T0 =  0.12770
     WEIGHT    B1   =  2.9456      B0 =  0.00001722

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS    =  1.000    (  99.4 MM,    13.2 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE   =  1.500    ( 149.1 MM,    43.4 GMS)
     MAXIMUM AGE IN FISHERY             = 10.000    ( 537.8 MM,  1902.4 GMS)

MINIMUM SIZE LIMIT =  304.80 MM    (12.0 INCHES,  357.2 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.26136
PRESENT VALUE USING IRR         = -0.7586E-02
NO. OF FUNCTION EVALUATIONS     =  11
```

A 1.2 IRR with 80 percent survival of released vermilion snapper (IRR over 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	132.37	86.96	-45.41	-45.41	279.43	673.99	0.4737	0.1290
2	132.37	96.52	-35.85	-81.26	279.43	642.66	0.4737	0.1502
3	132.37	112.77	-19.60	-100.87	279.43	626.68	0.4737	0.1799
4	132.37	128.13	-4.24	-105.11	279.43	636.20	0.4737	0.2014
5	132.37	138.82	6.45	-98.66	279.43	653.65	0.4737	0.2124
6	132.37	145.72	13.35	-85.31	279.43	668.46	0.4737	0.2180
7	132.37	149.94	17.57	-67.74	279.43	678.88	0.4737	0.2209
8	132.37	152.18	19.81	-47.93	279.43	684.85	0.4737	0.2222
9	132.37	152.86	20.49	-27.44	279.43	686.71	0.4737	0.2226
10	132.37	152.86	20.49	-6.96	279.43	686.71	0.4737	0.2226
11	132.37	152.86	20.49	13.53	279.43	686.71	0.4737	0.2226
12	132.37	152.86	20.49	34.02	279.43	686.71	0.4737	0.2226
13	132.37	152.86	20.49	54.50	279.43	686.71	0.4737	0.2226
14	132.37	152.86	20.49	74.99	279.43	686.71	0.4737	0.2226
15	132.37	152.86	20.49	95.48	279.43	686.71	0.4737	0.2226
16	132.37	152.86	20.49	115.96	279.43	686.71	0.4737	0.2226
17	132.37	152.86	20.49	136.45	279.43	686.71	0.4737	0.2226
18	132.37	152.86	20.49	156.94	279.43	686.71	0.4737	0.2226
19	132.37	152.86	20.49	177.43	279.43	686.71	0.4737	0.2226
20	132.37	152.86	20.49	197.91	279.43	686.71	0.4737	0.2226

```
MORTALITY PARAMETERS
    W/O S-L    NAT MORT = 0.300    FISH MORT = 0.370
     W/ S-L    NAT MORT = 0.374    FISH MORT = 0.
               P(RELE)  = 1.000    P(SURV)   = 0.800

GROWTH PARAMETERS
     LENGTH    LMAX =  626.50      K  =  0.1980        T0 =  0.12770
     WEIGHT    B1   =  2.9456      B0 =  0.00001722

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS    =  1.000    (  99.4 MM,    13.2 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE   =  1.500    ( 149.1 MM,    43.4 GMS)
     MAXIMUM AGE IN FISHERY             = 10.000    ( 537.8 MM,  1902.4 GMS)

MINIMUM SIZE LIMIT =  304.80 MM    (12.0 INCHES,  357.2 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.10796
PRESENT VALUE USING IRR         =  0.9953E-01
NO. OF FUNCTION EVALUATIONS     =  11
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A2.0 YIELD-PER-RECRUIT ANALYSIS FOR RED SNAPPER

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

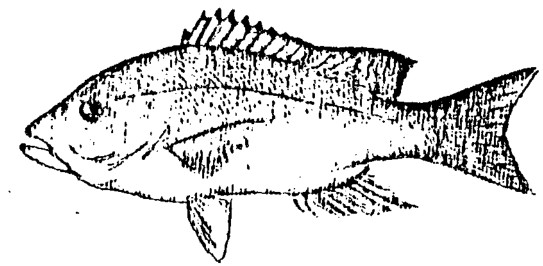
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.3000000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.2000000
MAXIMUM VALUE	0.7000000
INCREMENTING VALUE	0.1000000
BEST ESTIMATE OF EXISTING (F)	0.3000000
AGE AT FIRST RECRUITMENT	1.0000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.0000000
MAXIMUM VALUE	5.0000000
INCREMENTING VALUE	0.5000000
BEST ESTIMATE OF PREVAILING (t_c)	2.0000000
MAXIMUM AGE IN FISHERY	16.0000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	0.0000000
GROWTH PARAMETER (K)	0.1600000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	13682.3531494
LENGTH (L_{oo})	975.0000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.0000204
LENGTH-WEIGHT EXPONENT (b_1)	2.9530



PRIMARY REFERENCES FOR YPR:

Nelson, R. S. 1980. Growth and mortality aspects of natural populations of red snapper, *Lutjanus campechanus*, for the western central Atlantic and northern Gulf of Mexico. M.S. Thesis. N.C. State Univ., Raleigh. 73 p.

Nelson, R. S. and C. S. Manooch, III. 1982. Growth and mortality of red snapper in the west central Atlantic and northern Gulf of Mexico. Trans. Am. Fish. Soc. 111(4):465-475.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.2000000	0.3997788	413.0064659	1.9988938	2065.0323486	1033.0875549	345.2588921
0.3000000	0.4999383	401.0318832	1.6664610	1336.7729340	802.1627655	318.9999161
0.4000000	0.5714128	368.2421913	1.4285321	920.6054764	644.4415741	298.7177925
0.5000000	0.6249962	332.9047585	1.2499923	665.8095169	532.6508865	282.6293068
0.6000000	0.6666658	300.4710045	1.1111096	500.7850075	450.7071266	269.5687752
AGE LIABLE TO CAPTURE (1.5000000)						
0.2000000	0.3440387	448.4226341	1.7201935	2242.1131897	1303.4075775	393.5957184
0.3000000	0.4302823	453.6386147	1.4342743	1512.1287079	1054.2813721	369.4125900
0.4000000	0.4918139	433.0178108	1.2295348	1082.5445251	880.4505234	350.7064743
0.5000000	0.5379376	406.0475426	1.0758751	812.0950851	754.8228226	335.8595810
0.6000000	0.5738041	379.3220673	0.9563401	632.2034454	661.0654755	323.8044548

* AGE LIABLE TO CAPTURE (2.0000000)

0.2000000	0.2960571	478.8540230		1.4802854	2394.2701111	1617.4382019	438.2024994
0.3000000	0.3703258	501.3732681	←YPR	1.2344194	1671.2442169	1353.8706818	415.9440041
0.4000000	0.4233012	493.8436470		1.0582531	1234.6091156	1166.6482697	398.6961937
0.5000000	0.4630051	476.5281296		0.9260101	953.0562592	1029.2071838	384.9967003
0.6000000	0.4938772	456.9251785		0.8231286	761.5419617	925.1798248	373.8701019

AGE LIABLE TO CAPTURE (2.5000000) ←MIN SIZE

0.2000000	0.2547526	501.9600639		1.2737631	2509.8003235	1970.3822784	479.3637695
0.3000000	0.3187173	540.6430664	←OY	1.0623910	1802.1435547	1696.3091125	458.8913651
0.4000000	0.3643303	545.9973221	YPR	0.9108257	1364.9933014	1498.6320583	442.9938583
0.5000000	0.3985095	538.6385574		0.7970189	1077.2771149	1351.6330261	430.3551331
0.6000000	0.4250832	526.7255096		0.7084720	877.8758469	1239.1115875	420.0862389

AGE LIABLE TO CAPTURE (3.0000000)

0.2000000	0.2191946	516.4745331	1.0959731	2582.3726807	2356.2373352	517.3418732
0.3000000	0.2742934	569.3076248	0.9143113	1897.6920776	2075.5426636	498.5287743
0.4000000	0.3135716	586.4937057	0.7839291	1466.2342529	1870.3659668	483.8826294
0.5000000	0.3429968	588.6214600	0.6859937	1177.2429199	1716.1133881	472.2251015
0.6000000	0.3658714	584.2762909	0.6097856	973.7938156	1596.9444733	462.7487144

AGE LIABLE TO CAPTURE (3.5000000)

0.2000000	0.1885819	522.0885162	0.9429094	2610.4425964	2768.4978943	552.3785934
0.3000000	0.2360526	586.5595932	0.7868422	1955.1986389	2484.8676758	535.1089554
0.4000000	0.2698810	613.9872131	0.6747024	1534.9680176	2275.0296326	521.6237030
0.5000000	0.2952157	624.6063614	0.5904314	1249.2127228	2115.7627258	510.8744164
0.6000000	0.3149069	627.2178802	0.5248449	1045.3631287	1991.7562866	502.1305733

AGE LIABLE TO CAPTURE (4.0000000)

0.2000000	0.1622248	519.2205429		0.8111238	2596.1027222	3200.6246643	584.6967087
0.3000000	0.2031331	592.6327744	←MAX	0.6771102	1975.4425812	2917.4609375	568.8648071
0.4000000	0.2322733	628.4403687	YPR	0.5806832	1571.1009064	2705.6076660	556.4579620
0.5000000	0.2540888	646.2559509		0.5081777	1292.5119019	2543.4252625	546.5501404
0.6000000	0.2710409	654.9128494		0.4517349	1091.5214081	2416.2877502	538.4838104

AGE LIABLE TO CAPTURE (4.5000000)

0.2000000	0.1395296	508.7743683	0.6976480	2543.8718567	3646.3546448	614.5014343
0.3000000	0.1747925	588.4793549	0.5826418	1961.5978394	3366.7303162	600.0109177
0.4000000	0.1999006	630.7412338	0.4997515	1576.8530731	3155.2740479	588.6074219
0.5000000	0.2186890	654.3383331	0.4373780	1308.6766663	2992.0953979	579.4801712
0.6000000	0.2332844	667.9843750	0.3888073	1113.3072815	2863.3910522	572.0409470

AGE LIABLE TO CAPTURE (5.0000000)

0.2000000	0.1199853	491.9268684	0.5999266	2459.6343384	4099.8920288	641.9816742
0.3000000	0.1503922	575.4814072	0.5013075	1918.2713470	3826.5365295	628.7448578
0.4000000	0.1720330	622.3535690	0.4300826	1555.8839111	3617.6396484	618.2766876
0.5000000	0.1882180	650.3287735	0.3764360	1300.6575470	3455.1888733	609.8746490
0.6000000	0.2007861	667.8790970	0.3346434	1113.1318207	3326.3218689	603.0164642

A 2.1 IRR with 100 percent survival of released red snapper.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	501.37	483.68	-17.69	-17.69	1353.87	1549.79	0.3703	0.3121
2	501.37	494.14	-7.24	-24.93	1353.87	1534.44	0.3703	0.3220
3	501.37	504.02	2.65	-22.28	1353.87	1539.08	0.3703	0.3275
4	501.37	512.10	10.73	-11.55	1353.87	1549.58	0.3703	0.3305
5	501.37	518.10	16.72	5.17	1353.87	1559.97	0.3703	0.3321
6	501.37	522.26	20.89	26.06	1353.87	1568.25	0.3703	0.3330
7	501.37	525.02	23.65	49.71	1353.87	1574.19	0.3703	0.3335
8	501.37	526.78	25.40	75.11	1353.87	1578.18	0.3703	0.3338
9	501.37	527.87	26.50	101.61	1353.87	1580.75	0.3703	0.3339
10	501.37	528.53	27.16	128.77	1353.87	1582.35	0.3703	0.3340
11	501.37	528.93	27.55	156.32	1353.87	1583.32	0.3703	0.3341
12	501.37	529.16	27.79	184.11	1353.87	1583.90	0.3703	0.3341
13	501.37	529.30	27.92	212.03	1353.87	1584.24	0.3703	0.3341
14	501.37	529.37	28.00	240.03	1353.87	1584.43	0.3703	0.3341
15	501.37	529.37	28.00	268.03	1353.87	1584.43	0.3703	0.3341
16	501.37	529.37	28.00	296.03	1353.87	1584.43	0.3703	0.3341
17	501.37	529.37	28.00	324.03	1353.87	1584.43	0.3703	0.3341
18	501.37	529.37	28.00	352.03	1353.87	1584.43	0.3703	0.3341
19	501.37	529.37	28.00	380.03	1353.87	1584.43	0.3703	0.3341
20	501.37	529.37	28.00	408.03	1353.87	1584.43	0.3703	0.3341

MORTALITY PARAMETERS
W/O S-L NAT MORT = 0.300 FISH MORT = 0.300
W/ S-L NAT MORT = 0.300 FISH MORT = 0.
P(RELE) = 1.000 P(SURV) = 1.000

GROWTH PARAMETERS
LENGTH LMAX = 975.00 K = 0.1600 TO = 0.
WEIGHT B1 = 2.9530 B0 = 0.00002040

AGE (IN YEARS) PARAMETERS
AGE AT ENTRY TO FISHING GROUNDS = 1.000 (144.2 MM, 48.4 GMS)
AGE WHEN FIRST LIABLE TO CAPTURE = 2.000 (267.0 MM, 298.6 GMS)
MAXIMUM AGE IN FISHERY = 16.000 (899.6 MM, ****** GMS)

MINIMUM SIZE LIMIT = 304.80 MM (12.0 INCHES, 441.5 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 0.42563
PRESENT VALUE USING IRR = 0.3474E-01
NO. OF FUNCTION EVALUATIONS = 5

A 2.2 IRR with 60 percent survival of released red snapper (IRR above 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUI W/O S-L	W/ S-L
1	501.37	481.18	-20.19	-20.19	1353.87	1563.79	0.3703	0.3077
2	501.37	487.33	-14.05	-34.24	1353.87	1554.26	0.3703	0.3135
3	501.37	493.14	-8.24	-42.47	1353.87	1556.88	0.3703	0.3167
4	501.37	497.88	-3.49	-45.96	1353.87	1563.18	0.3703	0.3185
5	501.37	501.41	0.03	-45.92	1353.87	1569.49	0.3703	0.3195
6	501.37	503.86	2.48	-43.44	1353.87	1574.54	0.3703	0.3200
7	501.37	505.48	4.10	-39.34	1353.87	1578.17	0.3703	0.3203
8	501.37	506.51	5.14	-34.21	1353.87	1580.61	0.3703	0.3205
9	501.37	507.15	5.78	-28.43	1353.87	1582.18	0.3703	0.3205
10	501.37	507.54	6.17	-22.26	1353.87	1583.16	0.3703	0.3206
11	501.37	507.77	6.40	-15.86	1353.87	1583.75	0.3703	0.3206
12	501.37	507.91	6.54	-9.33	1353.87	1584.10	0.3703	0.3206
13	501.37	507.99	6.61	-2.71	1353.87	1584.31	0.3703	0.3206
14	501.37	508.03	6.66	3.95	1353.87	1584.43	0.3703	0.3206
15	501.37	508.03	6.66	10.61	1353.87	1584.43	0.3703	0.3206
16	501.37	508.03	6.66	17.27	1353.87	1584.43	0.3703	0.3206
17	501.37	508.03	6.66	23.93	1353.87	1584.43	0.3703	0.3206
18	501.37	508.03	6.66	30.59	1353.87	1584.43	0.3703	0.3206
19	501.37	508.03	6.66	37.25	1353.87	1584.43	0.3703	0.3206
20	501.37	508.03	6.66	43.91	1353.87	1584.43	0.3703	0.3206

MORTALITY PARAMETERS
W/O S-L NAT MORT = 0.300 FISH MORT = 0.300
W/ S-L NAT MORT = 0.420 FISH MORT = 0.
P(RELE) = 1.000 P(SURV) = 0.600

GROWTH PARAMETERS
LENGTH LMAX = 975.00 K = 0.1600 TO = 0.
WEIGHT B1 = 2.9530 B0 = 0.00002040

AGE (IN YEARS) PARAMETERS
AGE AT ENTRY TO FISHING GROUNDS = 1.000 (144.2 MM, 48.4 GMS)
AGE WHEN FIRST LIABLE TO CAPTURE = 2.000 (267.0 MM, 298.6 GMS)
MAXIMUM AGE IN FISHERY. = 16.000 (899.6 MM, ****** GMS)

MINIMUM SIZE LIMIT = 304.80 MM (12.0 INCHES, 441.5 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 0.06123
PRESENT VALUE USING IRR = -0.7089E-02
NO. OF FUNCTION EVALUATIONS = 10

A3.0 YIELD-PER-RECRUIT ANALYSIS FOR GRAY SNAPPER

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

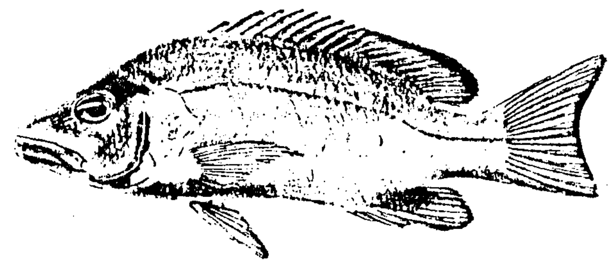
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo}[1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b_1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.300000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	0.900000
INCREMENTING VALUE	1.000000
BEST ESTIMATE OF EXISTING (F)	0.390000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.500000
BEST ESTIMATE OF PREVAILING (t_c)	1.000000
MAXIMUM AGE IN FISHERY	21.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-1.274500
GROWTH PARAMETER (K)	0.087800
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	9320.191040
LENGTH (L_{oo})	890.000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.000024
LENGTH-WEIGHT EXPONENT (b_1)	2.9122



PRIMARY REFERENCES FOR YPR:

Manooch, C. S., III. 1982. Aging reef fishes in the Southeast Fisheries Center. pp 24-35 In G. R. Huntsman, W. R. Nicholson, and W. W. Fox, Jr., (Eds.) The biological bases for reef fishery management. NOAA Tech. Memo., NMFS-SEFC-80.

Manooch, S. C., III and R. H. Matheson, III. Preliminary report on the age and growth of gray snapper, Lutjanus griseus. Unpubl. Report.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT		ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
* AGE LIABLE TO CAPTURE (1.0000000)							
0.1000000	0.2499161	121.5559807		2.4991614	1215.5598145	486.3870850	292.1397743
0.2000000	0.3999818	146.9885063		1.9999092	734.9425354	367.4879494	269.9629402
0.3000000	0.4999969	147.1490326		1.6666564	490.4967728	294.2998734	254.1536179
0.4000000	0.5714281	140.6171169	←YPR	1.4285702	351.5427895	246.0801582	242.3456631
0.5000000	0.6249999	132.8146248		1.2499999	265.6292496	212.5034218	233.1959782
0.6000000	0.6666667	125.3805866		1.1111111	208.9676437	188.0708809	225.8985729
0.7000000	0.7000000	118.7576742		1.0000000	169.6538200	169.6538200	219.9428158
0.8000000	0.7272727	112.9939880		0.9090909	141.2424850	155.3667336	214.9898758
AGE LIABLE TO CAPTURE (1.5000000) ←MIN SIZE							
0.1000000	0.2150888	124.3063421		2.1508883	1243.0634308	577.9302597	317.7847252
0.2000000	0.3442631	155.3162785		1.7213156	776.5813980	451.1557198	296.5876732
0.3000000	0.4303504	160.0068817		1.4345014	533.3562698	371.8060303	281.4623985
0.4000000	0.4918325	156.7854538	←OY	1.2295814	391.9636307	318.7781181	270.1624680
0.5000000	0.5379424	151.3703442		1.0758848	302.7406883	281.3876457	261.4059067
0.6000000	0.5738053	145.6739235	YPR	0.9563422	242.7898712	253.8734360	254.4219627
0.7000000	0.6024956	140.3347626		0.8607080	200.4782314	232.9224720	248.7220039
0.8000000	0.6259694	135.5348568		0.7824618	169.4185696	216.5199299	243.9817944

AGE LIABLE TO CAPTURE (2.0000000)

0.1000000	0.1851119	125.8454666	1.8511187	1258.4546661	679.8346634	342.3230438
0.2000000	0.2963051	161.7464542	1.4815256	808.7322769	545.8780441	322.0675774
0.3000000	0.3704050	170.6786003	1.2346832	568.9286652	460.7891808	307.5979576
0.4000000	0.4233240	170.6965160	1.0583100	426.7412872	403.2290154	296.7844620
0.5000000	0.4630113	167.7094803	0.9260226	335.4189606	362.2146797	288.4042015
0.6000000	0.4938788	163.8459187	0.8231313	273.0765305	331.7532959	281.7202492
0.7000000	0.5185728	159.9106312	0.7408182	228.4437580	308.3668137	276.2651100
0.8000000	0.5387769	156.2028275	0.6734711	195.2535324	289.9211731	271.7284966

AGE LIABLE TO CAPTURE (2.5000000)

0.1000000	0.1593096	126.1150875	1.5930960	1261.1508789	791.6352005	365.8015137
0.2000000	0.2550268	166.0865402	1.2751338	830.4327011	651.2514496	346.4515381
0.3000000	0.3188093	178.8197861	1.0626975	596.0659485	560.8989716	332.6106262
0.4000000	0.3643581	181.8619843	0.9108952	454.6549568	499.1298218	322.2629662
0.5000000	0.3985174	181.2150421	0.7970349	362.4300842	454.7229805	314.2428932
0.6000000	0.4250854	179.1677036	0.7084757	298.6128387	421.4863663	307.8460655
0.7000000	0.4463397	176.6587372	0.6376281	252.3696232	395.7943611	302.6252365
0.8000000	0.4637296	174.0874195	0.5796620	217.6092739	375.4072075	298.2834702

AGE LIABLE TO CAPTURE (3.0000000)

0.1000000	0.1371005	125.1365089	1.3710048	1251.3650970	912.7357788	388.2647667
0.2000000	0.2194976	168.2932396	1.0974878	841.4662018	766.7203064	369.7862892
0.3000000	0.2744002	184.2918701	0.9146674	614.3062286	671.6170654	356.5485268
0.4000000	0.3136056	190.0433388	0.7840140	475.1083450	605.9947433	346.6470490
0.5000000	0.3430071	191.5543308	0.6860142	383.1086617	558.4559021	338.9717751
0.6000000	0.3658744	191.2210979	0.6097907	318.7018280	522.6413803	332.8497581
0.7000000	0.3841681	190.0857086	0.5488116	271.5510101	494.7982101	327.8531761
0.8000000	0.3991357	188.6285248	0.4989197	235.7856541	472.5924263	323.6978951

AGE LIABLE TO CAPTURE (3.5000000)

0.1000000	0.1179840	122.9918270	1.1798395	1229.9182739	1042.4453735	409.7554131
0.2000000	0.1889167	168.4415398	0.9445834	842.2077026	891.6181335	392.1165161
0.3000000	0.2361768	187.1227074	0.7872559	623.7423553	792.2993622	379.4576759
0.4000000	0.2699225	195.2080059	0.6748061	488.0200119	723.2003174	369.9836807
0.5000000	0.2952289	198.6326465	0.5904577	397.2652969	672.8090591	362.6385155
0.6000000	0.3149110	199.8527317	0.5248516	333.0878868	634.6324463	356.7795296
0.7000000	0.3306566	199.9839249	0.4723665	285.6913185	604.8085403	351.9975777
0.8000000	0.3435393	199.5695076	0.4294241	249.4618835	580.9218979	348.0207672

AGE LIABLE TO CAPTURE (4.0000000)

0.1000000	0.1015292	119.8052502	1.0152921	1198.0525055	1180.0077209	430.3141098
0.2000000	0.1625948	166.6920891	0.8129739	833.4604492	1025.1995392	413.4848824
0.3000000	0.2032773	187.4648743 MAX YPR	0.6775909	624.8829117	922.2126465	401.3821297
0.4000000	0.2323239	197.4811840	0.5808099	493.7029572	850.0250931	392.3178101
0.5000000	0.2541057	202.5406380	0.5082114	405.0812759	797.0723114	385.2887154
0.6000000	0.2710464	205.1169434	0.4517440	341.8615723	756.7595596	379.6814957
0.7000000	0.2845988	206.3727570	0.4065696	294.8182220	725.1358414	375.1049500
0.8000000	0.2956870	206.8968163	0.3696088	258.6210175	699.7155762	371.2989578

AGE LIABLE TO CAPTURE (4.5000000)

0.1000000	0.0873654	115.7264462	0.8736543	1157.2644653	1324.6252136	449.9795761
0.2000000	0.1399385	163.2618065	0.6996927	816.3090363	1166.6680145	433.9321365
0.3000000	0.1749601	185.5563984	0.5832003	618.5213242	1060.5641174	422.3639603
0.4000000	0.1999625	197.0991478	0.4999063	492.7478676	985.6805420	413.6924286
0.5000000	0.2187107	203.5019436	0.4374214	407.0038872	930.4618073	406.9660149
0.6000000	0.2332917	207.2201385	0.3888196	345.3668976	888.2446136	401.5998039
0.7000000	0.2449564	209.4394798	0.3499377	299.1992569	855.0071564	397.2198677
0.8000000	0.2545002	210.7786560	0.3181252	263.4733200	828.2063293	393.5773430

AGE LIABLE TO CAPTURE (5.0000000)

0.1000000	0.0751734	110.9168148	0.7517344	1109.1681519	1475.4787445	468.7887421
0.2000000	0.1204373	158.3988800	0.6021864	791.9944000	1315.1981812	453.4971581
0.3000000	0.1505869	181.6870041	0.5019564	605.6233444	1206.5258942	442.4433937
0.4000000	0.1721086	194.3686180	0.4302716	485.9215431	1129.3368683	434.1486511
0.5000000	0.1882459	201.8273525	0.3764917	403.6547050	1072.1475983	427.7121887
0.6000000	0.2007960	206.4701385	0.3346601	344.1168976	1028.2580414	422.5766907
0.7000000	0.2108359	209.4854546	0.3011942	299.2649345	993.5946655	418.3849220
0.8000000	0.2190503	211.5079517	0.2738129	264.3849373	965.5678101	414.8988686

A 3.1 IRR with 100 percent survival of released gray snapper.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUI W/O S-L	W/ S-L
1	141.37	127.40	-13.98	-13.98	250.12	339.23	0.5652	0.3755
2	141.37	136.08	-5.29	-19.27	250.12	325.35	0.5652	0.4183
3	141.37	143.92	2.54	-16.72	250.12	327.30	0.5652	0.4397
4	141.37	150.09	8.72	-8.00	250.12	333.20	0.5652	0.4505
5	141.37	154.55	13.17	5.17	250.12	339.03	0.5652	0.4558
6	141.37	157.55	16.18	21.35	250.12	343.59	0.5652	0.4585
7	141.37	159.49	18.12	39.46	250.12	346.79	0.5652	0.4599
8	141.37	160.69	19.31	58.78	250.12	348.88	0.5652	0.4606
9	141.37	161.41	20.04	78.81	250.12	350.18	0.5652	0.4609
10	141.37	161.83	20.46	99.27	250.12	350.97	0.5652	0.4611
11	141.37	162.08	20.70	119.97	250.12	351.43	0.5652	0.4612
12	141.37	162.21	20.84	140.81	250.12	351.70	0.5652	0.4612
13	141.37	162.29	20.92	161.73	250.12	351.85	0.5652	0.4612
14	141.37	162.33	20.96	182.69	250.12	351.93	0.5652	0.4613
15	141.37	162.36	20.98	203.67	250.12	351.98	0.5652	0.4613
16	141.37	162.37	20.99	224.67	250.12	352.00	0.5652	0.4613
17	141.37	162.37	21.00	245.67	250.12	352.02	0.5652	0.4613
18	141.37	162.38	21.00	266.67	250.12	352.02	0.5652	0.4613
19	141.37	162.38	21.01	287.68	250.12	352.03	0.5652	0.4613
20	141.37	162.38	21.01	308.69	250.12	352.03	0.5652	0.4613

```
MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.300    FISH MORT = 0.390
     W/ S-L   NAT MORT = 0.300    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
     LENGTH   LMAX  =  890.00      K  =  0.0878        TO = -1.27450
     WEIGHT   B1    =  2.9122      B0 =  0.00002400

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS   =  1.000    ( 161.1 MM,    64.2 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE  =  1.000    ( 161.1 MM,    64.2 GMS)
     MAXIMUM AGE IN FISHERY            = 21.000    ( 764.1 MM, 5977.4 GMS)

MINIMUM SIZE LIMIT =  203.20 MM     ( 8.0 INCHES,  126.3 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.43094
PRESENT VALUE USING IRR         = -0.7762E-01
NO. OF FUNCTION EVALUATIONS     =  6
```

A 3.2 IRR with 60 percent survival of released gray snapper (IRR above 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	141.37	126.22	-15.15	-15.15	250.12	344.58	0.5652	0.3663
2	141.37	131.16	-10.22	-25.37	250.12	335.80	0.5652	0.3906
3	141.37	135.61	-5.77	-31.13	250.12	336.69	0.5652	0.4028
4	141.37	139.12	-2.26	-33.39	250.12	340.25	0.5652	0.4089
5	141.37	141.65	0.27	-33.12	250.12	343.86	0.5652	0.4119
6	141.37	143.35	1.98	-31.14	250.12	346.71	0.5652	0.4135
7	141.37	144.45	3.08	-28.06	250.12	348.72	0.5652	0.4142
8	141.37	145.13	3.76	-24.29	250.12	350.04	0.5652	0.4146
9	141.37	145.54	4.17	-20.12	250.12	350.86	0.5652	0.4148
10	141.37	145.78	4.41	-15.71	250.12	351.36	0.5652	0.4149
11	141.37	145.92	4.55	-11.16	250.12	351.65	0.5652	0.4150
12	141.37	146.00	4.63	-6.53	250.12	351.82	0.5652	0.4150
13	141.37	146.05	4.67	-1.86	250.12	351.92	0.5652	0.4150
14	141.37	146.07	4.70	2.83	250.12	351.97	0.5652	0.4150
15	141.37	146.08	4.71	7.54	250.12	352.00	0.5652	0.4150
16	141.37	146.09	4.72	12.26	250.12	352.01	0.5652	0.4150
17	141.37	146.09	4.72	16.98	250.12	352.02	0.5652	0.4150
18	141.37	146.10	4.72	21.70	250.12	352.03	0.5652	0.4150
19	141.37	146.10	4.72	26.42	250.12	352.03	0.5652	0.4150
20	141.37	146.10	4.72	31.15	250.12	352.03	0.5652	0.4150

```
MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.300    FISH MORT = 0.390
     W/ S-L   NAT MORT = 0.456    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 0.600

GROWTH PARAMETERS
     LENGTH   LMAX  =  890.00      K  =  0.0878        TO = -1.27450
     WEIGHT   B1    =  2.9122      B0 =  0.00002400

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS   =  1.000    ( 161.1 MM,    64.2 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE  =  1.000    ( 161.1 MM,    64.2 GMS)
     MAXIMUM AGE IN FISHERY            = 21.000    ( 764.1 MM, 5977.4 GMS)

MINIMUM SIZE LIMIT =  203.20 MM     ( 8.0 INCHES,  126.3 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.06059
PRESENT VALUE USING IRR         = -0.2468E-01
NO. OF FUNCTION EVALUATIONS     =  9
```

A4.0 YIELD-PER-RECRUIT ANALYSIS FOR YELLOWTAIL SNAPPER

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

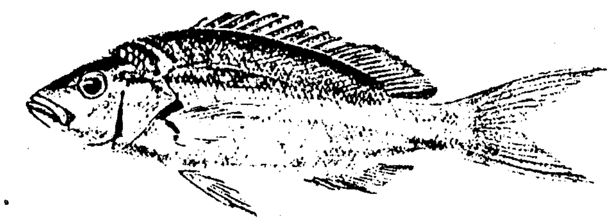
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_\infty (1-e^{-k(t-t_o)})$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.20000000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.10000000
MAXIMUM VALUE	1.10000000
INCREMENTING VALUE	0.10000000
BEST ESTIMATE OF EXISTING (F)	0.50000000
AGE AT FIRST RECRUITMENT	0.80000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.00000000
MAXIMUM VALUE	4.00000000
INCREMENTING VALUE	0.10000000
BEST ESTIMATE OF PREVAILING (t_c)	1.00000000
MAXIMUM AGE IN FISHERY	14.00000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-0.30500000
GROWTH PARAMETER (K)	0.28800000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	2854.67987060
LENGTH (L_∞)	600.20000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.00006130
LENGTH-WEIGHT EXPONENT (b_1)	2.76000000



PRIMARY REFERENCES FOR YPR:

Johnson, A. G. Age and growth of yellowtail snapper, Ocyurus chrysurus, from South Florida. NMFS, Panama City Lab., Panama City, Florida. Unpublished Manuscript.

Piedra, G. 1965. Materials on the biology of the yellowtail snapper (Ocyurus chrysurus Bloch). pp. 251-269 In A. S. Bodgavos (Ed.), Soviet-Cuban fishery research, Part I. Transl. from Russian). TT 69-59106.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
* AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.3137804	301.8818703	3.1378041	3018.8187256	962.0800552	385.6701202
0.2000000	0.4777446	376.0418510	2.3887230	1880.2092590	787.1190186	359.2715607
0.3000000	0.5756070	378.5639267	1.9186899	1261.8797455	657.6778107	338.2897339
0.4000000	0.6402638	359.6588707	1.6006596	899.1471710	561.7354050	321.5989113
0.5000000	0.6862015	335.8745995 ←YPR	1.3724031	671.7491989	489.4693260	308.1486626
0.6000000	0.7205701	312.6451721	1.2009502	521.0752869	433.8858261	297.1287422
0.7000000	0.7472745	291.6043549	1.0675350	416.5776482	390.2238960	287.9515152
0.8000000	0.7686298	273.0613441	0.9607873	341.3266792	355.2572937	280.1956749
0.9000000	0.7861000	256.8742142	0.8734444	285.4157906	326.7704163	273.5563393
1.0000000	0.8006577	242.7685070	0.8006577	242.7685070	303.2113457	267.8090935
1.1000000	0.8129756	230.4535885	0.7390688	209.5032635	283.4692421	262.7855911

AGE LIABLE TO CAPTURE (1.6000000)

0.1000000	0.2771643	312.4237366	2.7716432	3124.2373657	1127.2148590	419.0130882
0.2000000	0.4230839	407.2958069	2.1154194	2036.4790344	962.6833420	397.2135887
0.3000000	0.5102487	427.5038528	1.7008288	1425.0128326	837.8343582	379.7419662
0.4000000	0.5677622	421.9760284	1.4194055	1054.9400635	743.2266769	365.7712326
0.5000000	0.6085707	408.1031075	1.2171414	816.2062149	670.5927734	354.4816971
0.6000000	0.6390764	392.2534790	1.0651273	653.7557983	613.7818146	345.2197685
0.7000000	0.6627691	376.7693367	0.9468129	538.2419052	568.4775543	337.5020180
0.8000000	0.6817122	362.4597435	0.8521403	453.0746765	531.6902542	330.9780045
0.9000000	0.6972077	349.5330582	0.7746752	388.3700638	501.3327446	325.3926201
1.0000000	0.7101196	337.9623528	0.7101196	337.9623528	475.9231606	320.5575333
1.1000000	0.7210447	327.6346817	0.6554952	297.8497124	454.3888855	316.3312645

AGE LIABLE TO CAPTURE (2.0000000) MIN SIZE

0.1000000	0.2550448	316.2201157		2.5504475	3162.2011719	1239.8612976	438.2447853
0.2000000	0.3900771	422.9654732		1.9503853	2114.8273621	1084.3126221	419.0903397
0.3000000	0.4708068	454.0987854		1.5693560	1513.6626129	964.5119400	403.6461296
0.4000000	0.5240271	457.2523727		1.3100676	1143.1309204	872.5739746	391.2480812
0.5000000	0.5617507	450.0988121	OY YPR	1.1235014	900.1976242	801.2429962	381.2073021
0.6000000	0.5899309	439.4710197		0.9832182	732.4516983	744.9533386	372.9606590
0.7000000	0.6118092	428.0932541		0.8740131	611.5617905	699.7169418	366.0853500
0.8000000	0.6292984	417.0555725		0.7866230	521.3194656	662.7310104	360.2721481
0.9000000	0.6436034	406.7687988		0.7151149	451.9653282	632.0177689	355.2948380
1.0000000	0.6555228	397.3529567		0.6555228	397.3529587	606.1618805	350.9859657
1.1000000	0.6656081	388.8028488		0.6050982	353.4571381	584.1318130	347.2196045

AGE LIABLE TO CAPTURE (2.6000000)

0.1000000	0.2249512	316.6120377	2.2495121	3166.1203918	1407.4698029	463.2370834
0.2000000	0.3451886	437.4511642	1.7259430	2187.2558289	1267.2816162	447.5079193
0.3000000	0.4172052	482.7508812	1.3906839	1609.1696014	1157.1066895	434.7020111
0.4000000	0.4646198	497.6596565	1.1615496	1244.1491394	1071.1115265	424.3535080
0.5000000	0.4981697	499.8995552	0.9963394	999.7991104	1003.4724579	415.9395866
0.6000000	0.5232000	496.7779007	0.8720000	827.9631653	949.4990921	409.0146065
0.7000000	0.5426181	491.4591789	0.7751688	702.0845413	905.7182922	403.2352257
0.8000000	0.5581348	485.3721733	0.6976685	606.7152100	869.6325073	398.3463173
0.9000000	0.5708240	479.1787224	0.6342489	532.4207993	839.4508286	394.1595078
1.0000000	0.5813963	473.1848221	0.5813963	473.1848221	813.8766022	390.5346565
1.1000000	0.5903413	467.5244331	0.5366739	425.0222130	791.9561768	387.3660698

AGE LIABLE TO CAPTURE (2.9999999)

0.1000000	0.2067608	313.4289169	2.0676077	3134.2891846	1515.9012756	477.6516685
0.2000000	0.3180647	441.0367813	1.5903234	2205.1839294	1386.6260529	463.8895340
0.3000000	0.3848426	494.0420647	1.2828088	1646.8068848	1283.7508545	452.6073532
0.4000000	0.4287735	515.6490173	1.0719338	1289.1225433	1202.6139221	443.4448700
0.5000000	0.4598177	523.3965149	0.9196354	1046.7930298	1138.2695923	435.9722023
0.6000000	0.4829545	524.7749023	0.8049242	874.6248322	1086.5928040	429.8112373
0.7000000	0.5008921	523.1599121	0.7155601	747.3712997	1044.4563293	424.6648521
0.8000000	0.5152205	520.1535187	0.6440257	650.1918945	1009.5745163	420.3095016
0.9000000	0.5269360	516.5499496	0.5854844	573.9443817	980.2897949	416.5788651
1.0000000	0.5366960	512.7552414	0.5366960	512.7552414	955.3922729	413.3486557
1.1000000	0.5449536	508.9796104	0.4954123	462.7087402	933.9871292	410.5249329

AGE LIABLE TO CAPTURE (3.5999999)

0.1000000	0.1819954	304.0393906	1.8199537	3040.3939209	1670.5886383	496.3830948
0.2000000	0.2811469	437.9955254	1.4057347	2189.9776306	1557.8882446	485.1636429
0.3000000	0.3408348	499.8667946	1.1381159	1666.2226410	1466.5956268	475.8638458
0.4000000	0.3800635	529.6749008	0.9501588	1324.0622406	1393.5167542	468.2484131
0.5000000	0.4077253	544.2669678	0.8154506	1088.5339355	1334.8864746	462.0036430
0.6000000	0.4283024	551.3874969	0.7138374	918.9791565	1287.3787994	456.8384552
0.7000000	0.4442355	554.5718231	0.6346221	792.2454605	1248.3735809	452.5162697
0.8000000	0.4569533	555.6114731	0.5711917	694.5143356	1215.9041443	448.8551140
0.9000000	0.4673479	555.4511566	0.5192754	617.1679459	1188.5176086	445.7177048
1.0000000	0.4760057	554.6132126	0.4760057	554.6132126	1165.1397400	443.0005798
1.1000000	0.4833301	553.3978500	0.4393910	503.0889587	1144.9687195	440.6251411

AGE LIABLE TO CAPTURE (3.9999999)

0.1000000	0.1670134	295.1535950		1.6701337	2951.5359497	1767.2453766	507.1860962
0.2000000	0.2588174	431.0286903		1.2940869	2155.1434631	1665.3777466	497.4236298
0.3000000	0.3142437	497.1064301	MAX	1.0474792	1657.0214233	1581.9135132	489.2682190
0.4000000	0.3506569	531.0536728		0.8766423	1327.6341705	1514.4536133	482.5488892
0.5000000	0.3762940	549.3599701	← YPR	0.7525880	1098.7199402	1459.9221954	477.0156822
0.6000000	0.3953367	559.5929184		0.6588944	932.6548615	1415.4844971	472.4270363
0.7000000	0.4100657	565.4165649		0.5858082	807.7379456	1378.8437500	468.5814819
0.8000000	0.4218148	568.7082901		0.5272685	710.8853607	1348.2416840	465.3213882
0.9000000	0.4314139	570.4850388		0.4793488	633.8722610	1322.3613434	462.5264854
1.0000000	0.4394077	571.3265381		0.4394077	571.3265381	1300.2197876	460.1054726
1.1000000	0.4461695	571.5781021		0.4056087	519.6164627	1281.0783539	457.9886971

A 4.1 IRR with 100 percent survival of released yellowtail snapper.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	335.87	270.83	-65.04	-65.04	489.47	828.35	0.6862	0.3270
2	335.87	315.85	-20.02	-85.06	489.47	768.15	0.6862	0.4112
3	335.87	369.52	33.65	-51.42	489.47	772.59	0.6862	0.4783
4	335.87	408.09	72.21	20.80	489.47	797.66	0.6862	0.5116
5	335.87	432.72	96.84	117.64	489.47	819.30	0.6862	0.5282
6	335.87	447.30	111.43	229.06	489.47	833.94	0.6862	0.5364
7	335.87	455.52	119.64	348.71	489.47	842.84	0.6862	0.5405
8	335.87	459.98	124.11	472.81	489.47	847.93	0.6862	0.5425
9	335.87	462.36	126.48	599.30	489.47	850.72	0.6862	0.5435
10	335.87	463.59	127.72	727.01	489.47	852.21	0.6862	0.5440
11	335.87	464.23	128.35	855.37	489.47	853.00	0.6862	0.5442
12	335.87	464.55	128.68	984.05	489.47	853.40	0.6862	0.5444
13	335.87	464.70	128.83	1112.87	489.47	853.58	0.6862	0.5444
14	335.87	464.72	128.85	1241.72	489.47	853.61	0.6862	0.5444
15	335.87	464.72	128.85	1370.56	489.47	853.61	0.6862	0.5444
16	335.87	464.72	128.85	1499.41	489.47	853.61	0.6862	0.5444
17	335.87	464.72	128.85	1628.26	489.47	853.61	0.6862	0.5444
18	335.87	464.72	128.85	1757.10	489.47	853.61	0.6862	0.5444
19	335.87	464.72	128.85	1885.95	489.47	853.61	0.6862	0.5444
20	335.87	464.72	128.85	2014.79	489.47	853.61	0.6862	0.5444

```
MORTALITY PARAMETERS
    W/O S-L    NAT MORT = 0.200    FISH MORT = 0.500
    W/ S-L     NAT MORT =0.200     FISH MORT = 0.000
               P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
      LENGTH    LMAX =  600.20      K  =  0.2880        TO = -0.30500
      WEIGHT    B1   =  2.7600      B0 = 0.000061300

AGE (IN YEARS) PARAMETERS
      AGE AT ENTRY TO FISHING GROUNDS   =  0.800    ( 163.6 MM,    79.0 GMS)
      AGE WHEN FIRST LIABLE TO CAPTURE  =  1.000    ( 188.0 MM,   116.0 GMS)
      MAXIMUM AGE IN FISHERY            = 14.000    ( 590.4 MM,  2728.5 GMS)

MINIMUM SIZE LIMIT =  304.80 MM    (12.0 INCHES,   439.9 GMS)

INTERNAL RATE OF RETURN FOR Y/R > 49.5 PERCENT
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A 4.2 IRR with 80 percent survival of released yellowtail snapper (IRR above 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	335.87	268.65	-67.23	-67.23	489.47	833.48	0.6862	0.3223
2	335.87	302.61	-33.26	-100.49	489.47	784.95	0.6862	0.3855
3	335.87	342.80	6.93	-93.56	489.47	786.97	0.6862	0.4356
4	335.87	371.65	35.78	-57.79	489.47	807.11	0.6862	0.4605
5	335.87	390.06	54.18	-3.60	489.47	824.96	0.6862	0.4728
6	335.87	400.96	65.08	61.48	489.47	837.15	0.6862	0.4790
7	335.87	407.09	71.22	132.69	489.47	844.59	0.6862	0.4820
8	335.87	410.43	74.55	207.25	489.47	848.85	0.6862	0.4835
9	335.87	412.20	76.32	283.57	489.47	851.19	0.6862	0.4843
10	335.87	413.12	77.25	360.82	489.47	852.44	0.6862	0.4846
11	335.87	413.60	77.72	438.54	489.47	853.10	0.6862	0.4848
12	335.87	413.84	77.97	516.51	489.47	853.44	0.6862	0.4849
13	335.87	413.95	78.08	594.58	489.47	853.59	0.6862	0.4850
14	335.87	413.96	78.09	672.67	489.47	853.61	0.6862	0.4850
15	335.87	413.96	78.09	750.76	489.47	853.61	0.6862	0.4850
16	335.87	413.96	78.09	828.85	489.47	853.61	0.6862	0.4850
17	335.87	413.96	78.09	906.94	489.47	853.61	0.6862	0.4850
18	335.87	413.96	78.09	985.03	489.47	853.61	0.6862	0.4850
19	335.87	413.96	78.09	1063.12	489.47	853.61	0.6862	0.4850
20	335.87	413.96	78.09	1141.21	489.47	853.61	0.6862	0.4850

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MORTALITY PARAMETERS
    W/O S-L    NAT MORT = 0.200    FISH MORT = 0.500
    W/ S-L     NAT MORT =0.300     FISH MORT = 0.000
               P(RELE)  = 1.000    P(SURV)   = 0.800

GROWTH PARAMETERS
      LENGTH    LMAX =  600.20      K  =  0.2880        TO = -0.30500
      WEIGHT    B1   =  2.7600      B0 = 0.000061300

AGE (IN YEARS) PARAMETERS
      AGE AT ENTRY TO FISHING GROUNDS   =  0.800    ( 163.6 MM,    79.0 GMS)
      AGE WHEN FIRST LIABLE TO CAPTURE  =  1.000    ( 188.0 MM,   116.0 GMS)
      MAXIMUM AGE IN FISHERY            = 14.000    ( 590.4 MM,  2728.5 GMS)

MINIMUM SIZE LIMIT =  304.80 MM    (12.0 INCHES,   439.9 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 36.1211 PERCENT
PRESENT VALUE USING IRR         = -.7469E-01
NO. OF FUNCTION EVALUATIONS     =  9
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A5.0 YIELD-PER-RECRUIT ANALYSIS FOR BLACK SEA BASS

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

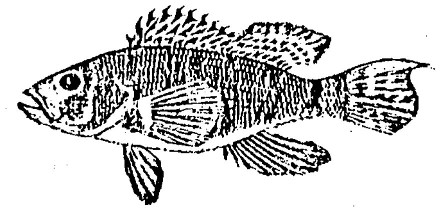
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_\infty\,[1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b_1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.300000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.230000
MAXIMUM VALUE	0.730000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.300000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.500000
BEST ESTIMATE OF PREVAILING (t_c)	1.000000
MAXIMUM AGE IN FISHERY	10.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	0.185500
GROWTH PARAMETER (K)	0.222000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	1307.3728333
LENGTH (L_∞)	350.0000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.00002654
LENGTH-WEIGHT EXPONENT (b_1)	3.0237



PRIMARY REFERENCES FOR YPR:

Cupka, D. M., R. K. Dias, and J. Tucker. 1973. Biology of the black sea bass *Centropristis striata* (Pisces: Serranidae), from South Carolina waters. S.C. Wildlife Mar. Resour. Dept., Mar. Res. Center, Charleston, S.C.

Huntsman, G. R. and C. S. Manooch, III. 1979. Minimum size limits for reef fishes. Proc. Annu. Conf. Southeastern Assoc. Fish Wildl. Agencies 32:509-513.

Low, R. A., Jr. 1981. Mortality rates and management strategies for black sea bass off the southeast coast of the United States. N. Am. J. Fish. Management 1:93-103.

Mercer, L. P. 1978. The reproductive biology and population dynamics of black sea bass, *Centropristis striata*. Ph. D. Dissertation. College of William and Mary, Williamsburg, Va.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
* AGE LIABLE TO CAPTURE (1.0000000)		(offshore)				
0.2300000	0.4302821	61.3902450	1.8707917	266.9141083	142.6744137	142.6059265
0.3300000	0.5220035	61.0381742 ← YPR	1.5818288	184.9641647	116.9305859	133.3607349
0.4300000	0.5882154	57.2754583	1.3679428	133.1987400	97.3715754	125.7399502
0.5300000	0.6381903	52.5986414 ← YPR	1.2041326	99.2427197	82.4184294	119.4231405
0.6300000	0.6772624	47.9878182 (inshore)	1.0750197	76.1711397	70.8555784	114.1386318
AGE LIABLE TO CAPTURE (1.5000000)						
0.2300000	0.3693861	67.4768648	1.6060265	293.3776741	182.6729946	164.0098610
0.3300000	0.4487170	69.9435129	1.3597486	211.9500408	155.8744354	155.9206753
0.4300000	0.5059686	68.2923088	1.1766711	158.8193226	134.9734154	149.2000847
0.5300000	0.5491344	65.1316681	1.0361025	122.8899393	118.6078920	143.5983295
0.6300000	0.5828452	61.5928755	0.9251510	97.7664690	105.6762257	138.8947182

AGE LIABLE TO CAPTURE (2.0000000)

0.2300000	0.3168553	72.4900684	1.3776317	315.1742134	228.7797260	183.1116829
0.3300000	0.3855355	77.7780342	1.1682895	235.6910133	201.7402573	176.0712852
0.4300000	0.4351030	78.3886137	1.0118675	182.2991009	180.1610336	170.1696148
0.5300000	0.4724343	76.9662638	0.8913855	145.2193661	162.9142132	165.2177677
0.6300000	0.5015499	74.7498751	0.7961109	118.6505947	149.0377674	161.0406494

AGE LIABLE TO CAPTURE (2.5000000)

0.2300000	0.2715102	75.9031715	1.1804791	330.0137901	279.5591888	200.1471939
0.3300000	0.3310329	83.7646694	1.0031301	253.8323326	253.0403004	194.0589485
0.4300000	0.3740154	86.5584126	0.8698032	201.2986336	231.4300861	188.9041367
0.5300000	0.4063542	86.8933649	0.7667061	163.9497452	213.8364887	184.5451736
0.6300000	0.4315378	86.0716143	0.6849806	136.6216087	199.4532433	180.8472080

AGE LIABLE TO CAPTURE (3.0000000)

0.2300000	0.2323339	77.4745998	1.0101473	336.8460884	333.4623337	215.3270950
0.3300000	0.2839785	87.5014439	0.8605409	265.1558914	308.1270218	210.1033154
0.4300000	0.3213213	92.2427721	0.7472589	214.5180740	287.0733109	205.6311932
0.5300000	0.3493955	94.2084761	0.6592369	177.7518406	269.6327324	201.8152905
0.6300000	0.3712222	94.7211246	0.5892417	150.3509903	255.1601505	198.5555687

AGE LIABLE TO CAPTURE (3.5000000)

0.2300000	0.1984491	77.1978188	MAX	0.8628223	335.6426926	389.0055923	228.8396797
0.3300000	0.2433090	88.9042320	YPR	0.7372999	269.4067650	365.3964424	224.4001179
0.4300000	0.2758240	95.2709742		0.6414511	221.5604057	345.4049835	220.5531101
0.5300000	0.3002625	98.6550188	(off-	0.5665330	186.1415443	328.5625801	217.2366543
0.6300000	0.3192320	100.3603821	shore)	0.5067174	159.3021927	314.3807297	214.3800526

AGE LIABLE TO CAPTURE (4.0000000) MIN SIZE

0.2300000	0.1690987	75.2262802	@	0.7352117	327.0707855	444.8661385	240.8533096
0.3300000	0.2081046	88.1110783	MAX	0.6306201	267.0032692	423.3979836	237.1237202
0.4300000	0.2364866	95.7493982	&	0.5499688	222.6730194	404.8829918	233.8495216
0.5300000	0.2578322	100.3019714	OY	0.4864758	189.2490025	389.0204201	230.9940853
0.6300000	0.2743791	103.0196657	YPR	0.4355224	163.5232773	375.4646606	228.5105610

AGE LIABLE TO CAPTURE (4.5000000) (inshore)

0.2300000	0.1436284	71.8032484	0.6244712	312.1880379	499.9238777	251.5186291
0.3300000	0.1775684	85.3899403	0.5380859	258.7573967	480.8848839	248.4294567
0.4300000	0.2024086	93.9511833	0.4707176	218.4911232	464.1660500	245.6797333
0.5300000	0.2211281	99.4187098	0.4172228	187.5824699	449.5978203	243.2509289
0.6300000	0.2356309	102.9604721	0.3740172	163.4293194	436.9566498	241.1147003

AGE LIABLE TO CAPTURE (5.0000000)

0.2300000	0.1214723	67.2071323	0.5281405	292.2049255	553.2711639	260.9705772
0.3300000	0.1510077	81.0652628	0.4575991	245.6523132	536.8287048	258.4558067
0.4300000	0.1728045	90.2266731	0.4018710	209.8294716	522.1313934	256.1848831
0.5300000	0.1892969	96.3716831	0.3571639	181.8333645	509.1033707	254.1511383
0.6300000	0.2020839	100.5605040	0.3207681	159.6198463	497.6176071	252.3396721

@ OY YPR (offshore)

A 5.1 IRR with 100 percent survival of released black sea bass at F=0.30.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	61.68	33.64	-28.04	-28.04	123.92	439.17	0.4977	0.0766
2	61.68	37.50	-24.18	-52.22	123.92	421.73	0.4977	0.0889
3	61.68	45.71	-15.97	-68.19	123.92	406.46	0.4977	0.1125
4	61.68	58.90	-2.78	-70.97	123.92	397.97	0.4977	0.1480
5	61.68	69.25	7.57	-63.40	123.92	409.19	0.4977	0.1692
6	61.68	76.34	14.66	-48.74	123.92	422.02	0.4977	0.1809
7	61.68	80.91	19.23	-29.52	123.92	432.09	0.4977	0.1873
8	61.68	83.42	21.73	-7.78	123.92	438.16	0.4977	0.1904
9	61.68	84.47	22.79	15.01	123.92	440.89	0.4977	0.1916
10	61.68	84.47	22.79	37.80	123.92	440.89	0.4977	0.1916
11	61.68	84.47	22.79	60.59	123.92	440.89	0.4977	0.1916
12	61.68	84.47	22.79	83.38	123.92	440.89	0.4977	0.1916
13	61.68	84.47	22.79	106.17	123.92	440.89	0.4977	0.1916
14	61.68	84.47	22.79	128.96	123.92	440.89	0.4977	0.1916
15	61.68	84.47	22.79	151.75	123.92	440.89	0.4977	0.1916
16	61.68	84.47	22.79	174.54	123.92	440.89	0.4977	0.1916
17	61.68	84.47	22.79	197.33	123.92	440.89	0.4977	0.1916
18	61.68	84.47	22.79	220.12	123.92	440.89	0.4977	0.1916
19	61.68	84.47	22.79	242.91	123.92	440.89	0.4977	0.1916
20	61.68	84.47	22.79	265.70	123.92	440.89	0.4977	0.1916

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MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.300    FISH MORT = 0.300
     W/ S-L   NAT MORT = 0.300    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
     LENGTH   LMAX =  350.00      K  =  0.2220       T0 =  0.18550
     WEIGHT   B1   =  3.0237      B0 =  0.00002654

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS   =  1.000    (  57.9 MM,    5.7 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE  =  1.000    (  57.9 MM,    5.7 GMS)
     MAXIMUM AGE IN FISHERY            = 10.000    ( 310.4 MM,  909.2 GMS)

MINIMUM SIZE LIMIT =  203.20 MM    ( 8.0 INCHES,  252.6 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.17273
PRESENT VALUE USING IRR         = -0.1021E-01
NO. OF FUNCTION EVALUATIONS     =   8
```

A 5.2 IRR with 100 percent survival of released black sea bass at F=0.53.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	52.60	19.83	-32.77	-32.77	82.42	398.42	0.6382	0.0498
2	52.60	25.91	-26.69	-59.46	82.42	373.36	0.6382	0.0694
3	52.60	39.97	-12.63	-72.08	82.42	358.77	0.6382	0.1114
4	52.60	65.98	13.38	-58.71	82.42	353.55	0.6382	0.1866
5	52.60	82.94	30.34	-28.37	82.42	371.46	0.6382	0.2233
6	52.60	92.30	39.70	11.34	82.42	385.77	0.6382	0.2393
7	52.60	97.17	44.57	55.90	82.42	394.61	0.6382	0.2462
8	52.60	99.45	46.85	102.76	82.42	399.22	0.6382	0.2491
9	52.60	100.32	47.72	150.48	82.42	401.08	0.6382	0.2501
10	52.60	100.32	47.72	198.19	82.42	401.08	0.6382	0.2501
11	52.60	100.32	47.72	245.91	82.42	401.08	0.6382	0.2501
12	52.60	100.32	47.72	293.63	82.42	401.08	0.6382	0.2501
13	52.60	100.32	47.72	341.35	82.42	401.08	0.6382	0.2501
14	52.60	100.32	47.72	389.07	82.42	401.08	0.6382	0.2501
15	52.60	100.32	47.72	436.79	82.42	401.08	0.6382	0.2501
16	52.60	100.32	47.72	484.50	82.42	401.08	0.6382	0.2501
17	52.60	100.32	47.72	532.22	82.42	401.08	0.6382	0.2501
18	52.60	100.32	47.72	579.94	82.42	401.08	0.6382	0.2501
19	52.60	100.32	47.72	627.66	82.42	401.08	0.6382	0.2501
20	52.60	100.32	47.72	675.38	82.42	401.08	0.6382	0.2501

```
MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.300    FISH MORT = 0.530
     W/ S-L   NAT MORT = 0.300    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
     LENGTH   LMAX =  350.00      K  =  0.2220       T0 =  0.18550
     WEIGHT   B1   =  3.0237      B0 =  0.00002654

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS   =  1.000    (  57.9 MM,    5.7 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE  =  1.000    (  57.9 MM,    5.7 GMS)
     MAXIMUM AGE IN FISHERY            = 10.000    ( 310.4 MM,  909.2 GMS)

MINIMUM SIZE LIMIT =  203.20 MM    ( 8.0 INCHES,  252.6 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.32420
PRESENT VALUE USING IRR         = -0.6472E-02
NO. OF FUNCTION EVALUATIONS     =  10
```

A 5.3 IRR with 80 percent survival of released black sea bass at F=0.30 (IRR over 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	61.68	33.58	-28.10	-28.10	123.92	439.52	0.4977	0.0764
2	61.68	36.56	-25.12	-53.22	123.92	425.56	0.4977	0.0859
3	61.68	42.68	-19.01	-72.23	123.92	412.90	0.4977	0.1034
4	61.68	52.08	-9.60	-81.83	123.92	405.48	0.4977	0.1284
5	61.68	59.42	-2.26	-84.09	123.92	414.40	0.4977	0.1434
6	61.68	64.44	2.76	-81.33	123.92	425.08	0.4977	0.1516
7	61.68	67.67	5.99	-75.34	123.92	433.57	0.4977	0.1561
8	61.68	69.42	7.73	-67.61	123.92	438.64	0.4977	0.1583
9	61.68	70.14	8.46	-59.15	123.92	440.89	0.4977	0.1591
10	61.68	70.14	8.46	-50.69	123.92	440.89	0.4977	0.1591
11	61.68	70.14	8.46	-42.24	123.92	440.89	0.4977	0.1591
12	61.68	70.14	8.46	-33.78	123.92	440.89	0.4977	0.1591
13	61.68	70.14	8.46	-25.33	123.92	440.89	0.4977	0.1591
14	61.68	70.14	8.46	-16.87	123.92	440.89	0.4977	0.1591
15	61.68	70.14	8.46	-8.41	123.92	440.89	0.4977	0.1591
16	61.68	70.14	8.46	0.04	123.92	440.89	0.4977	0.1591
17	61.68	70.14	8.46	8.50	123.92	440.89	0.4977	0.1591
18	61.68	70.14	8.46	16.96	123.92	440.89	0.4977	0.1591
19	61.68	70.14	8.46	25.41	123.92	440.89	0.4977	0.1591
20	61.68	70.14	8.46	33.87	123.92	440.89	0.4977	0.1591

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MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.300    FISH MORT = 0.300
     W/ S-L   NAT MORT = 0.360    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 0.800

GROWTH PARAMETERS
     LENGTH   LMAX =  350.00      K  =  0.2220        TO =   0.18550
     WEIGHT   B1   =  3.0237      B0 =  0.00002654

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS  =  1.000    (  57.9 MM,     5.7 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE =  1.000    (  57.9 MM,     5.7 GMS)
     MAXIMUM AGE IN FISHERY           = 10.000    ( 310.4 MM,   909.2 GMS)

MINIMUM SIZE LIMIT =  203.20 MM     ( 8.0 INCHES,  252.6 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.03110
PRESENT VALUE USING IRR         = -0.1705E-01
NO. OF FUNCTION EVALUATIONS     =  12
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A 5.4 IRR with 80 percent survival of released black sea bass at F=0.53 (IRR over 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	52.60	19.75	-32.85	-32.85	82.42	398.95	0.6382	0.0495
2	52.60	24.30	-28.30	-61.15	82.42	378.59	0.6382	0.0642
3	52.60	34.09	-18.51	-79.66	82.42	365.71	0.6382	0.0932
4	52.60	50.63	-1.97	-81.63	82.42	360.58	0.6382	0.1404
5	52.60	61.34	8.74	-72.89	82.42	375.51	0.6382	0.1633
6	52.60	67.23	14.63	-58.26	82.42	387.86	0.6382	0.1733
7	52.60	70.29	17.69	-40.57	82.42	395.56	0.6382	0.1777
8	52.60	71.70	19.10	-21.47	82.42	399.52	0.6382	0.1795
9	52.60	72.23	19.63	-1.84	82.42	401.08	0.6382	0.1801
10	52.60	72.23	19.63	17.79	82.42	401.08	0.6382	0.1801
11	52.60	72.23	19.63	37.42	82.42	401.08	0.6382	0.1801
12	52.60	72.23	19.63	57.05	82.42	401.08	0.6382	0.1801
13	52.60	72.23	19.63	76.67	82.42	401.08	0.6382	0.1801
14	52.60	72.23	19.63	96.30	82.42	401.08	0.6382	0.1801
15	52.60	72.23	19.63	115.93	82.42	401.08	0.6382	0.1801
16	52.60	72.23	19.63	135.56	82.42	401.08	0.6382	0.1801
17	52.60	72.23	19.63	155.19	82.42	401.08	0.6382	0.1801
18	52.60	72.23	19.63	174.81	82.42	401.08	0.6382	0.1801
19	52.60	72.23	19.63	194.44	82.42	401.08	0.6382	0.1801
20	52.60	72.23	19.63	214.07	82.42	401.08	0.6382	0.1801

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MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.300    FISH MORT = 0.530
     W/ S-L   NAT MORT = 0.406    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 0.800

GROWTH PARAMETERS
     LENGTH   LMAX =  350.00      K  =  0.2220        TO =   0.18550
     WEIGHT   B1   =  3.0237      B0 =  0.00002654

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS  =  1.000    (  57.9 MM,     5.7 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE =  1.000    (  57.9 MM,     5.7 GMS)
     MAXIMUM AGE IN FISHERY           = 10.000    ( 310.4 MM,   909.2 GMS)

MINIMUM SIZE LIMIT =  203.20 MM     ( 8.0 INCHES,  252.6 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.13922
PRESENT VALUE USING IRR         =  0.5008E-01
NO. OF FUNCTION EVALUATIONS     =  7
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A6.0 YIELD-PER-RECRUIT ANALYSIS FOR SPECKLED HIND

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

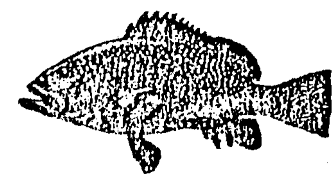
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{\infty} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.200000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.110000
MAXIMUM VALUE	0.810000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.420000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF PREVAILING (t_c)	3.000000
MAXIMUM AGE IN FISHERY	15.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-1.920000
GROWTH PARAMETER (K)	0.088000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	24750.000000
LENGTH (L_{∞})	1105.000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.000011
LENGTH-WEIGHT EXPONENT (b_1)	3.0730



PRIMARY REFERENCES FOR YPR:

Matheson, R. H., III. 1981. Age, growth, and mortality of two groupers, Epinephelus drummondhayi Goode and Bean and Epinephelus niveatus (Valenciennes), from North Carolina and South Carolina. M.S. Thesis. N.C. State Univ. at Raleigh, N.C. 67 p.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.1100000	0.3502128	704.5092850	3.1837532	6404.6298828	2011.6603241	433.1245117
0.2100000	0.5105485	787.7441101	2.4311835	3751.1624451	1542.9367828	399.8014374
0.3100000	0.6073613	753.0682526	1.9592299	2429.2524414	1239.9016724	375.7457924
0.4100000	0.6719998	698.3157730	1.6390238	1703.2091980	1039.1607666	358.0345421
0.5100000	0.7182752	647.1763458	1.4083828	1268.9732361	901.0144348	344.6102486
0.6100000	0.7530775	604.0148392	1.2345532	990.1882629	802.0620346	334.1350441
0.7100000	0.7802175	568.4281387	1.0988979	800.6030121	728.5508804	325.7483749
AGE LIABLE TO CAPTURE (1.5000000)						
0.1100000	0.3161839	725.1502151	2.8743994	6592.2747192	2293.4442444	461.1607056
0.2100000	0.4616244	837.4242325	2.1982116	3987.7344666	1814.0812683	429.8411140
0.3100000	0.5494366	822.5627441	1.7723760	2653.4282227	1497.1023254	407.0327225
0.4100000	0.6080081	780.2670746	1.4829466	1903.0904236	1283.3168488	390.1556320
0.5100000	0.6499090	737.0696793	1.2743313	1445.2346649	1134.1122131	377.3320923
0.6100000	0.6814086	699.1478577	1.1170633	1146.1440277	1026.0331726	367.3147964
0.7100000	0.7059688	667.1356583	0.9943222	939.6276855	944.9931335	359.2912216

AGE LIABLE TO CAPTURE (1.9999999)

0.1100000	0.2853536	740.8511047	2.5941238	6735.0100708	2596.2562561	487.9086151
0.2100000	0.4173185	880.6482468	1.9872312	4193.5631104	2110.2543030	458.5413017
0.3100000	0.4970029	885.6058044	1.6032351	2856.7929382	1781.8926697	436.9513397
0.4100000	0.5500965	856.3023148	1.3416987	2088.5422363	1556.6403046	420.8852196
0.5100000	0.5880447	821.7228317	1.1530288	1611.2212524	1397.3815613	408.6420593
0.6100000	0.6165585	789.7230530	1.0107517	1294.6279602	1280.8565521	399.0651169
0.7100000	0.6387853	761.9284439	0.8996976	1073.1386566	1192.7770691	391.3897820

AGE LIABLE TO CAPTURE (2.4999999)

0.1100000	0.2574153	751.1883316	2.3401389	6828.9848633	2918.1964417	513.4175034
0.2100000	0.3771872	916.4173660	1.7961297	4363.8922119	2429.6086731	485.9535103
0.3100000	0.4495341	940.6820450	1.4501101	3034.4582214	2092.5708923	465.5564117
0.4100000	0.4976840	924.4824600	1.2138634	2254.8352661	1857.5692596	450.2809563
0.5100000	0.5320626	898.8519440	1.0432600	1762.4548035	1689.3724823	438.5998726
0.6100000	0.5578778	873.1727066	0.9145538	1431.4306641	1565.1684265	429.4470596
0.7100000	0.5779944	850.0033951	0.8140766	1197.1878815	1470.6083527	422.1060333

* AGE LIABLE TO CAPTURE (2.9999999)

0.1100000	0.2320913	755.9646530		2.1099211	6872.4059448	3257.1861877	537.7341995
0.2100000	0.3408286	944.1112061		1.6229934	4495.7676392	2770.0467224	512.1262894
0.3100000	0.4065537	986.7634735		1.3114635	3183.1080017	2427.1418457	492.8995247
0.4100000	0.4502447	983.4338684	YPR	1.0981577	2398.6192017	2184.2210693	478.3974190
0.5100000	0.4814015	966.7937851		0.9439245	1895.6741028	2008.2900238	467.2622910
0.6100000	0.5047786	947.5910187		0.8275059	1553.4279022	1877.2408447	458.5188904
0.7100000	0.5229875	929.2500992		0.7366021	1308.8029480	1776.8112793	451.4992065

AGE LIABLE TO CAPTURE (3.4999999)

0.1100000	0.2091305	755.1755371	1.9011861	6865.2321777	3611.0259094	560.9032974
0.2100000	0.3078786	963.4420853	1.4660884	4587.8194580	3129.2925415	537.1054230
0.3100000	0.3676296	1023.2580643	1.1859018	3300.8324890	2783.3943481	519.0292435
0.4100000	0.4073019	1032.2963867	0.9934194	2517.7960510	2534.4744568	505.2861633
0.5100000	0.4355530	1024.4593658	0.8540256	2008.7438660	2352.0886536	494.6832619
0.6100000	0.4567289	1011.6908112	0.7487359	1658.5095215	2215.0795898	486.3361168
0.7100000	0.4732137	998.2115784	0.6664982	1405.9317932	2109.4306946	479.6258583

AGE LIABLE TO CAPTURE (3.9999998) MIN SIZE

0.1100000	0.1863052	748.9756851		1.7118654	6808.8698730	3977.4564514	582.9671860
0.2100000	0.2780070	974.4010773		1.3238429	4640.0051270	3504.9516296	560.9339371
0.3100000	0.3323701	1049.9459381		1.0721616	3386.9223938	3158.9663391	543.9910889
0.4100000	0.3684239	1070.6554413		0.8985948	2611.3547363	2906.0425110	530.9957047
0.5100000	0.3940569	1071.2612457	OY YPR	0.7726606	2100.5122681	2718.5445862	520.9137650
0.6100000	0.4132468	1064.7337952		0.6774538	1745.4652405	2576.5083313	512.9514999
0.7100000	0.4281745	1056.0140991		0.6030626	1487.3437958	2466.3173523	506.5399208

AGE LIABLE TO CAPTURE (4.4999999)

0.1100000	0.1694095	737.6426773	1.5400859	6705.8425293	4354.2002563	603.9662781
0.2100000	0.2509146	977.2036514	1.1948316	4653.3507690	3894.5661621	583.6522675
0.3100000	0.3004199	1066.9106598	0.9690965	3441.6473083	3551.3980103	567.8275299
0.4100000	0.3332186	1098.4646149	0.8127284	2679.1819763	3296.5281372	555.5714951
0.5100000	0.3564958	1107.0341034	0.6990113	2170.6551208	3105.3219910	546.0019226
0.6100000	0.3738959	1106.4441986	0.6129442	1813.8429565	2959.2303467	538.4151154
0.7100000	0.3874182	1102.2833557	0.5456595	1552.5117645	2845.2026062	532.2927551

AGE LIABLE TO CAPTURE (4.9000000)

0.1100000	0.1555562	725.1249466		1.4141469	6592.0449829	4661.4993896	620.0248337
0.2100000	0.2310585	973.8264771		1.1002785	4637.2689819	4214.6321411	601.0531006
0.3100000	0.2770246	1073.6895905		0.8936278	3463.5148315	3875.7911682	586.1129913
0.4100000	0.3074588	1113.2716980		0.7498995	2715.2968140	3620.8808594	574.4443359
0.5100000	0.3290245	1127.8164063	MAX YPR	0.6451461	2211.4047241	3427.7582703	565.2803802
0.6100000	0.3451227	1131.7095184		0.5657749	1855.2615051	3279.1511841	557.9886017
0.7100000	0.3576210	1131.0039063		0.5036915	1592.9632416	3162.5771790	552.0918045

A 6.1 IRR with 100 percent survival of released speckled hind.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	982.25	679.28	-302.97	-302.97	2164.40	2973.91	0.4538	0.2284
2	982.25	792.30	-189.95	-492.92	2164.40	2798.75	0.4538	0.2831
3	982.25	890.48	-91.77	-584.69	2164.40	2792.15	0.4538	0.3189
4	982.25	959.07	-23.18	-607.88	2164.40	2835.83	0.4538	0.3382
5	982.25	1005.09	22.84	-585.04	2164.40	2883.50	0.4538	0.3486
6	982.25	1035.00	52.75	-532.29	2164.40	2922.55	0.4538	0.3541
7	982.25	1053.95	71.70	-460.59	2164.40	2951.04	0.4538	0.3571
8	982.25	1065.70	83.45	-377.15	2164.40	2970.52	0.4538	0.3588
9	982.25	1072.86	90.61	-286.54	2164.40	2983.25	0.4538	0.3596
10	982.25	1077.15	94.90	-191.64	2164.40	2991.32	0.4538	0.3601
11	982.25	1079.70	97.45	-94.19	2164.40	2996.31	0.4538	0.3603
12	982.25	1081.10	98.85	4.66	2164.40	2999.13	0.4538	0.3605
13	982.25	1081.10	98.85	103.51	2164.40	2999.13	0.4538	0.3605
14	982.25	1081.10	98.85	202.37	2164.40	2999.13	0.4538	0.3605
15	982.25	1081.10	98.85	301.22	2164.40	2999.13	0.4538	0.3605
16	982.25	1081.10	98.85	400.07	2164.40	2999.13	0.4538	0.3605
17	982.25	1081.10	98.85	498.92	2164.40	2999.13	0.4538	0.3605
18	982.25	1081.10	98.85	597.77	2164.40	2999.13	0.4538	0.3605
19	982.25	1081.10	98.85	696.62	2164.40	2999.13	0.4538	0.3605
20	982.25	1081.10	98.85	795.47	2164.40	2999.13	0.4538	0.3605

```
MORTALITY PARAMETERS
    W/O S-L    NAT MORT = 0.200    FISH MORT = 0.420
     W/ S-L    NAT MORT = 0.200    FISH MORT = 0.
               P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
     LENGTH    LMAX = 1105.00      K  =  0.0880       T0 = -1.92000
     WEIGHT    B1   =    3.0730    B0 =  0.00001100

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS    =  1.000    ( 250.4 MM,  258.4 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE   =  3.000    ( 388.3 MM,  995.3 GMS)
     MAXIMUM AGE IN FISHERY             = 15.000    ( 855.7 MM, ****** GMS)

MINIMUM SIZE LIMIT =  457.20 MM     (18.0 INCHES, 1644.0 GMS)

INTERNAL RATE OF RETURN FOR Y/R =  0.07968
PRESENT VALUE USING IRR          = -0.3496E-01
NO. OF FUNCTION EVALUATIONS      =  13
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A 6.2 IRR with 80 percent survival of released speckled hind (IRR less than 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	982.25	676.85	-305.40	-305.40	2164.40	2978.97	0.4538	0.2272
2	982.25	762.66	-219.59	-524.99	2164.40	2838.58	0.4538	0.2687
3	982.25	837.13	-145.12	-670.11	2164.40	2829.75	0.4538	0.2958
4	982.25	889.15	-93.10	-763.21	2164.40	2864.16	0.4538	0.3104
5	982.25	924.05	-58.20	-821.41	2164.40	2903.09	0.4538	0.3183
6	982.25	946.74	-35.52	-856.92	2164.40	2935.37	0.4538	0.3225
7	982.25	961.10	-21.15	-878.07	2164.40	2959.04	0.4538	0.3248
8	982.25	970.01	-12.24	-890.32	2164.40	2975.27	0.4538	0.3260
9	982.25	975.44	-6.81	-897.13	2164.40	2985.89	0.4538	0.3267
10	982.25	978.70	-3.55	-900.68	2164.40	2992.62	0.4538	0.3270
11	982.25	980.63	-1.62	-902.31	2164.40	2996.78	0.4538	0.3272
12	982.25	981.69	-0.57	-902.87	2164.40	2999.13	0.4538	0.3273
13	982.25	981.69	-0.57	-903.44	2164.40	2999.13	0.4538	0.3273
14	982.25	981.69	-0.57	-904.00	2164.40	2999.13	0.4538	0.3273
15	982.25	981.69	-0.57	-904.57	2164.40	2999.13	0.4538	0.3273
16	982.25	981.69	-0.57	-905.13	2164.40	2999.13	0.4538	0.3273
17	982.25	981.69	-0.57	-905.70	2164.40	2999.13	0.4538	0.3273
18	982.25	981.69	-0.57	-906.26	2164.40	2999.13	0.4538	0.3273
19	982.25	981.69	-0.57	-906.83	2164.40	2999.13	0.4538	0.3273
20	982.25	981.69	-0.57	-907.39	2164.40	2999.13	0.4538	0.3273

```
MORTALITY PARAMETERS
    W/O S-L    NAT MORT = 0.200    FISH MORT = 0.420
     W/ S-L    NAT MORT = 0.284    FISH MORT = 0.
               P(RELE)  = 1.000    P(SURV)   = 0.800

GROWTH PARAMETERS
     LENGTH    LMAX = 1105.00      K  =  0.0880       T0 = -1.92000
     WEIGHT    B1   =    3.0730    B0 =  0.00001100

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS    =  1.000    ( 250.4 MM,  258.4 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE   =  3.000    ( 388.3 MM,  995.3 GMS)
     MAXIMUM AGE IN FISHERY             = 15.000    ( 855.7 MM, ****** GMS)

MINIMUM SIZE LIMIT =  457.20 MM     (18.0 INCHES, 1644.0 GMS)

INTERNAL RATE OF RETURN FOR Y/R < 0.01
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A7.0 YIELD-PER-RECRUIT ANALYSIS FOR SCAMP

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

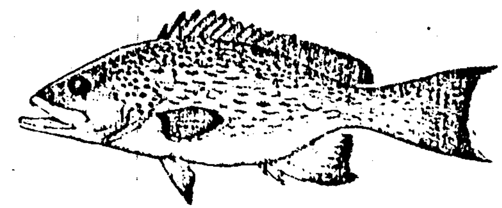
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo}\,[1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b_1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.200000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	0.900000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.250000
AGE AT FIRST RECRUITMENT	0.500000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	0.500000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.500000
BEST ESTIMATE OF PREVAILING (t_c)	1.000000
MAXIMUM AGE IN FISHERY	21.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-3.910000
GROWTH PARAMETER (K)	0.067000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	16562.364990
LENGTH (L_{oo})	1090.000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.000024
LENGTH-WEIGHT EXPONENT (b_1)	2.910000



PRIMARY REFERENCES FOR YPR:

Matheson, R. H., NMFS, Beaufort Lab., Beaufort, N.C., unpubl. data.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (0.5000000)						
0.1000000	0.3326222	416.2430496	3.3262217	4162.4305420	1251.3990021	425.8692932
0.2000000	0.4998627	478.6878815	2.4993134	2393.4394226	957.6387787	395.0753708
0.3000000	0.5999788	472.5424614	1.9999293	1575.1415405	787.5986099	374.6741638
0.4000000	0.6666636	453.8719711	1.6666591	1134.6799164	680.8110504	360.3200798
0.5000000	0.7142853	434.8749504	1.4285706	869.7499008	608.8252945	349.6989365
0.6000000	0.7499999	418.1396103	1.2499999	696.8993454	557.5195236	341.5265236
0.7000000	0.7777778	403.9285622	1.1111111	577.0408020	519.3367310	335.0441666
0.8000000	0.8000000	391.9484024	1.0000000	489.9355011	489.9355087	329.7768593
* AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.3008648	422.0185509	3.0086485	4220.1855469	1402.6847992	447.5967865
0.2000000	0.4522669	497.1255188 ←YPR	2.2613347	2485.6275940	1099.1860657	417.9411392
0.3000000	0.5428778	499.9549446	1.8095927	1666.5164795	920.9345932	398.2357101
0.4000000	0.6032212	487.2894249	1.5080531	1218.2235565	807.8121033	384.3586464
0.5000000	0.6463119	472.4112320	1.2926238	944.8224640	730.9338303	374.0881004
0.6000000	0.6786280	458.5985718	1.1310466	764.3309479	675.7731552	366.1850204
0.7000000	0.7037624	446.5273476	1.0053749	637.8962097	634.4859161	359.9162598
0.8000000	0.7238699	436.1583290	0.9048374	545.1979065	602.5368805	354.8224792

AGE LIABLE TO CAPTURE (1.5000000)

0.1000000	0.2721243	425.4213219	2.7212430	4254.2132568	1563.3345642	468.5921860
0.2000000	0.4091976	512.0268478	2.0459882	2560.1342468	1251.2947083	440.0488968
0.3000000	0.4912098	523.3768082	1.6373661	1744.5893555	1065.4852295	421.0199318
0.4000000	0.5458160	516.5754623	1.3645399	1291.4386444	946.4278946	407.6050339
0.5000000	0.5848070	505.8149223	1.1696140	1011.6298447	864.9262619	397.6737099
0.6000000	0.6140480	494.9861717	1.0234133	824.9769516	806.1034470	390.0311394
0.7000000	0.6367906	485.1433640	0.9097009	693.0619431	761.8570099	383.9689178
0.8000000	0.6549846	476.4829178	0.8187307	595.6036453	727.4719391	379.0429688

AGE LIABLE TO CAPTURE (2.0000000) ← MIN SIZE

OY YPR

0.1000000	0.2461132	426.4613342	2.4611315	4264.6133423	1732.7856293	488.8780022
0.2000000	0.3702237	523.2896042	1.8511187	2616.4480286	1413.4415283	461.4228973
0.3000000	0.4444577	542.5766983	1.4815255	1808.5889893	1220.7612610	443.0521698
0.4000000	0.4938733	541.3806458	1.2346832	1353.4516144	1096.1934204	430.0852699
0.5000000	0.5291550	534.6364899	1.0583100	1069.2729797	1010.3589935	420.4822311
0.6000000	0.5556135	526.7690277	0.9260225	877.9483795	948.0853348	413.0916367
0.7000000	0.5761919	519.1719437	0.8231313	741.6742020	901.0399551	407.2291718
0.8000000	0.5926546	512.2574463	0.7408182	640.3218079	864.3440399	402.4655113

AGE LIABLE TO CAPTURE (2.5000000)

0.1000000	0.2225714	425.2073250	2.2257140	4252.0732422	1910.4310913	508.4758682
0.2000000	0.3349552	530.9200134	1.6747758	2654.6000671	1585.0480499	482.0864334
0.3000000	0.4021534	557.4688721	1.3405112	1858.2295685	1386.2096100	464.3569183
0.4000000	0.4468733	561.5298691	1.1171832	1403.8246613	1256.5751801	451.8245087
0.5000000	0.4787989	558.6208954	0.9575978	1117.2417908	1166.7129974	442.5392380
0.6000000	0.5027398	553.6235352	0.8378997	922.7058868	1101.2127533	435.3923950
0.7000000	0.5213600	548.2308731	0.7448000	783.1869583	1051.5399475	429.7231064
0.8000000	0.5362560	543.0495758	0.6703200	678.8119659	1012.6684723	425.1163940

AGF LIABLE TO CAPTURE (3.0000000)

0.1000000	0.2012637	421.7743874	2.0126374	4217.7438965	2095.6303101	527.4065475
0.2000000	0.3030389	535.0130463	1.5151946	2675.0652466	1765.4928589	502.0619621
0.3000000	0.3638735	568.0896149	1.2129116	1893.6320496	1561.2283783	484.9577904
0.4000000	0.4043455	576.9945602	1.0108638	1442.4863892	1426.9839020	472.8470612
0.5000000	0.4332347	577.6793823	0.8664694	1155.3587646	1333.4096985	463.8694687
0.6000000	0.4548977	575.4075165	0.7581629	959.0125275	1264.9161987	456.9584160
0.7000000	0.4717460	572.1315765	0.6739229	817.3308182	1212.7957611	451.4759789
0.8000000	0.4852245	568.6306534	0.6065306	710.7883148	1171.8918457	447.0210381

AGE LIABLE TO CAPTURE (3.5000000)

0.1000000	0.1819772	416.3126106	1.8197725	4163.1260986	2287.7179565	545.6899567
0.2000000	0.2741556	535.7334747	1.3707780	2678.6673889	1954.1219788	521.3710022
0.3000000	0.3292348	574.5737381	1.0974493	1915.2457886	1745.1792297	504.8775291
0.4000000	0.3658644	587.8680038	0.9146609	1469.6699982	1606.7922516	493.1763954
0.5000000	0.3920064	591.8620529	0.7840129	1183.7241058	1509.8273926	484.4968262
0.6000000	0.4116084	592.1315308	0.6860140	986.8858795	1438.5798645	477.8139191
0.7000000	0.4268534	590.8491287	0.6097906	844.0701828	1384.1967468	472.5121803
0.8000000	0.4390493	588.9444427	0.5488116	736.1805496	1341.4084778	468.2040367

AGF LIABLE TO CAPTURE (4.0000000)

MAX YPR

0.1000000	0.1645192	408.9973221	1.6451925	4089.9732361	2486.0150146	563.3452148
0.2000000	0.2480161	533.2997360	1.2400806	2666.4986877	2150.2624512	540.0342407
0.3000000	0.2978906	577.1331863	0.9929685	1923.7772827	1937.4000549	524.1380692
0.4000000	0.3310446	594.3306841	0.8276114	1485.8466949	1795.3434296	512.8351974
0.5000000	0.3547014	601.3303604	0.7094029	1202.6607208	1695.3144226	504.4444084
0.6000000	0.3724385	603.9291611	0.6207309	1006.5485992	1621.5539856	497.9822769
0.7000000	0.3862329	604.4918594	0.5517613	863.5597992	1565.0966492	492.8553429
0.8000000	0.3972682	604.0756302	0.4965853	755.0945358	1520.5737305	488.6891556

AGE LIABLE TO CAPTURE (4.5000000)

0.1000000	0.1487154	400.0197830	1.4871539	4000.1978455	2689.8344116	580.3906097
0.2000000	0.2243589	527.9671097	1.1217943	2639.8355713	2353.2260742	558.0714874
0.3000000	0.2695269	576.0363235	0.8984232	1920.1210785	2137.2123413	542.7604904
0.4000000	0.2995376	596.6679611	0.7488440	1491.6698914	1991.9633942	531.8453064
0.5000000	0.3209462	606.3306198	0.6418923	1212.6612396	1889.1972504	523.7345581
0.6000000	0.3369961	611.0300369	0.5616602	1018.3833923	1813.1665039	517.4861298
0.7000000	0.3494780	613.2720337	0.4992542	876.1029053	1754.8231964	512.5282745
0.8000000	0.3594631	614.2211304	0.4493289	767.7764053	1708.7179565	508.4993820

AGE LIABLE TO CAPTURE (5.0000000)

0.1000000	0.1344079	389.5795975	1.3440790	3895.7959900	2898.4874268	596.8436890
0.2000000	0.2029471	520.0151062	1.0147353	2600.0755310	2562.3190002	575.5017090
0.3000000	0.2438600	571.5906143	0.8128665	1905.3020477	2343.9297180	560.7650681
0.4000000	0.2710281	595.1692047	0.6775702	1487.9230042	2195.9687805	550.2278442
0.5000000	0.2904029	607.1722488	0.5808059	1214.3444977	2090.7924500	542.3888245
0.6000000	0.3049264	613.7353058	0.5082107	1022.8921738	2012.7325897	536.3473282
0.7000000	0.3162207	617.4813538	0.4517438	882.1162186	1952.6912994	531.5530624
0.8000000	0.3252557	619.6623154	0.4065696	774.5778885	1905.1544342	527.6569519

A 7.1 IRR with 100 percent survival of released scamp.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	502.21	425.32	-76.90	-76.90	999.18	1283.29	0.5026	0.3314
2	502.21	441.66	-60.55	-137.45	999.18	1249.73	0.5026	0.3534
3	502.21	461.97	-40.24	-177.69	999.18	1232.10	0.5026	0.3749
4	502.21	479.36	-22.86	-200.55	999.18	1233.29	0.5026	0.3887
5	502.21	493.62	-8.60	-209.14	999.18	1242.00	0.5026	0.3974
6	502.21	504.92	2.71	-206.44	999.18	1252.85	0.5026	0.4030
7	502.21	513.65	11.43	-195.00	999.18	1263.33	0.5026	0.4066
8	502.21	520.23	18.01	-176.99	999.18	1272.41	0.5026	0.4089
9	502.21	525.10	22.88	-154.11	999.18	1279.79	0.5026	0.4103
10	502.21	528.64	26.43	-127.68	999.18	1285.55	0.5026	0.4112
11	502.21	531.19	28.98	-98.70	999.18	1289.90	0.5026	0.4118
12	502.21	533.00	30.79	-67.91	999.18	1293.12	0.5026	0.4122
13	502.21	534.28	32.06	-35.85	999.18	1295.45	0.5026	0.4124
14	502.21	535.16	32.95	-2.90	999.18	1297.12	0.5026	0.4126
15	502.21	535.77	33.56	30.66	999.18	1298.29	0.5026	0.4127
16	502.21	536.19	33.98	64.64	999.18	1299.11	0.5026	0.4127
17	502.21	536.48	34.26	98.90	999.18	1299.68	0.5026	0.4128
18	502.21	536.67	34.46	133.36	999.18	1300.07	0.5026	0.4128
19	502.21	536.80	34.59	167.95	999.18	1300.34	0.5026	0.4128
20	502.21	536.88	34.66	202.61	999.18	1300.49	0.5026	-0.4128

MORTALITY PARAMETERS
W/O S-L NAT MORT = 0.200 FISH MORT = 0.250
W/ S-L NAT MORT = 0.200 FISH MORT = 0.
P(RELE) = 1.000 P(SURV) = 1.000

GROWTH PARAMETERS
LENGTH LMAX = 1090.00 K = 0.0670 T0 = -3.91000
WEIGHT B1 = 2.9100 B0 = 0.00002400

AGE (IN YEARS) PARAMETERS
AGE AT ENTRY TO FISHING GROUNDS = 0.500 (278.8 MM, 313.5 GMS)
AGE WHEN FIRST LIABLE TO CAPTURE = 1.000 (305.6 MM, 409.1 GMS)
MAXIMUM AGE IN FISHERY = 21.000 (884.6 MM, 9020.8 GMS)

MINIMUM SIZE LIMIT = 355.60 MM (14.0 INCHES, 636.1 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 0.05946
PRESENT VALUE USING IRR = 0.1996E-01
NO. OF FUNCTION EVALUATIONS = 12

A 7.2 IRR with 80 percent survival of released scamp (IRR less than 1 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	502.21	424.17	-78.05	-78.05	999.18	1286.83	0.5026	0.3296
2	502.21	436.96	-65.25	-143.30	999.18	1259.99	0.5026	0.3468
3	502.21	452.79	-49.43	-192.72	999.18	1245.46	0.5026	0.3636
4	502.21	466.33	-35.88	-228.61	999.18	1246.10	0.5026	0.3742
5	502.21	477.44	-24.78	-253.39	999.18	1252.97	0.5026	0.3810
6	502.21	486.24	-15.97	-269.36	999.18	1261.69	0.5026	0.3854
7	502.21	493.03	-9.18	-278.54	999.18	1270.19	0.5026	0.3882
8	502.21	498.15	-4.06	-282.60	999.18	1277.58	0.5026	0.3899
9	502.21	501.95	-0.27	-282.87	999.18	1283.59	0.5026	0.3910
10	502.21	504.71	2.49	-280.38	999.18	1288.29	0.5026	0.3918
11	502.21	506.69	4.48	-275.90	999.18	1291.84	0.5026	0.3922
12	502.21	508.10	5.88	-270.02	999.18	1294.47	0.5026	0.3925
13	502.21	509.09	6.87	-263.15	999.18	1296.38	0.5026	0.3927
14	502.21	509.78	7.56	-255.58	999.18	1297.74	0.5026	0.3928
15	502.21	510.25	8.04	-247.54	999.18	1298.70	0.5026	0.3929
16	502.21	510.58	8.37	-239.18	999.18	1299.37	0.5026	0.3929
17	502.21	510.80	8.59	-230.59	999.18	1299.84	0.5026	0.3930
18	502.21	510.95	8.74	-221.85	999.18	1300.16	0.5026	0.3930
19	502.21	511.06	8.84	-213.01	999.18	1300.38	0.5026	0.3930
20	502.21	511.11	8.90	-204.11	999.18	1300.50	0.5026	-0.3930

MORTALITY PARAMETERS
W/O S-L NAT MORT = 0.200 FISH MORT = 0.250
W/ S-L NAT MORT = 0.250 FISH MORT = 0.
P(RELE) = 1.000 P(SURV) = 0.800

GROWTH PARAMETERS
LENGTH LMAX = 1090.00 K = 0.0670 T0 = -3.91000
WEIGHT B1 = 2.9100 B0 = 0.00002400

AGE (IN YEARS) PARAMETERS
AGE AT ENTRY TO FISHING GROUNDS = 0.500 (278.8 MM, 313.5 GMS)
AGE WHEN FIRST LIABLE TO CAPTURE = 1.000 (305.6 MM, 409.1 GMS)
MAXIMUM AGE IN FISHERY = 21.000 (884.6 MM, 9020.8 GMS)

MINIMUM SIZE LIMIT = 355.60 MM (14.0 INCHES, 636.1 GMS)

INTERNAL RATE OF RETURN FOR Y/R < 0.01

A8.0 YIELD-PER-RECRUIT ANALYSIS FOR RED GROUPER

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

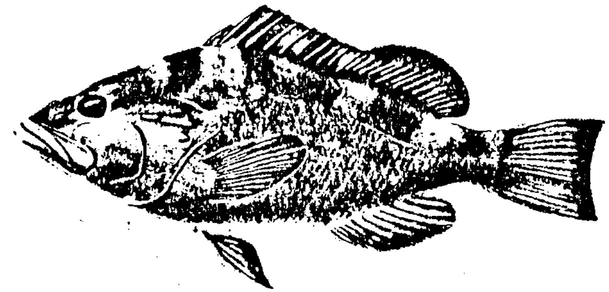
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{\infty} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.200000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	0.80000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.350000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	8.00000
INCREMENTING VALUE	0.50000
BEST ESTIMATE OF PREVAILING (t_c)	2.00000
MAXIMUM AGE IN FISHERY	25.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	0.090524
GROWTH PARAMETER (K)	0.112700
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	7152.58490
LENGTH (L_{∞})	928.000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.00014791
LENGTH-WEIGHT EXPONENT (b_1)	2.5895



PRIMARY REFERENCES FOR YPR:

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Melo, A. M. Undated. Aspectos Biologicas Pesqueros de *Epinephelus morio* (Val.). M.S. Thesis. Universidad Nacional Autonoma de Mexico, Mexico City, D. F. 68 p.

Moe, M. A. 1969. Biology of the red grouper, *Epinephelus morio* (Valenciennes), from the eastern Gulf of Mexico. Fla. Dept. Nat. Resour. Lab. Prof. Pap. Ser. No. 10. 95 p.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.3330845	192.7014034	3.3308447	1927.0140344	578.5361372	318.7112736
0.2000000	0.4999661	186.1847553	2.4998307	930.9237764	372.3947324	274.4816208
0.3000000	0.5999963	155.3870720	1.9999877	517.9569068	258.9800446	244.4688704
0.4000000	0.6666663	127.3760865	1.6666657	318.4402163	191.0642362	222.8550473
0.5000000	0.7142857	105.3414830	1.4285714	210.6829660	147.4780836	206.5578953
0.6000000	0.7500000	88.4552782	1.2500000	147.4254637	117.9403715	193.8317102
0.7000000	0.7777778	75.4730705	1.1111111	107.8186722	97.0368050	183.6188210
0.8000000	0.8000000	65.3712183	1.0000000	81.7140229	81.7140229	175.2416248
AGE LIABLE TO CAPTURE (1.5000000)						
0.1000000	0.3013509	201.9251623	3.0135085	2019.2516228	670.0666728	352.0322149
0.2000000	0.4523813	204.4259003	2.2619064	1022.1295015	451.8885019	310.2805872
0.3000000	0.5428982	178.4812834	1.8096606	594.9376112	328.7564666	281.9197013
0.4000000	0.6032245	152.7819378	1.5080612	381.9548446	253.2754223	261.4910503
0.5000000	0.6463124	131.6911893	1.2926248	263.3823785	203.7577962	246.0869538
0.6000000	0.6786281	115.0247787	1.1310468	191.7079645	169.4960549	234.0580704
0.7000000	0.7037624	101.8820747	1.0053749	145.5458210	144.7677078	224.4047645
0.8000000	0.7238699	91.4249838	0.9048374	114.2812298	126.3002917	216.4865696

* AGE LIABLE TO CAPTURE (2.0000000)

0.1000000	0.2726352	210.6999799		2.7263522	2106.9997995	772.8274542	383.5216552
0.2000000	0.4093240	222.6980750		2.0466201	1113.4903751	544.0630579	344.1168155
0.3000000	0.4912335	202.4141157	← YPR	1.6374449	674.7137190	412.0527728	317.3183221
0.4000000	0.5458199	179.8543901		1.3645499	449.6359753	329.5123069	298.0100872
0.5000000	0.5848076	160.4565705		1.1696152	320.9131410	274.3749640	283.4501417
0.6000000	0.6140481	144.6585925		1.0234134	241.0976542	235.5818743	272.0803576
0.7000000	0.6367906	131.9084512		0.9097008	188.4406446	207.1457310	262.9559750
0.8000000	0.6549846	121.5660100		0.8187308	151.9575125	185.6013249	255.4716320

AGE LIABLE TO CAPTURE (2.5000000)

0.1000000	0.2466503	218.6174687	2.4665027	2186.1746870	886.3459513	413.2794405
0.2000000	0.3703634	240.2134451	1.8518170	1201.0672254	648.5885113	376.0976663
0.3000000	0.4444852	226.1030451	1.4816172	753.6768169	508.6852613	350.7771329
0.4000000	0.4938781	207.2945198	1.2346953	518.2362996	419.7280755	332.5281415
0.5000000	0.5291558	190.1024558	1.0583116	380.3649116	359.4073001	318.7661294
0.6000000	0.5556137	175.7892129	0.9260228	292.9820215	316.3874946	308.0193364
0.7000000	0.5761919	163.9040172	0.8231314	234.1485960	284.4607906	299.3940972
0.8000000	0.5926546	154.0882999	0.7408182	192.6103749	259.9968110	292.3206347

AGE LIABLE TO CAPTURE (3.0000000)

0.1000000	0.2231361	225.3369077	2.2313605	2253.3690775	1009.8632786	441.3999062
0.2000000	0.3351095	256.2827936	1.6755475	1281.4139678	764.7732787	406.3245925
0.3000000	0.4021853	248.5691771	1.3406177	828.5639238	618.0463849	382.4023668
0.4000000	0.4468792	233.8966776	1.1171980	584.7416939	523.4002291	365.1548399
0.5000000	0.4787999	219.4881967	0.9575999	430.9763934	458.4131718	352.1470847
0.6000000	0.5027400	206.9006968	0.8379000	344.8344946	411.5461019	341.9891548
0.7000000	0.5213600	196.2474302	0.7448000	280.3534717	376.4144107	333.8372671
0.8000000	0.5362560	187.2876139	0.6703200	234.1095174	349.2503601	327.1506163

AGE LIABLE TO CAPTURE (3.5000000) ← MIN SIZE

0.1000000	0.2018573	230.6076582		2.0185734	2306.0765822	1142.4288881	467.9721765
0.2000000	0.3032095	270.3649751		1.5160475	1351.8248757	891.6771336	434.8934594
0.3000000	0.3639106	269.0144949	OY	1.2130353	896.7149829	739.2323861	412.2944254
0.4000000	0.4043528	258.6523391	← YPR	1.0108819	646.6308477	639.6700177	395.9937992
0.5000000	0.4332361	247.1961601		0.8664721	494.3923201	570.5807600	383.6990286
0.6000000	0.4548980	236.6796384		0.7581633	394.4660640	520.2916899	374.0977060
0.7000060	0.4717461	227.5155401		0.6739230	325.0222002	482.2839153	366.3924793
0.8000000	0.4852245	219.6512604		0.6065307	274.5640755	452.6796317	360.0722024

AGE LIABLE TO CAPTURE (4.0000000)

0.1000000	0.1826013	234.2727926	1.8260128	2342.7279255	1282.9745114	493.0804476
0.2000000	0.2743441	282.0805854	1.3717206	1410.4029269	1028.1998043	461.8948474
0.3000000	0.3292779	286.8483954	1.0975930	956.1613180	871.1437451	440.5481967
0.4000000	0.3658732	280.7902727	0.9146830	701.9756818	767.4524402	425.1429554
0.5000000	0.3920081	272.3852688	0.7840163	544.7705375	694.8459337	413.5221725
0.6000000	0.4116087	264.0813719	0.6860145	440.1356199	641.5035427	404.4469713
0.7000000	0.4268535	256.5613698	0.6097907	366.5162426	601.0525263	397.1639342
0.8000000	0.4390493	249.9469350	0.5488116	312.4336687	569.2912621	391.1899572

AGE LIABLE TO CAPTURE (4.5000000)

0.1000000	0.1651753	236.2619766	1.6517528	2362.6197658	1430.3712560	516.8042551
0.2000000	0.2482245	291.2045793	1.2411223	1456.0228964	1173.1502290	487.4143371
0.3000000	0.2979406	301.6838221	0.9931355	1005.6127402	1012.5634908	467.2533545
0.4000000	0.3310554	299.7779979	0.8276384	749.4449947	905.5222540	452.6948740
0.5000000	0.3547036	294.3985187	0.7094072	588.7970374	829.9846261	441.7112357
0.6000000	0.3724389	288.3437079	0.6207316	480.5728458	774.2039539	433.1333444
0.7000000	0.3862330	282.5339387	0.5517614	403.6199125	731.5116295	426.2493670
0.8000000	0.3972682	277.2483603	0.4965853	346.5604504	697.8870461	420.6027159

AGE LIABLE TO CAPTURE (5.0000000)

0.1000000	0.1494051	236.5788952	1.4940506	2365.7889520	1583.4730796	539.2187270
0.2000000	0.2245891	297.6476298	1.1229456	1488.2381491	1325.2985530	511.5327788
0.3000000	0.2695851	313.3165782	0.8986171	1044.3885940	1162.2175451	492.4946412
0.4000000	0.2995508	315.3013323	0.7488770	788.2533307	1052.5804969	478.7370426
0.5000000	0.3209490	312.8240007	0.6418980	625.6480015	974.6844743	468.3557461
0.6000000	0.3369967	308.9700760	0.5616611	514.9501266	916.8341695	460.2479366
0.7000000	0.3494781	304.8638414	0.4992544	435.5197735	872.3403862	453.7411573
0.8000000	0.3594632	300.9234103	0.4493290	376.1542629	837.1467092	448.4030981

AGE LIABLE TO CAPTURE (5.5000000)

0.1000000	0.1351329	235.2866009	1.3513293	2352.8660092	1741.1493014	560.3948222
0.2000000	0.2032015	301.4325638	1.0160077	1507.1628190	1483.4167512	534.3265466
0.3000000	0.2439276	321.6966979	0.8130919	1072.3223263	1318.8205452	516.3521346
0.4000000	0.2710442	327.2330732	0.6776105	818.0826829	1207.3052404	503.3521484
0.5000000	0.2904066	327.4623374	0.5808131	654.9246749	1127.5996681	493.5403245
0.6000000	0.3049272	325.6966039	0.5082120	542.8276732	1068.1126865	485.8768669
0.7000000	0.3162208	323.2304978	0.4517441	461.7578540	1022.1669733	479.7266235
0.8000000	0.3252557	320.6018670	0.4065697	400.7523338	985.6916903	474.6818049

AGE LIABLE TO CAPTURE (6.0000000)

0.1000000	0.1222162	232.4928507	1.2221618	2324.9285071	1902.3083320	580.3995575
0.2000000	0.1838477	302.6698227	0.9192383	1513.3491134	1646.3076551	555.8677779
0.3000000	0.2207111	326.8974763	0.7357038	1089.6582542	1481.1099797	538.9014997
0.4000000	0.2452502	335.5978522	0.6131255	838.9946304	1368.3896346	526.6183387
0.5000000	0.2627706	338.2888211	0.5255412	676.5776421	1287.3922528	517.3449521
0.6000000	0.2759095	338.4524879	0.4598492	564.0874798	1226.6793040	510.1015348
0.7000000	0.2861284	337.5214001	0.4087549	482.1734287	1179.6149867	504.2882989
0.8000000	0.2943036	336.1339670	0.3678794	420.1674588	1142.1335745	499.5198989

AGE LIABLE TO CAPTURE (6.5000000)

0.1000000	0.1105257	228.3366108	1.1052569	2283.3661079	2065.9144184	599.2962205
0.2000000	0.1663338	301.5342738	0.8316690	1507.6713688	1812.8261355	576.2245993
0.3000000	0.1997035	329.0855256	0.6656782	1096.9517519	1647.8709711	560.2142254
0.4000000	0.2219107	340.5374549	0.5547768	851.3436373	1534.5697668	548.6094680
0.5000000	0.2377645	345.4153573	0.4755290	690.8307146	1452.7625649	539.8452246
0.6000000	0.2496532	347.3194902	0.4160887	578.8658170	1391.2077357	532.9988790
0.7000000	0.2588997	347.7898053	0.3698567	496.8425790	1343.3379144	527.5041950
0.8000000	0.2662969	347.5467492	0.3328711	434.4334365	1305.1101817	522.9970701

AGE LIABLE TO CAPTURE (7.0000000)

0.1000000	0.0999446	222.9763219	0.9994461	2229.7632189	2230.9988660	617.1445721
0.2000000	0.1504847	298.2446105	0.7524234	1491.2230523	1981.8936103	595.4613396
0.3000000	0.1806942	328.4937189	0.6023141	1094.9790629	1817.9536117	580.3578477
0.4000000	0.2007920	342.2790371 MAX YPR	0.5019801	855.6975929	1704.6444092	569.3953296
0.5000000	0.2151380	349.0551592	0.4302760	698.1103184	1622.4709885	561.1125910
0.6000000	0.2258955	352.4939579	0.3764926	587.4899298	1560.4290761	554.6416211
0.7000000	0.2342621	354.2146850	0.3346602	506.0209785	1512.0440720	549.4480482
0.8000000	0.2409554	355.0023772	0.3011942	443.7529715	1473.3117727	545.1878853

AGE LIABLE TO CAPTURE (7.5000000)

0.1000000	0.0903672	216.5801425	0.9036723	2165.8014250	2396.6669393	634.0010382
0.2000000	0.1361416	293.0458778	0.6807082	1465.2293890	2152.5073583	613.6387308
0.3000000	0.1634932	325.3978977	0.5449772	1084.6596591	1990.2844195	599.3961601
0.4000000	0.1816829	341.1074438	0.4542071	852.7686094	1877.4883095	589.0418754
0.5000000	0.1946646	349.4917046	0.3893293	698.9834092	1795.3528369	581.2145794
0.6000000	0.2043987	354.2531577	0.3406645	590.4219295	1733.1480158	575.0984963
0.7000000	0.2119691	357.0649783	0.3028131	510.0928261	1684.5139598	570.1895543
0.8000000	0.2180254	358.7607128	0.2725318	448.4508910	1645.4994011	566.1628260

AGE LIABLE TO CAPTURE (8.0000000)

0.1000000	0.0816978	209.3181554	0.8169784	2093.1815539	2562.1014134	649.9188904
0.2000000	0.1231612	286.1952151	0.6158058	1430.9760756	2323.7457840	630.8140966
0.3000000	0.1479281	320.0975919	0.4930936	1066.9919731	2163.8731867	617.3894109
0.4000000	0.1643919	337.3420486	0.4109797	843.3551214	2052.0604720	607.6114213
0.5000000	0.1761395	347.0525427	0.3522790	694.1050853	1970.3278227	600.2150098
0.6000000	0.1849475	352.9266718	0.3082458	588.2111197	1908.2533376	594.4344714
0.7000000	0.1917976	356.6690413	0.2739966	509.5272019	1859.6116444	589.7945896
0.8000000	0.1972776	359.1471696	0.2465970	448.9339620	1820.5170631	585.9885115

A 8.1 IRR with 100 percent survival of released red grouper.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	190.76	155.35	-35.41	-35.41	366.14	696.80	0.5210	0.2229
2	190.76	168.84	-21.92	-57.33	366.14	645.39	0.5210	0.2616
3	190.76	191.88	1.12	-56.22	366.14	618.54	0.5210	0.3102
4	190.76	212.38	21.62	-34.60	366.14	627.87	0.5210	0.3382
5	190.76	229.02	38.26	3.66	366.14	646.17	0.5210	0.3544
6	190.76	241.67	50.91	54.57	366.14	664.38	0.5210	0.3638
7	190.76	250.84	60.08	114.65	366.14	679.51	0.5210	0.3691
8	190.76	257.23	66.47	181.11	366.14	691.01	0.5210	0.3722
9	190.76	261.55	70.79	251.91	366.14	699.26	0.5210	0.3740
10	190.76	264.41	73.65	325.56	366.14	704.96	0.5210	0.3751
11	190.76	266.27	75.51	401.07	366.14	708.78	0.5210	0.3757
12	190.76	267.45	76.69	477.76	366.14	711.27	0.5210	0.3760
13	190.76	268.20	77.44	555.19	366.14	712.88	0.5210	0.3762
14	190.76	268.66	77.90	633.09	366.14	713.89	0.5210	0.3763
15	190.76	268.95	78.18	711.27	366.14	714.53	0.5210	0.3764
16	190.76	269.12	78.36	789.63	366.14	714.92	0.5210	0.3764
17	190.76	269.23	78.46	868.10	366.14	715.16	0.5210	0.3765
18	190.76	269.29	78.53	946.63	366.14	715.30	0.5210	0.3765
19	190.76	269.33	78.57	1025.19	366.14	715.39	0.5210	0.3765
20	190.76	269.35	78.59	1103.78	366.14	715.44	0.5210	0.3765
21	190.76	269.36	78.60	1182.39	366.14	715.48	0.5210	0.3765
22	190.76	269.37	78.61	1261.00	366.14	715.49	0.5210	0.3765
23	190.76	269.38	78.62	1339.61	366.14	715.50	0.5210	0.3765
24	190.76	269.38	78.62	1418.23	366.14	715.50	0.5210	0.3765
25	190.76	269.38	78.62	1496.85	366.14	715.50	0.5210	0.3765

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MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.200   FISH MORT = 0.350
     W/ S-L   NAT MORT = 0.200   FISH MORT = 0.000
              P(RELE)  = 1.000   P(SURV)   = 1.000

GROWTH PARAMETERS
     LENGTH   LMAX =  928.00    K  =  0.1127        TO =  0.09052
     WEIGHT   B1   =  2.5895    B0 =  0.000147910

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS   =  1.000   (  90.4 MM,   17.2 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE  =  2.000   ( 179.6 MM,  101.8 GMS)
     MAXIMUM AGE IN FISHERY            = 25.000   ( 871.9 MM, 6086.7 GMS)

MINIMUM SIZE LIMIT =  304.80 MM    (12.0 INCHES,   400.3 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 43.6250 PERCENT
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A 8.2 IRR with 60 percent survival of released red grouper (IRR over 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	190.76	154.16	-36.60	-36.60	366.14	704.57	0.5210	0.2188
2	190.76	161.53	-29.23	-65.84	366.14	673.93	0.5210	0.2397
3	190.76	173.73	-17.03	-82.87	366.14	655.20	0.5210	0.2652
4	190.76	184.56	-6.20	-89.06	366.14	659.49	0.5210	0.2799
5	190.76	193.34	2.58	-86.48	366.14	670.54	0.5210	0.2883
6	190.76	200.01	9.25	-77.23	366.14	682.09	0.5210	0.2932
7	190.76	204.84	14.07	-63.16	366.14	691.89	0.5210	0.2961
8	190.76	208.20	17.44	-45.72	366.14	699.39	0.5210	0.2977
9	190.76	210.47	19.71	-26.01	366.14	704.81	0.5210	0.2986
10	190.76	211.98	21.21	-4.79	366.14	708.56	0.5210	0.2992
11	190.76	212.95	22.19	17.40	366.14	711.07	0.5210	0.2995
12	190.76	213.57	22.81	40.21	366.14	712.72	0.5210	0.2997
13	190.76	213.96	23.20	63.41	366.14	713.77	0.5210	0.2998
14	190.76	214.21	23.44	86.85	366.14	714.44	0.5210	0.2998
15	190.76	214.36	23.59	110.45	366.14	714.86	0.5210	0.2999
16	190.76	214.45	23.69	134.13	366.14	715.12	0.5210	0.2999
17	190.76	214.50	23.74	157.88	366.14	715.28	0.5210	0.2999
18	190.76	214.54	23.78	181.65	366.14	715.37	0.5210	0.2999
19	190.76	214.56	23.80	205.45	366.14	715.43	0.5210	0.2999
20	190.76	214.57	23.81	229.25	366.14	715.46	0.5210	0.2999
21	190.76	214.58	23.81	253.07	366.14	715.49	0.5210	0.2999
22	190.76	214.58	23.82	276.89	366.14	715.50	0.5210	0.2999
23	190.76	214.58	23.82	300.71	366.14	715.50	0.5210	0.2999
24	190.76	214.58	23.82	324.53	366.14	715.50	0.5210	0.2999
25	190.76	214.58	23.82	348.35	366.14	715.50	0.5210	0.2999

```
MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.200   FISH MORT = 0.350
     W/ S-L   NAT MORT = 0.340   FISH MORT = 0.000
              P(RELE)  = 1.000   P(SURV)   = 0.600

GROWTH PARAMETERS
     LENGTH   LMAX =  928.00    K  =  0.1127        TO =  0.09052
     WEIGHT   B1   =  2.5895    B0 =  0.000147910

AGE (IN YEARS) PARAMETERS
     AGE AT ENTRY TO FISHING GROUNDS   =  1.000   (  90.4 MM,   17.2 GMS)
     AGE WHEN FIRST LIABLE TO CAPTURE  =  2.000   ( 179.6 MM,  101.8 GMS)
     MAXIMUM AGE IN FISHERY            = 25.000   ( 871.9 MM, 6086.7 GMS)

MINIMUM SIZE LIMIT =  304.80 MM    (12.0 INCHES,   400.3 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 13.6802 PERCENT
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A9.0 YIELD-PER-RECRUIT ANALYSIS FOR GAG

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

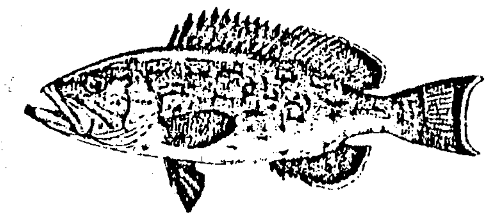
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo}[1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b_1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.300000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	0.700000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.300000
AGE AT FIRST RECRUITMENT	0.500000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	0.500000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.500000
BEST ESTIMATE OF PREVAILING (t_c)	1.000000
MAXIMUM AGE IN FISHERY	13.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-1.127000
GROWTH PARAMETER (K)	0.122000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	25032.7189941
LENGTH (L_{oo})	1290.000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.000012
LENGTH-WEIGHT EXPONENT (b_1)	2.9960



PRIMARY REFERENCES FOR YPR:

Manooch, C. S., III and M. Haimovici. 1978. Age and growth of the gag, *Mycteroperca microlepis*, and size-age composition of the recreational catch off the southeastern United States. Trans. Am. Fish. Soc. 107: 234-240.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (0.5000000)						
0.1000000	0.2483155	473.1050415	2.4831551	4731.0504150	1905.2577057	475.1583557
0.2000000	0.3992278	586.8031998	1.9961391	2934.0160217	1469.8454590	438.4283714
0.3000000	0.4997235	587.1255417	1.6657449	1957.0851288	1174.9009094	410.5991020
0.4000000	0.5713380	554.5010376	1.4283451	1386.2525787	970.5306015	389.1241798
0.5000000	0.6249716	515.3613586	1.2499433	1030.7227173	824.6156082	372.1761246
0.6000000	0.6666580	478.1115227	1.1110967	796.8525391	717.1766052	358.5042229
* AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.2134061	487.1334496	2.1340614	4871.3345337	2282.6589966	522.5611496
0.2000000	0.3434298	627.5857086	1.7171490	3137.9285583	1827.4060974	488.5041466
0.3000000	0.4300327	650.0076752 ←YPR	1.4334423	2166.6922302	1511.5308380	462.5222816
0.4000000	0.4917225	633.4086227	1.2293063	1583.5215454	1288.1423645	442.3936577
0.5000000	0.5379061	605.6021500	1.0758121	1211.2042999	1125.8511505	426.4756775
0.6000000	0.5737936	576.3986511	0.9563227	960.6644135	1004.5400238	413.6222954

AGE LIABLE TO CAPTURE (1.5000000)

0.1000000	0.1833429	495.7715378	1.8334291	4957.7153931	2704.0671387	567.0581741
0.2000000	0.2953841	660.1311722	1.4769207	3300.6558838	2234.8226318	535.5594025
0.3000000	0.3700358	703.8007202	1.2334527	2346.0023804	1901.9799957	511.3446579
0.4000000	0.4231896	703.4424133	1.0579740	1758.6060181	1662.2392883	492.4981651
0.5000000	0.4629646	687.6946030	0.9259292	1375.3892059	1485.4150543	477.5566406
0.6000000	0.4938630	667.4841995	0.8231050	1112.4736633	1351.5573578	465.4765282

AGE LIABLE TO CAPTURE (2.0000000)

0.1000000	0.1574499	498.3456573	1.5744994	4983.4566040	3165.1053467	608.8106842
0.2000000	0.2540089	682.7528992	1.2700446	3413.7644958	2687.9090576	579.7634354
0.3000000	0.3183804	745.7634430	1.0612679	2485.8781433	2342.3662720	557.2432861
0.4000000	0.3641940	760.8886948	0.9104849	1902.2217255	2089.2403259	539.6212921
0.5000000	0.3984575	757.0662766	0.7969151	1514.1325531	1899.9924011	525.6075439
0.6000000	0.4250641	746.0490570	0.7084402	1243.4150848	1755.1448059	514.2591171

AGE LIABLE TO CAPTURE (2.5000000) MIN SIZE

0.1000000	0.1351455	494.7154694	1.3514547	4947.1547241	3660.6144409	647.9695587
0.2000000	0.2183727	694.7526627	1.0918635	3473.7633362	3181.4996948	621.2741318
0.3000000	0.2739019	774.5060120 OY	0.9130064	2581.6867065	2827.6764221	600.3833771
0.4000000	0.3134051	803.6689911 YPR	0.7835128	2009.1724701	2564.3134460	583.9347000
0.5000000	0.3429301	811.0020142	0.6858603	1622.0040283	2364.9190063	570.8050690
0.6000000	0.3658456	808.8046036	0.6097427	1348.0076752	2210.7810669	560.1505356

AGE LIABLE TO CAPTURE (3.0000000)

0.1000000	0.1159287	485.1618309	1.1592872	4851.6183472	4185.0013428	684.6759796
0.2000000	0.1876735	696.2392120	0.9383676	3481.1960754	3709.8427429	660.2386017
0.3000000	0.2355978	789.7704239	0.7853261	2632.5680847	3352.1972656	640.9188385
0.4000000	0.2696776	831.1047668	0.6741940	2077.7619019	3081.8456726	625.5986023
0.5000000	0.2951301	848.4033585	0.5902601	1696.8067169	2874.6761780	613.3145981
0.6000000	0.3148722	854.2576447	0.5247870	1423.7627411	2713.0299683	603.3199463

AGE LIABLE TO CAPTURE (3.5000000)

0.1000000	0.0993686	470.2624435	0.9936860	4702.6244507	4732.5056152	719.0620499
0.2000000	0.1612209	687.9129257 MAX	0.8061043	3439.5646362	4266.8977661	696.7936935
0.3000000	0.2026046	792.1519623 YPR	0.6753488	2640.5065308	3909.8410034	678.9925995
0.4000000	0.2320249	843.5927582	0.5800622	2108.9818726	3635.7856445	664.7621384
0.5000000	0.2539789	869.4371948	0.5079577	1738.8743896	3423.2658081	653.2904892
0.6000000	0.2709940	882.3385162	0.4516566	1470.5641937	3255.9339600	643.9258347

AGE LIABLE TO CAPTURE (4.0000000)

0.1000000	0.0850940	450.7768440	0.8509404	4507.7684326	5297.3964233	751.2513428
0.2000000	0.1384201	670.8611679	0.6921006	3354.3058472	4846.5583496	731.0664978
0.3000000	0.1741786	782.8258286	0.5805954	2609.4194336	4494.3854980	714.7370529
0.4000000	0.1995972	842.2818909	0.4989931	2105.7047119	4219.9076538	701.5636520
0.5000000	0.2185478	875.1716995	0.4370956	1750.3433990	4004.4863281	690.8764648
0.6000000	0.2332210	894.0089035	0.3887017	1490.0148315	3833.3118896	682.1161499

AGE LIABLE TO CAPTURE (4.5000000)

0.1000000	0.0727856	427.5507011	0.7278560	4275.5070190	5874.1114502	781.3595505
0.2000000	0.1187592	646.3833389	0.5937958	3231.9167175	5442.8080444	763.1748505
0.3000000	0.1496790	763.3086395	0.4989299	2544.3621216	5099.6389771	748.2743530
0.4000000	0.1716625	828.7842789	0.4291562	2071.9606934	4827.9870605	736.1308670
0.5000000	0.1880367	867.2487335	0.3760734	1734.4974670	4612.1243286	726.2057037
0.6000000	0.2007006	890.9025192	0.3345009	1484.8375244	4438.9638062	718.0286713

AGE LIABLE TO CAPTURE (5.0000000)

0.1000000	0.0621683	401.4429779	0.6216826	4014.4297791	6457.3618774	809.4949646
0.2000000	0.1017968	615.8542709	0.5089842	3079.2713623	6049.8364868	793.2278824
0.3000000	0.1285534	735.2695160	0.4285113	2450.8983765	5719.5653687	779.7167892
0.4000000	0.1475895	804.9421997	0.3689738	2012.3554840	5453.9258423	768.5810852
0.5000000	0.1617560	847.6153259	0.3235119	1695.2306519	5240.0874023	759.4009552
0.6000000	0.1726978	875.0277328	0.2878297	1458.3795471	5066.8142090	751.7909927

A 9.1 IRR with 100 percent survival of released gag.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	650.01	500.26	-149.75	-149.75	1511.53	2774.18	0.4300	0.1803
2	650.01	541.23	-108.77	-258.52	1511.53	2607.19	0.4300	0.2076
3	650.01	602.80	-47.21	-305.73	1511.53	2521.20	0.4300	0.2391
4	650.01	654.45	4.45	-301.29	1511.53	2552.70	0.4300	0.2564
5	650.01	694.01	44.00	-257.28	1511.53	2610.40	0.4300	0.2659
6	650.01	722.39	72.38	-184.90	1511.53	2664.94	0.4300	0.2711
7	650.01	741.77	91.76	-93.14	1511.53	2707.90	0.4300	0.2739
8	650.01	754.53	104.52	11.38	1511.53	2738.79	0.4300	0.2755
9	650.01	762.68	112.67	124.05	1511.53	2759.77	0.4300	0.2764
10	650.01	767.77	117.76	241.82	1511.53	2773.44	0.4300	0.2768
11	650.01	770.89	120.88	362.69	1511.53	2782.09	0.4300	0.2771
12	650.01	772.37	122.36	485.06	1511.53	2786.30	0.4300	0.2772
13	650.01	772.70	122.69	607.75	1511.53	2787.25	0.4300	0.2772
14	650.01	772.70	122.69	730.44	1511.53	2787.25	0.4300	0.2772
15	650.01	772.70	122.69	853.14	1511.53	2787.25	0.4300	0.2772
16	650.01	772.70	122.69	975.83	1511.53	2787.25	0.4300	0.2772
17	650.01	772.70	122.69	1098.53	1511.53	2787.25	0.4300	0.2772
18	650.01	772.70	122.69	1221.22	1511.53	2787.25	0.4300	0.2772
19	650.01	772.70	122.69	1343.91	1511.53	2787.25	0.4300	0.2772
20	650.01	772.70	122.69	1466.61	1511.53	2787.25	0.4300	0.2772

MORTALITY PARAMETERS
W/O S-L   NAT MORT = 0.300   FISH MORT = 0.300
W/ S-L   NAT MORT = 0.300   FISH MORT = 0.
P(RELE) = 1.000   P(SURV) = 1.000

GROWTH PARAMETERS
LENGTH   LMAX = 1290.00   K = 0.1220   T0 = -1.12700
WEIGHT   B1 = 2.9960   B0 = 0.00001200

AGE (IN YEARS) PARAMETERS
AGE AT ENTRY TO FISHING GROUNDS = 0.500   (232.2 MM, 147.1 GMS)
AGE WHEN FIRST LIABLE TO CAPTURE = 1.000   (294.8 MM, 300.7 GMS)
MAXIMUM AGE IN FISHERY = 13.000   (1059.8 MM, ****** GMS)

MINIMUM SIZE LIMIT = 457.20 MM   (18.0 INCHES, 1119.1 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 0.19360
PRESENT VALUE USING IRR = 0.2596E-01
NO. OF FUNCTION EVALUATIONS = 13

A 9.2 IRR with 80 percent survival of released gag (IRR over 3 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	650.01	499.90	-150.11	-150.11	1511.53	2777.09	0.4300	0.1800
2	650.01	531.68	-118.33	-268.44	1511.53	2643.23	0.4300	0.2011
3	650.01	578.63	-71.38	-339.82	1511.53	2571.17	0.4300	0.2250
4	650.01	617.98	-32.03	-371.85	1511.53	2594.81	0.4300	0.2382
5	650.01	648.09	-1.92	-373.77	1511.53	2641.40	0.4300	0.2454
6	650.01	669.67	19.66	-354.11	1511.53	2686.12	0.4300	0.2493
7	650.01	684.41	34.40	-319.71	1511.53	2721.57	0.4300	0.2515
8	650.01	694.10	44.09	-275.62	1511.53	2747.13	0.4300	0.2527
9	650.01	700.30	50.29	-225.33	1511.53	2764.50	0.4300	0.2533
10	650.01	704.16	54.16	-171.17	1511.53	2775.84	0.4300	0.2537
11	650.01	706.53	56.52	-114.65	1511.53	2783.01	0.4300	0.2539
12	650.01	707.65	57.64	-57.01	1511.53	2786.48	0.4300	0.2540
13	650.01	707.90	57.89	0.88	1511.53	2787.25	0.4300	0.2540
14	650.01	707.90	57.89	58.77	1511.53	2787.25	0.4300	0.2540
15	650.01	707.90	57.89	116.66	1511.53	2787.25	0.4300	0.2540
16	650.01	707.90	57.89	174.55	1511.53	2787.25	0.4300	0.2540
17	650.01	707.90	57.89	232.43	1511.53	2787.25	0.4300	0.2540
18	650.01	707.90	57.89	290.32	1511.53	2787.25	0.4300	0.2540
19	650.01	707.90	57.89	348.21	1511.53	2787.25	0.4300	0.2540
20	650.01	707.90	57.89	406.10	1511.53	2787.25	0.4300	0.2540

MORTALITY PARAMETERS
W/O S-L   NAT MORT = 0.300   FISH MORT = 0.300
W/ S-L   NAT MORT = 0.360   FISH MORT = 0.
P(RELE) = 1.000   P(SURV) = 0.800

GROWTH PARAMETERS
LENGTH   LMAX = 1290.00   K = 0.1220   T0 = -1.12700
WEIGHT   B1 = 2.9960   B0 = 0.00001200

AGE (IN YEARS) PARAMETERS
AGE AT ENTRY TO FISHING GROUNDS = 0.500   (232.2 MM, 147.1 GMS)
AGE WHEN FIRST LIABLE TO CAPTURE = 1.000   (294.8 MM, 300.7 GMS)
MAXIMUM AGE IN FISHERY = 13.000   (1059.8 MM, ****** GMS)

MINIMUM SIZE LIMIT = 457.20 MM   (18.0 INCHES, 1119.1 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 0.06792
PRESENT VALUE USING IRR = 0.2897E-01
NO. OF FUNCTION EVALUATIONS = 13

A10.0 YIELD-PER-RECRUIT ANALYSIS FOR RED HIND

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

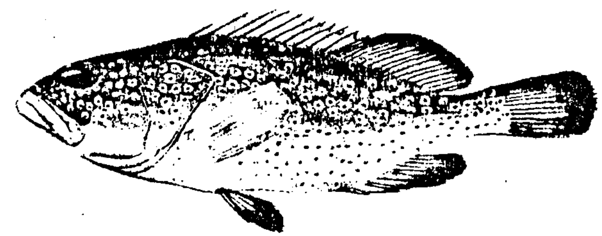
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{\infty} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b_1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.200000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	1.000000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.200000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF PREVAILING (t_c)	2.000000
MAXIMUM AGE IN FISHERY	8.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-0.440000
GROWTH PARAMETER (K)	0.180000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	2112.917572
LENGTH (L_{∞})	520.000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.0000176
LENGTH-WEIGHT EXPONENT (b_1)	2.96000



PRIMARY REFERENCES FOR YPR:

Burnett-Herkes, J. 1975. Contribution to the biology of the red hind, Epinephelus guttatus, a commercially important serranid fish from the tropical western Atlantic. Ph.D. Dissertation. Univ. Miami, Coral Gables, Fla. 154 p.

Thompson, R. and J. L. Munro. 1974. The biology, ecology and bionomics of Caribbean reef fishes: Serranidae. Zool. Dept. Univ. West Indies Res. Rep. No. 3. 82 p.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.2925145	85.4173784	2.9251452	854.1737900	292.0107269	244.1379356
0.2000000	0.4695950	116.7692146	2.3479748	583.8460770	248.6594257	230.4281979
0.3000000	0.5818816	123.6048803	1.9396052	412.0162659	212.4227467	218.3690300
0.4000000	0.6566696	120.0218973	1.6416740	300.0547409	182.7736416	207.9663429
0.5000000	0.7089667	112.6014071	1.4179334	225.2028141	158.8246708	199.0943394
0.6000000	0.7472266	104.3033381	1.2453777	173.8388958	139.5872917	191.5636005
0.7000000	0.7763495	96.3691607	1.1090708	137.6702290	124.1311493	185.1695671
0.8000000	0.7992705	89.2442217	0.9990881	111.5552769	111.6570969	179.7202892
0.9000000	0.8178113	83.0205076	0.9086792	92.2450085	101.5154781	175.0486526
1.0000000	0.8331459	77.6448936	0.8331459	77.6448936	93.1948290	171.0153370
AGE LIABLE TO CAPTURE (1.5000000)						
0.1000000	0.2587608	87.9290314	2.5870084	879.2903137	339.8869209	264.5736618
0.2000000	0.4188160	125.2290592	2.0940798	626.1453018	299.0073738	253.0877762
0.3000000	0.5218518	137.7449551	1.7395061	459.1498489	263.9541397	242.8433628
0.4000000	0.5910145	138.5953541	1.4775363	346.4883842	234.5041447	233.8798275
0.5000000	0.6394827	134.3487339	1.2789654	268.6974678	210.0897007	226.1335011
0.6000000	0.6748844	128.2228336	1.1248073	213.7047215	189.9924000	219.4824409
0.7000000	0.7017357	121.7367020	1.0024795	173.9095726	173.4794273	213.7820549
0.8000000	0.7227816	115.5601835	0.9034770	144.4502277	159.8825665	208.8882370
0.9000000	0.7397405	109.9478035	0.8219339	122.1642256	148.6302376	204.6697636
1.0000000	0.7537222	104.9583416	0.7537222	104.9583416	139.2533455	201.0132656

* AGE LIABLE TO CAPTURE (1.9999999)

0.1000000	0.2277985	89.2119226	2.2779849	892.1192322	391.6264877	283.1244545
0.2000000	0.3722286	131.7960873 ← YPR	1.8611430	658.9804382	354.0729828	273.6204414
0.3000000	0.4667811	149.8950062	1.5559371	499.6500206	321.1248131	265.0260811
0.4000000	0.5309067	155.4323807	1.3272666	388.5809479	292.7678108	257.3962669
0.5000000	0.5760382	154.7758198	1.1520763	309.5516396	268.6902199	250.7094383
0.6000000	0.6089946	151.2831898	1.0149910	252.1386490	248.4146614	244.8949394
0.7000000	0.6339145	146.6906242	0.9055921	209.5580330	231.4044399	239.8573112
0.8000000	0.6533611	141.8672485	0.8167013	177.3340588	217.1345310	235.4940758
0.9000000	0.6689593	137.2239323	0.7432892	152.4710350	205.1304512	231.7067680
1.0000000	0.6817663	132.9336681	0.6817663	132.9336681	194.9842281	228.4066582

AGE LIABLE TO CAPTURE (2.4999999)

0.1000000	0.1995147	89.0204744	1.9951472	890.2047501	446.1849937	299.9522285
0.2000000	0.3293666	135.8955650	1.6468331	679.4778290	412.5966568	292.2021828
0.3000000	0.4160756	159.1530552	1.3869186	530.5101852	382.5099564	285.0985451
0.4000000	0.4756630	169.3526917	1.1891575	423.3817253	356.0350266	278.6989288
0.5000000	0.5178956	172.4834805	1.0357912	344.9669609	333.0468254	273.0074463
0.6000000	0.5487922	171.9182758	0.9146537	286.5304604	313.2666054	267.9899712
0.7000000	0.5721105	169.5368996	0.8173008	242.1955700	296.3359070	263.5893173
0.8000000	0.5902325	166.3707581	0.7377907	207.9634457	281.8732414	259.7377357
0.9000000	0.6046949	162.9719677	0.6718832	181.0799637	269.5110893	256.3656616
1.0000000	0.6165087	159.6242580	0.6165087	159.6242580	258.9164734	253.4071560

AGE LIABLE TO CAPTURE (2.9999999)

0.1000000	0.1735438	87.2298565	1.7358381	872.2985687	502.5229912	315.2053642
0.2000000	0.2898911	137.1658802 ← MAX YPR	1.4490053	605.8294067	473.3104935	308.9945831
0.3000000	0.3691781	164.8923798	1.2305937	549.6412659	446.6472359	303.2267799
0.4000000	0.4246312	179.4910946	1.0615789	448.7277336	422.6987915	297.9540901
0.5000000	0.4643415	186.4150314	0.9286831	372.8300629	401.4610291	293.1936340
0.6000000	0.4935320	188.9258881	0.8225534	314.8764801	382.8036919	288.9350166
0.7000000	0.5155683	188.9643993	0.7355261	269.9491425	366.5167389	285.1489182
0.8000000	0.5326428	187.6765768	0.6658035	234.5957146	352.3497887	281.7949333
0.9000000	0.5462023	185.7318459	0.6068915	206.3687172	340.0422096	278.8278160
1.0000000	0.5572154	183.5149021	0.5572154	183.5149021	329.3428268	276.2019005

AGE LIABLE TO CAPTURE (3.4999999)

0.1000000	0.1497645	83.8186331	1.4976450	838.1863327	559.6695557	329.0199318
0.2000000	0.2531359	135.4328995	1.2656796	677.1644974	535.0204849	324.1462288
0.3000000	0.3255617	166.7321262	1.0852056	555.7737503	512.1368103	319.5631332
0.4000000	0.3771790	185.2666664	0.9429474	463.1666641	491.1903267	315.3129997
0.5000000	0.4146711	195.8246193	0.8293422	391.6492386	472.2408142	311.4169083
0.6000000	0.4424685	201.4365978	0.7374475	335.7276611	455.2563629	307.8778534
0.7000000	0.4635271	204.0159435	0.6621816	291.4513474	440.1380730	304.6848984
0.8000000	0.4798342	204.7663479	0.5997927	255.9579334	426.7439842	301.8176079
0.9000000	0.4927372	204.4415398	0.5474858	227.1572647	414.9098892	299.2498627
1.0000000	0.5031594	203.5103111	0.5031594	203.5103111	404.4649277	296.9530144

AGE LIABLE TO CAPTURE (3.9999998)

0.1000000	0.1278376	78.8449669	1.2783759	788.4496689	616.7588806	341.5207138
0.2000000	0.2190042	130.6699696	1.0950212	653.3498535	596.6549530	337.7939529
0.3000000	0.2847228	164.4853954	0.9490762	548.2846527	577.7035294	334.2479286
0.4000000	0.3326831	186.3198681	0.8317076	465.7996674	560.0521622	330.9138489
0.5000000	0.3681703	200.2043324	0.7363405	400.4086647	543.7819061	327.8111534
0.6000000	0.3948307	208.8316765	0.6580511	348.0527916	528.9145432	324.9484863
0.7000000	0.4151903	213.9988270	0.5931290	305.7126083	515.4235001	322.3254280
0.8000000	0.4310079	216.9030838	0.5387598	271.1288528	503.2462463	319.9345284
0.9000000	0.4435148	218.3406429	0.4927943	242.6007118	492.2961273	317.7633972
1.0000000	0.4535792	218.8396587	0.4535792	218.8396587	482.4728432	315.7965508

AGE LIABLE TO CAPTURE (4.4999999) ←MIN SIZE

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YPR

0.1000000	0.1076038	72.4224243	1.0760379	724.2242432	673.0471725	352.8222084
0.2000000	0.1870644	122.9553699	0.9353222	614.7768555	657.2888489	350.0640030
0.3000000	0.2461750	158.1011295	0.8205834	527.0037613	642.2305527	347.4109154
0.4000000	0.2905168	182.4393902	0.7262921	456.0984726	627.9821701	344.8837700
0.5000000	0.3240951	199.1948528	0.6481903	398.3897057	614.6184769	342.4975662
0.6000000	0.3497909	210.6373577	0.5829849	351.0622635	602.1807098	340.2615891
0.7000000	0.3696821	218.3639317	0.5281173	311.9484711	590.6802826	338.1799469
0.8000000	0.3852718	223.4976063	0.4815897	279.3720055	580.1037521	336.2523270
0.9000000	0.3976512	226.8275452	0.4418346	252.0306034	570.4183884	334.4748955
1.0000000	0.4076156	228.9078159	0.4076156	228.9078159	561.5776596	332.8412056

AGE LIABLE TO CAPTURE (4.9000000)

0.1000000	0.0925134	66.3397141	0.9251340	663.3971405	717.0821838	361.0708122
0.2000000	0.1628753	114.7542477	0.8143764	573.7712402	704.5529251	358.9668045
0.3000000	0.2166662	150.0335617	0.7222205	500.1118698	692.4642181	356.9268875
0.4000000	0.2580298	175.6911030	0.6450746	439.2277565	680.8945541	354.9649696
0.5000000	0.2900474	194.3037453	0.5800947	388.6074905	669.9035187	353.0919533
0.6000000	0.3150132	207.7612305	0.5250220	346.2687149	659.5318146	351.3156548
0.7000000	0.3346390	217.4491272	0.4780557	310.6416092	649.8020859	349.6409378
0.8000000	0.3502041	224.3831921	0.4377552	280.4789886	640.7211227	348.0699768
0.9000000	0.3626670	229.3078232	0.4029634	254.7864685	632.2819443	346.6026192
1.0000000	0.3727475	232.7684155	0.3727475	232.7684155	624.4667282	345.2368126

A11.0 YIELD-PER-RECRUIT ANALYSIS FOR GRAYSBY

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

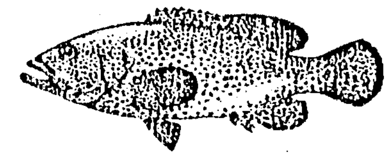
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo}\,[1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.200000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	0.900000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.200000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF PREVAILING (t_c)	3.00000
MAXIMUM AGE IN FISHERY	10.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-0.940000
GROWTH PARAMETER (K)	0.130000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	1174.2792969
LENGTH (L_{oo})	415.0000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.000010016
LENGTH-WEIGHT EXPONENT (b_1)	3.0821



PRIMARY REFERENCES FOR YPR:

Nagelkerken, W. P. 1979. Biology of the graysby, *Epinephelus cruentatus*, of the coral reef of Curaçao. Stud. Fauna Curaçao other Caribb. Isl. 61:1-118.

AGE LIABLE TO CAPTURE (1.0000000)

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
0.1000000	0.3109315	39.4787571	3.1093150	394.7875707	126.9693087	178.8263874
0.2000000	0.4863381	50.3748268	2.4316907	251.8741341	103.5798405	166.8946448
0.3000000	0.5933346	50.7897946	1.9777420	169.2993153	85.6005944	157.0710553
0.4000000	0.6636556	47.7994769	1.6591390	119.4986924	72.0245200	149.1086752
0.5000000	0.7129741	44.0690562	1.4259481	88.1381124	61.8101810	142.6736791
0.6000000	0.7494401	40.5260321	1.2490669	67.5433869	54.0750812	137.4445359
0.7000000	0.7775417	37.4326216	1.1107738	53.4751739	48.1422696	133.1518151
0.8000000	0.7999013	34.8106004	0.9998766	43.5132504	43.5186211	129.5845033
0.9000000	0.8181408	32.6057532	0.9090453	36.2286146	39.8534757	126.5824854
1.0000000	0.8333163	30.7487449	0.8333163	30.7487449	36.8992466	124.0256255

AGE LIABLE TO CAPTURE (1.5000000)

0.1000000	0.2780621	40.6304858		2.7806207	406.3048578	146.1202027	192.2226962
0.2000000	0.4373200	53.8869376		2.1866001	269.4346878	123.2208347	181.6606593
0.3000000	0.5351584	56.2669113		1.7838612	187.5563710	105.1406745	172.8401415
0.4000000	0.5995472	54.6382420		1.4988681	136.5956050	91.1325059	165.6000835
0.5000000	0.6446283	51.7924324		1.2892565	103.5848649	80.3446515	159.6898857
0.6000000	0.6778722	48.8121243		1.1297870	81.3535405	72.0078542	154.8518972
0.7000000	0.7034274	46.0759760		1.0048963	65.8228229	65.5021045	150.8604198
0.8000000	0.7237226	43.6819503		0.9046533	54.6024379	60.3573072	147.5327889
0.9000000	0.7402571	41.6232434		0.8225079	46.2480483	56.2280876	144.7269632
1.0000000	0.7540032	39.8596526		0.7540032	39.8596526	52.8640397	142.3344386

AGE LIABLE TO CAPTURE (2.0000000)

0.1000000	0.2481524	41.3822183		2.4815239	413.8221830	166.7613116	204.6893509
0.2000000	0.3926787	56.8272922		1.9633937	284.1364612	144.7170071	195.4082931
0.3000000	0.4822411	61.1830014		1.6074704	203.9433380	126.8722236	187.5438546
0.4000000	0.5413285	61.0120040		1.3533213	152.5300099	112.7079024	181.0015812
0.5000000	0.5826451	59.1718878		1.1652903	118.3437757	101.5573350	175.6013893
0.6000000	0.6130278	56.8731177		1.0217130	94.7885296	92.7741267	171.1432060
0.7000000	0.6363152	54.6014158		0.9090217	78.0020225	85.8087605	167.4426808
0.8000000	0.6547649	52.5293886		0.8184561	65.6617357	80.2263381	164.3449156
0.9000000	0.6697696	50.6988587		0.7441885	56.3320652	75.6959637	161.7259773
1.0000000	0.6822294	49.1005917		0.6822294	49.1005917	71.9707923	159.4891367

AGE LIABLE TO CAPTURE (2.5000000)

0.1000000	0.2209122	41.6714350		2.2091218	416.7143505	188.6334838	216.2821708
0.2000000	0.3519675	59.0492998		1.7598376	295.2464990	167.7691700	208.1947829
0.3000000	0.4340375	65.3137965		1.4467917	217.7126551	150.4796138	201.2397183
0.4000000	0.4883923	66.6346112		1.2209808	166.5865279	136.4366494	195.3718758
0.5000000	0.5263791	65.8739635		1.0527582	131.7479271	125.1454730	190.4691298
0.6000000	0.5542364	64.3388967		0.9237274	107.2314945	116.0856494	186.3820917
0.7000000	0.5755173	62.6094067		0.8221676	89.4420095	108.7880536	182.9648141
0.8000000	0.5923268	60.9289354		0.7404085	76.1611693	102.8637175	180.0892901
0.9000000	0.6059656	59.3877916		0.6732952	65.9864351	98.0052124	177.6496609
1.0000000	0.6172723	58.0087430		0.6172723	58.0087430	93.9759328	175.5611641

*AGE LIABLE TO CAPTURE (3.0000000)

0.1000000	0.1960783	41.4636963		1.9607835	414.6369634	211.4649400	227.0536620
0.2000000	0.3147789	60.4551599	YPR	1.5738946	302.2757996	192.0559348	220.0737023
0.3000000	0.3900469	68.4975864		1.3001563	228.3252880	175.6137269	213.9809140
0.4000000	0.4401788	71.2918649		1.1004470	178.2296623	161.9611481	208.7645629
0.5000000	0.4752346	71.6441580		0.9504692	143.2883159	150.7553462	204.3483818
0.6000000	0.5008810	70.9238888		0.8348016	118.2064813	141.5982898	200.6262920
0.7000000	0.5204027	69.7894845		0.7434324	99.6992635	134.1067021	197.4871858
0.8000000	0.5357670	68.5492756		0.6697088	85.6865944	127.9460495	194.8286595
0.9000000	0.5481953	67.3406500		0.6091059	74.8229444	122.8406137	192.5627210
1.0000000	0.5584744	66.2187187		0.5584744	66.2187187	118.5707267	190.6167542

AGE LIABLE TO CAPTURE (3.5000000)

0.1000000	0.1734124	40.7492106	MAX	1.7341236	407.4921077	234.9844688	237.0532580
0.2000000	0.2807407	60.9910171	YPR	1.4037036	304.9550854	217.2503340	231.0952833
0.3000000	0.3498077	70.6300130		1.1660258	235.4333766	201.9109448	225.8166353
0.4000000	0.3961689	74.8365095		0.9904222	187.0912738	188.9005253	221.2284006
0.5000000	0.4286581	76.3025294		0.8573162	152.6050588	178.0032412	217.2888684
0.6000000	0.4523885	76.4236526		0.7539809	127.3727544	168.9336690	213.9276074
0.7000000	0.4703875	75.9181244		0.6719821	108.4544635	161.3948637	211.0641653
0.8000000	0.4844950	75.1510955		0.6056188	93.9388694	155.1122140	208.6199368
0.9000000	0.4958629	74.3043356		0.5509587	82.5603728	149.8485579	206.5242970
1.0000000	0.5052351	73.4649657		0.5052351	73.4649657	145.4074805	204.7168547

AGE LIABLE TO CAPTURE (4.0000000)

0.1000000	0.1526979	39.5381912		1.5269789	395.3819118	258.9308213	246.3275444
0.2000000	0.2495123	60.6394673		1.2475614	303.1973364	243.0319916	241.3067301
0.3000000	0.3128927	71.6547154		1.0429758	238.8490513	229.0072743	236.7924612
0.4000000	0.3558774	77.1775642		0.8896934	192.9439105	216.8656118	232.8076245
0.5000000	0.3861299	79.7321840		0.7722598	159.4643680	206.4905611	229.3349017
0.6000000	0.4082213	80.7030081		0.6803688	134.5050135	197.6942649	226.3318295
0.7000000	0.4249256	80.8469720		0.6070365	115.4956743	190.2614870	223.7438862
0.8000000	0.4379610	80.5757778		0.5474513	100.7197223	183.9793388	221.5138767
0.9000000	0.4484169	80.1114383		0.4982410	89.0127093	178.6539392	219.5876328
1.0000000	0.4570016	79.5719785		0.4570016	79.5719785	174.1175112	217.9168538

AGE LIABLE TO CAPTURE (4.5000000)

0.1000000	0.1337387	37.8559686	1.3373871	378.5596855	283.0591641	254.9204688
0.2000000	0.2207810	59.4112622	1.1039052	297.0563109	269.0958502	250.7525226
0.3000000	0.2789038	71.5524283	0.9296793	238.5080942	256.5487747	246.9507507
0.4000000	0.3188464	78.2672355	0.7971161	195.6680888	245.4699971	243.5423185
0.5000000	0.3471558	81.8644018	0.6943116	163.7288036	235.8145975	240.5255823
0.6000000	0.3678664	83.6798792	0.6131107	139.4664654	227.4735478	237.8786830
0.7000000	0.3834972	84.4859542	0.5478531	120.6942202	220.3039847	235.5679379
0.8000000	0.3956447	84.7282439	0.4945559	105.9103548	214.1524559	233.5545940
0.9000000	0.4053391	84.6632793	0.4503767	94.0703104	208.8702637	231.7995216
1.0000000	0.4132581	84.4377532	0.4132581	84.4377532	204.3220580	230.2660418

AGE LIABLE TO CAPTURE (5.0000000) MIN SIZE

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0.1000000	0.1163567	35.7384122	1.1635671	357.3841222	307.1452708	262.8735339
0.2000000	0.1942595	57.3372796	0.9712973	286.6863979	295.1582503	259.4747106
0.3000000	0.2474675	70.3300635	0.9248916	234.4335449	284.1992169	256.3310588
0.4000000	0.2846388	78.0873159	0.7115970	195.2182899	274.3382749	253.4688578
0.5000000	0.3112574	82.6625879	0.6225149	165.3251757	265.5752700	250.8950972
0.6000000	0.3308244	85.3072293	0.5513740	142.1787156	257.8625580	248.6018349
0.7000000	0.3455957	86.7837860	0.4937082	123.9768371	251.1135928	246.5710367
0.8000000	0.3570411	87.5568531	0.4463014	109.4460664	245.2290404	244.7789444
0.9000000	0.3661304	87.9093474	0.4068115	97.6770526	240.1039562	243.1995009
1.0000000	0.3735127	88.0133716	0.3735127	88.0133716	235.6369184	241.8067360

A12.0 YIELD-PER-RECRUIT ANALYSIS FOR RED PORGY

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

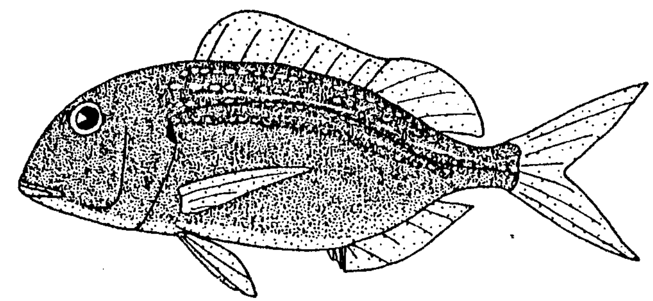
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b_1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.200000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	0.700000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.400000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	5.000000
INCREMENTING VALUE	0.500000
BEST ESTIMATE OF PREVAILING (t_c)	3.000000
MAXIMUM AGE IN FISHERY	13.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-1.880000
GROWTH PARAMETER (K)	0.096000
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	5544.0496216
LENGTH (L_{oo})	763.0000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.00002524
LENGTH-WEIGHT EXPONENT (b_1)	2.8939



PRIMARY REFERENCES FOR YPR:

Manooch, C. S., III, and G. R. Huntsman. 1977. Age, growth, and mortality of the red porgy, *Pagrus pagrus*. Trans. Am. Fish. Soc. 106:26-33.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.3242254	167.8207245	3.2422543	1678.2072449	517.6050720	316.1699409
0.2000000	0.4958851	202.5530777	2.4794256	1012.7653885	408.4677429	293.6604881
0.3000000	0.5985128	199.4635201	1.9950425	664.8783951	333.2652817	276.6912651
0.4000000	0.6661690	187.3935318	1.6654224	468.4838257	281.3003082	263.8688316
0.5000000	0.7141251	174.7041950	1.4282502	349.4083900	244.6408863	254.0178127
0.6000000	0.7499492	163.5124302	1.2499153	272.5207176	218.0313416	246.2828331
AGE LIABLE TO CAPTURE (1.5000000)						
0.1000000	0.2920376	171.7001133	2.9203759	1717.0011444	587.9384003	335.9820938
0.2000000	0.4478711	214.1761532	2.2393554	1070.8807678	478.2093964	315.1621780
0.3000000	0.5411745	216.8681145	1.8039150	722.8937149	400.7360115	299.2815781
0.4000000	0.6026170	208.5584488	1.5065425	521.3961182	346.0878830	287.1835670
0.5000000	0.6461062	198.2853165	1.2922124	396.5706329	306.8927612	277.8430099
0.6000000	0.6785595	188.6852512	1.1309325	314.4754181	278.0673676	270.4889526

AGE LIABLE TO CAPTURE (2.0000000)						
0.1000000	0.2628445	174.2761993	2.6284446	1742.7619934	663.0392761	354.7767372
0.2000000	0.4043395	223.9406834	2.0216973	1119.7034149	553.8432541	335.5915070
0.3000000	0.4892309	232.3493481	1.6307696	774.4978256	474.9278069	320.7753448
0.4000000	0.5450780	227.9257336	1.3626950	569.8143311	418.1525192	309.3862801
0.5000000	0.5845429	220.2478352	1.1690857	440.4956703	376.7864571	300.5425377
0.6000000	0.6139555	212.4230556	1.0232592	354.0384254	345.9909592	293.5566368
AGE LIABLE TO CAPTURE (2.5000000)						
0.1000000	0.2363575	175.4565296	2.3635752	1754.5653076	742.3352814	372.5963135
0.2000000	0.3648546	231.5980911	1.8242731	1157.9904633	634.7681656	354.9914436
0.3000000	0.4421585	245.5130539	1.4738615	818.3768463	555.2603378	341.2174606
0.4000000	0.4929719	244.9827671	1.2324297	612.4569168	496.9507751	330.5245171
0.5000000	0.5288158	239.9836082	1.0576317	479.9672165	453.8132019	322.1664238
0.6000000	0.5554887	234.0388165	0.9258145	390.0646935	421.3205566	315.5377579
* AGE LIABLE TO CAPTURE (3.0000000)						
0.1000000	0.2123156	175.2064724	2.1231560	1752.0647278	825.2171631	389.4812050
0.2000000	0.3290214	237.0020580	1.6451068	1185.0102997	720.3242416	373.4023819
0.3000000	0.3994821	256.0996170	1.3316069	853.6653900	641.0791092	360.6497612
0.4000000	0.4457723	259.3747635 YPR	1.1144308	648.4369049	581.8547897	350.6426659
0.5000000	0.4783634	257.0599518	0.9567268	514.1199036	537.3737564	342.7615623
0.6000000	0.5025714	253.0345612	0.8376190	421.7242661	503.4798431	336.4812202
AGE LIABLE TO CAPTURE (3.5000000)						
0.1000000	0.1904821	173.5405865	1.9048210	1735.4058685	911.0598145	405.4698906
0.2000000	0.2964811	240.0954475	1.4824053	1200.4772491	809.8171768	390.8622704
0.3000000	0.3607699	263.9680023	1.2025663	879.8933411	731.6797028	379.1111031
0.4000000	0.4030008	270.8886948	1.0075020	677.2217331	672.1790161	369.7818489
0.5000000	0.4326756	271.2040329	0.8653511	542.4080658	626.8069077	362.3717003
0.6000000	0.4546703	269.0868645	0.7577839	448.4781075	591.8284988	356.4329529
AGE LIABLE TO CAPTURE (4.0000000)						
0.1000000	0.1706428	170.5123615	1.7064282	1705.1236267	999.2354813	420.5990334
0.2000000	0.2669080	240.8936577	1.3345402	1204.4682922	902.5343170	407.4067345
0.3000000	0.3256289	269.0754967	1.0854298	896.9183197	826.3255157	396.6374245
0.4000000	0.3642219	279.4300652	0.9105548	698.5751572	767.1972656	387.9799843
0.5000000	0.3912885	282.2786179	0.7825769	564.5572357	721.4079666	381.0373154
0.6000000	0.4113014	282.0218391	0.6855024	470.0363960	685.6816483	375.4358101
AGE LIABLE TO CAPTURE (4.5000000) MIN SIZE						
0.1000000	0.1526037	166.2047844	1.5260370	1662.0478516	1089.1268463	434.9036560
0.2000000	0.2400063	239.4685936	1.2000316	1197.3429718	997.7595520	423.0692291
0.3000000	0.2937011	271.4570999	0.9790038	904.8569946	924.2630157	413.2618217
0.4000000	0.3290385	284.9995461 OY	0.8225962	712.4988632	866.1586609	405.2716827
0.5000000	0.3537795	290.2564920 YPR	0.7075590	580.5129852	820.4446640	398.7955246
0.6000000	0.3720242	291.7885361	0.6200403	486.3142242	784.3268433	393.5294228
AGE LIABLE TO CAPTURE (5.0000000)						
0.1000000	0.1361889	160.7213573	1.3618892	1607.2135773	1180.1353302	448.4172363
0.2000000	0.2155067	235.9332428	1.0775333	1179.6662140	1094.7839813	437.8812180
0.3000000	0.2646595	271.2052574 MAX	0.8821984	904.0175247	1024.7326202	429.0146179
0.4000000	0.2970874	287.6688957 YPR	0.7427185	719.1722336	968.2971725	421.6882095
0.5000000	0.3197624	295.1939430	0.6395249	590.3878860	923.1664200	415.6798973
0.6000000	0.3364368	298.4310036	0.5607280	497.3850060	887.0344162	410.7500076

A 12.1 IRR with 100 percent survival of released red porgy.

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	259.37	153.02	-106.36	-106.36	581.85	881.45	0.4458	0.1736
2	259.37	177.75	-81.63	-187.99	581.85	840.23	0.4458	0.2115
3	259.37	214.80	-44.57	-232.56	581.85	824.96	0.4458	0.2604
4	259.37	240.83	-18.54	-251.10	581.85	838.62	0.4458	0.2872
5	259.37	258.43	-0.95	-252.05	581.85	856.04	0.4458	0.3019
6	259.37	269.96	10.58	-241.47	581.85	870.95	0.4458	0.3100
7	259.37	277.33	17.95	-223.52	581.85	882.12	0.4458	0.3144
8	259.37	281.95	22.57	-200.94	581.85	889.93	0.4458	0.3168
9	259.37	284.79	25.42	-175.53	581.85	895.14	0.4458	0.3182
10	259.37	286.14	26.76	-148.76	581.85	897.73	0.4458	0.3187
11	259.37	286.14	26.76	-122.00	581.85	897.73	0.4458	0.3187
12	259.37	286.14	26.76	-95.23	581.85	897.73	0.4458	0.3187
13	259.37	286.14	26.76	-68.47	581.85	897.73	0.4458	0.3187
14	259.37	286.14	26.76	-41.70	581.85	897.73	0.4458	0.3187
15	259.37	286.14	26.76	-14.94	581.85	897.73	0.4458	0.3187
16	259.37	286.14	26.76	11.82	581.85	897.73	0.4458	0.3187
17	259.37	286.14	26.76	38.59	581.85	897.73	0.4458	0.3187
18	259.37	286.14	26.76	65.35	581.85	897.73	0.4458	0.3187
19	259.37	286.14	26.76	92.12	581.85	897.73	0.4458	0.3187
20	259.37	286.14	26.76	118.88	581.85	897.73	0.4458	0.3187

```
MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.200    FISH MORT = 0.400
    W/ S-L    NAT MORT = 0.200    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 1.000

GROWTH PARAMETERS
    LENGTH    LMAX = 763.00      K  = 0.0960          TO = -1.88000
    WEIGHT    B1   = 2.8939      B0 = 0.00002524

AGE (IN YEARS) PARAMETERS
    AGE AT ENTRY TO FISHING GROUNDS    = 1.000    ( 184.3 MM,   90.8 GMS)
    AGE WHEN FIRST LIABLE TO CAPTURE   = 3.000    ( 285.4 MM,  322.0 GMS)
    MAXIMUM AGE IN FISHERY             = 13.000   ( 580.1 MM, 2508.7 GMS)

MINIMUM SIZE LIMIT = 355.60 MM     (14.0 INCHES,  608.6 GMS)

INTERNAL RATE OF RETURN FOR Y/R = 0.03464
PRESENT VALUE USING IRR         = 0.5796E-01
NO. OF FUNCTION EVALUATIONS     = 12
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A 12.2 IRR with 90 percent survival of released red porgy (IRR less than 1 percent).

YEAR	YIELD/RECRUIT IN GRAMS W/O S-L	W/ S-L	NET GAIN	ACC GAIN	AVE WT/FISH IN GMS W/O S-L	W/ S-L	NO. CAUGHT/RECRUIT W/O S-L	W/ S-L
1	259.37	152.40	-106.97	-106.97	581.85	883.19	0.4458	0.1726
2	259.37	174.01	-85.36	-192.34	581.85	846.09	0.4458	0.2057
3	259.37	206.09	-53.29	-245.63	581.85	831.43	0.4458	0.2479
4	259.37	228.61	-30.76	-276.39	581.85	843.49	0.4458	0.2710
5	259.37	243.84	-15.54	-291.92	581.85	859.35	0.4458	0.2837
6	259.37	253.81	-5.56	-297.49	581.85	873.04	0.4458	0.2907
7	259.37	260.19	0.81	-296.68	581.85	883.34	0.4458	0.2946
8	259.37	264.18	4.81	-291.87	581.85	890.55	0.4458	0.2967
9	259.37	266.64	7.27	-284.60	581.85	895.36	0.4458	0.2978
10	259.37	267.80	8.42	-276.18	581.85	897.73	0.4458	0.2983
11	259.37	267.80	8.42	-267.75	581.85	897.73	0.4458	0.2983
12	259.37	267.80	8.42	-259.33	581.85	897.73	0.4458	0.2983
13	259.37	267.80	8.42	-250.91	581.85	897.73	0.4458	0.2983
14	259.37	267.80	8.42	-242.48	581.85	897.73	0.4458	0.2983
15	259.37	267.80	8.42	-234.06	581.85	897.73	0.4458	0.2983
16	259.37	267.80	8.42	-225.63	581.85	897.73	0.4458	0.2983
17	259.37	267.80	8.42	-217.21	581.85	897.73	0.4458	0.2983
18	259.37	267.80	8.42	-208.79	581.85	897.73	0.4458	0.2983
19	259.37	267.80	8.42	-200.36	581.85	897.73	0.4458	0.2983
20	259.37	267.80	8.42	-191.94	581.85	897.73	0.4458	0.2983

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MORTALITY PARAMETERS
    W/O S-L   NAT MORT = 0.200    FISH MORT = 0.400
    W/ S-L    NAT MORT = 0.240    FISH MORT = 0.
              P(RELE)  = 1.000    P(SURV)   = 0.900

GROWTH PARAMETERS
    LENGTH    LMAX = 763.00      K  = 0.0960          TO = -1.88000
    WEIGHT    B1   = 2.8939      B0 = 0.00002524

AGE (IN YEARS) PARAMETERS
    AGE AT ENTRY TO FISHING GROUNDS    = 1.000    ( 184.3 MM,   90.8 GMS)
    AGE WHEN FIRST LIABLE TO CAPTURE   = 3.000    ( 285.4 MM,  322.0 GMS)
    MAXIMUM AGE IN FISHERY             = 13.000   ( 580.1 MM, 2508.7 GMS)

MINIMUM SIZE LIMIT = 355.60 MM     (14.0 INCHES,  608.6 GMS)

INTERNAL RATE OF RETURN FOR Y/R < 0.01
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A13.0 YIELD-PER-RECRUIT ANALYSIS FOR WHITE GRUNT

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

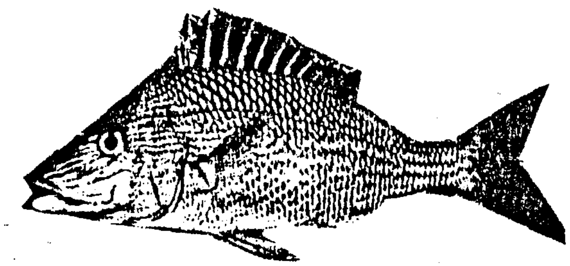
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo} [1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.600000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	1.100000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.400000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	3.000000
INCREMENTING VALUE	1.000000
BEST ESTIMATE OF PREVAILING (t_c)	2.000000
MAXIMUM AGE IN FISHERY	13.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	-1.007000
GROWTH PARAMETER (K)	0.108400
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	4334.3199463
LENGTH (L_{oo})	640.0000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.00001426
LENGTH-WEIGHT EXPONENT (b_1)	3.022900



PRIMARY REFERENCES FOR YPR:

Manooch, C. S., III. 1977. Age, growth, and mortality of the white grunt, *Haemulon plumieri* (Lacèpède) (Pisces: Pomadasyidae), from North Carolina and South Carolina. Proc. Annu. Conf. Southeastern Assoc. Game Fish Comm. 30:58-70.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.1428250	22.9099894	1.4282502	229.0998936	160.4059944	194.0992584
0.2000000	0.2499831	34.6046824	1.2499153	173.0234127	138.4281044	186.5497398
0.3000000	0.3333265	40.7239456	1.1110885	135.7464848	122.1743279	180.4725037
0.4000000	0.3999975	43.9243913	0.9999939	109.8109779	109.8116522	175.4838600
0.5000000	0.4545446	45.5318274	0.9090892	91.0636549	100.1702051	171.3183613
0.6000000	0.4999997	46.2423973	0.8333329	77.0706615	92.4848461	167.7888088
0.7000000	0.5384615	46.4381289	0.7692306	66.3401842	86.2422523	164.7602348
0.8000000	0.5714285	46.3361840	0.7142857	57.9202299	81.0883255	162.1331387
0.9000000	0.6000000	46.0635624	0.6666667	51.1817355	76.7726049	159.8326988
1.0000000	0.6250000	45.6962023	0.6250000	45.6962023	73.1139240	157.8015556
1.1000000	0.6470588	45.2802362	0.5882353	41.1638513	69.9785471	155.9950428

* AGE LIABLE TO CAPTURE (2.0000000)

0.1000000	0.0783662	20.8377521		0.7836616	208.3775215	265.9024277	239.8465023
0.2000000	0.1371822	32.8664789		0.6859111	164.3323956	239.5826302	233.1106472
0.3000000	0.1829280	40.1733928	MAX	0.6097601	133.9113083	219.6131039	227.6721096
0.4000000	0.2195210	44.8021846	YPR	0.5488025	112.0054607	204.0906639	223.2012596
0.5000000	0.2494584	47.8345737	& YPR	0.4989169	95.6691475	191.7536716	219.4656143
0.6000000	0.2744053	49.8739948		0.4573422	83.1233244	181.7530231	216.2993412
0.7000000	0.2955138	51.2732544		0.4221625	73.2475061	173.5054607	213.5821381
0.8000000	0.3136066	52.2473092		0.3920082	65.3091364	166.6014404	211.2250175
0.9000000	0.3292870	52.9317341		0.3658744	58.8130374	160.7465210	209.1609287
1.0000000	0.3430073	53.4146285		0.3430073	53.4146285	155.7244816	207.3384647
1.1000000	0.3551134	53.7548428		0.3228304	48.8680391	151.3737335	205.7175407

AGE LIABLE TO CAPTURE (3.0000000) MIN SIZE

0.1000000	0.0429885	17.2285745		0.4298851	172.2857456	400.7716179	280.8512878
0.2000000	0.0752733	27.9426062		0.3763665	139.7130318	371.2154045	274.8682175
0.3000000	0.1003857	34.9663792		0.3346189	116.5545969	348.3203812	270.0138359
0.4000000	0.1204722	39.7832155	OY	0.3011805	99.4580383	330.2273026	266.0126839
0.5000000	0.1369042	43.2139225	YPR	0.2738084	86.4278450	315.6508713	262.6649818
0.6000000	0.1505962	45.7358966		0.2509936	76.2264938	303.6989136	259.8256416
0.7000000	0.1621811	47.6397138		0.2316873	68.0567341	293.7438660	257.3882294
0.8000000	0.1721108	49.1095362		0.2151385	61.3869200	285.3366852	255.2735062
0.9000000	0.1807165	50.2663803		0.2007961	55.8515334	278.1505127	253.4215603
1.0000000	0.1882464	51.1921539		0.1882464	51.1921539	271.9423218	251.7863579
1.1000000	0.1948904	51.9438648		0.1771731	47.2216954	266.5286407	250.3319683

A14.0 YIELD-PER-RECRUIT ANALYSIS FOR TOMTATE

SOUTHEAST FISHERIES CENTER/BEAUFORT LABORATORY

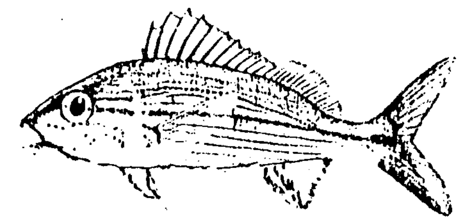
BEVERTON & HOLT YIELD-PER-RECRUIT ANALYSIS

AGE-LENGTH EQUATION $L_t = L_{oo}\,[1-e^{-k(t-t_o)}]$

LENGTH-WEIGHT EQUATION $W_t = b_o L^{b1}$

INPUT PARAMETERS

INSTANTANEOUS NATURAL MORTALITY (M)	0.600000
INSTANTANEOUS FISHING MORTALITY (F)	
MINIMUM VALUE	0.100000
MAXIMUM VALUE	1.100000
INCREMENTING VALUE	0.100000
BEST ESTIMATE OF EXISTING (F)	0.400000
AGE AT FIRST RECRUITMENT	1.000000
AGE LIABLE TO CAPTURE (t_c)	
MINIMUM VALUE	1.000000
MAXIMUM VALUE	4.000000
INCREMENTING VALUE	1.000000
BEST ESTIMATE OF PREVAILING (t_c)	3.500000
MAXIMUM AGE IN FISHERY	9.000000
THEORETICAL AGE AT LENGTH ZERO (t_o)	1.280000
GROWTH PARAMETER (K)	0.220170
MAXIMUM ASYMPTOTIC VALUES	
WEIGHT	430.5779266
LENGTH (L_{oo})	310.0000000
LENGTH-WEIGHT COEFFICIENT (b_o)	0.0000086
LENGTH-WEIGHT EXPONENT (b_1)	3.090500



PRIMARY REFERENCES FOR YPR:

Manooch, C. S., III, and C. A. Barans. 1982. Distribution, abundance, and age and growth of the tomtate, Haemulon aurolineatum, along the southeastern coast. Fish. Bull. 80(1):1-19.

Sokolova, L. V. 1969. Distribution and biological characteristics of the main commercial fish of Campeche Bank. p. 208-224 In A. S. Bogdanov (Ed.), Soviet-Cuban fishery research, Part I. Transl. from Russian). TT 69-59106.

INSTANTANEOUS FISHING MORTALITY	YIELD IN NUMBERS PER RECRUIT	YIELD IN WEIGHT PER RECRUIT	ABUNDANCE PER RECRUIT	BIOMASS PER RECRUIT	INDIVIDUAL MEAN WEIGHT	INDIVIDUAL MEAN LENGTH
AGE LIABLE TO CAPTURE (1.0000000)						
0.1000000	0.1423289	2.1214471	1.4232888	21.2144706	14.9052469	58.4074359
0.2000000	0.2495846	2.8669999	1.2479231	14.3349997	11.4870862	51.0889707
0.3000000	0.3330845	2.9799777	1.1102816	9.9332590	8.9466125	44.9290566
0.4000000	0.3998658	2.8178244	0.9996645	7.0445610	7.0469250	39.7067213
0.5000000	0.4544769	2.5511984	0.9089539	5.1023967	5.6134825	35.2409897
0.6000000	0.4999661	2.2599849	0.8332769	3.7666416	4.5202760	31.3877733
0.7000000	0.5384452	1.9798714	0.7692074	2.8283877	3.6770158	28.0338058
0.8000000	0.5714208	1.7252062	0.7142759	2.1565077	3.0191520	25.0902758
0.9000000	0.5999963	1.5001092	0.6666626	1.6667880	2.5001974	22.4873188
1.0000000	0.6249983	1.3040938	0.6249983	1.3040938	2.0865559	20.1696064
1.1000000	0.6470580	1.1346821	0.5882346	1.0315292	1.7536018	18.0929499

AGE LIABLE TO CAPTURE (2.0000000)

0.1000000	0.0778178	2.3297276		0.7781784	23.2972760	29.9382205	107.5586023
0.2000000	0.1366956	3.4717474		0.6834778	17.3587372	25.3976622	101.9351835
0.3000000	0.1826013	3.9770133		0.6086709	13.2567109	21.7797663	97.1359663
0.4000000	0.2193245	4.1423127		0.5483112	10.3557817	18.8866870	93.0261774
0.5000000	0.2493469	4.1286596		0.4986937	8.2573192	16.5578959	89.4872532
0.6000000	0.2743441	4.0239108		0.4572402	6.7065179	14.6673851	86.4194822
0.7000000	0.2954810	3.8761466		0.4221157	5.5373523	13.1180925	83.7411423
0.8000000	0.3135893	3.7116100		0.3919866	4.6395125	11.8358966	81.3860836
0.9000000	0.3292779	3.5444672		0.3658644	3.9382969	10.7643635	79.3010731
1.0000000	0.3430026	3.3821484		0.3430026	3.3821484	9.8604168	77.4432325
1.1000000	0.3551110	3.2283350		0.3228282	2.9348500	9.0910587	75.7779140

AGE LIABLE TO CAPTURE (3.0000000)

0.1000000	0.0423825	2.3331303		0.4238252	23.3313034	55.0493541	146.7143459
0.2000000	0.0746789	3.7380185		0.3733943	18.6900923	50.0545688	142.5253124
0.3000000	0.0999446	4.5844130	MAX	0.3331487	15.2813766	45.8695340	138.8809204
0.4000000	0.1201791	5.0912954	YPR	0.3004476	12.7282383	42.3642492	135.7118740
0.5000000	0.1367202	5.3896509		0.2734404	10.7793018	39.4210229	132.9507847
0.6000000	0.1504847	5.5586885		0.2508078	9.2644808	36.9385686	130.5363865
0.7000000	0.1621151	5.6468594		0.2315929	8.0669420	34.8324189	128.4152565
0.8000000	0.1720723	5.6841637		0.2150903	7.1052046	33.0335813	126.5419674
0.9000000	0.1806942	5.6893994		0.2007714	6.3215549	31.4863369	124.8785019
1.0000000	0.1882336	5.6744933		0.1882336	5.6744933	30.1460109	123.3932848
1.1000000	0.1948831	5.6470895		0.1771665	5.1337178	28.9768000	122.0602055

AGE LIABLE TO CAPTURE (4.0000000) MIN SIZE

0.1000000	0.0229010	2.0061704		0.2290104	20.0617039	87.6017065	177.7359333
0.2000000	0.0405678	3.3653166		0.2028392	16.8265829	82.9552937	174.7706375
0.3000000	0.0544875	4.2988021		0.1816251	14.3293405	78.8951569	172.1262360
0.4000000	0.0656740	4.9492210	OY	0.1641851	12.3730525	75.3603792	169.7765846
0.5000000	0.0748288	5.4091578	YPR	0.1496576	10.8183156	72.2871141	167.6918812
0.6000000	0.0824446	5.7392659		0.1374076	9.5654432	69.6136255	165.8417072
0.7000000	0.0888733	5.9796740		0.1269618	8.5423914	67.2831488	164.1969986
0.8000000	0.0943704	6.1572198		0.1179630	7.6965247	65.2452612	162.7311230
0.9000000	0.0991245	6.2900661		0.1101383	6.9889622	63.4562330	161.4203548
1.0000000	0.1032771	6.3906564		0.1032771	6.3906564	61.8787065	160.2439613
1.1000000	0.1069363	6.4676337		0.0972149	5.8796670	60.4811568	159.1840477

* Age liable to capture (3.5).

Prevailing YPR was estimated between the values presented for age liable to capture = 3.0 (YPR = 5.09) and age liable to capture = 4.0 (YPR = 4.95).

YPR = 5.02.

Table A 15. Yield-per-recruit parameters for snappers (Lutjanidae).

SPECIES	t_c	t_r	t_o	t_λ	K	Z	M	F	L_∞ (mm)	LENGTH-WEIGHT RELATIONSHIP W =	GEOGRAPHIC AREA	SOURCE*
L. camphechanus (Red snapper)	2		0.10		0.175	0.80	0.30	0.50	950	$2.04 \times 10^{-5} TL^{2.953}$	Louisiana All areas	Nelson and Manooch (1982)
			-0.10		0.170	0.43	0.30	0.13	941		Panama City	
			-0.01		0.155	0.58	0.30	0.28	970	$1.36 \times 10^{-5} L^{3.017}$	Daytona, Florida	Nelson and Manooch (1982)
			-0.01		0.165	0.35	0.30	0.05	970	$3.15 \times 10^{-5} L^{2.887}$	North and South Carolina	Nelson and Manooch (1982)
	5			16	0.170				941		Gulf of Mexico	Nelson (1980)
			0	16	0.160				975			
L. griseus (Gray snapper)				18	0.101				890		Florida	Manooch (1982)
			-1.2745	21	0.0878				890	$2.4 \times 10^{-8} L^{2.9122}$	Northeast Florida, Gulf of Mexico	Manooch and Matheson (unpubl.)
O. chrysurus (Yellowtail snapper)			-0.305	14	0.288				600.2	$6.13 \times 10^{-5} L^{2.76}$	Southern Florida, East and West Coasts of Florida	Johnson (unpubl. ms.)
					0.160		0.20		529	$7.327 \times 10^{-5} L^{2.73927}$	Cuba	Piedra (1965)
R. aurorubens (Vermilion snapper)			0.1277		0.198				626.5	$1.722 \times 10^{-5} TL^{2.9456}$	North and South Carolina	Grimes (1976)
L. buccanella (Blackfin snapper)									470	Log W = 3.05 Log $(FL)^{-4.86}$	Puerto Rico	Boardman and Weiler (1980)
L. vivanus (Silk snapper)	2								1170	Log W = 3.10 Log $(FL)^{-5.0}$	U. S. Virgin Islands	Boardman and Weiler (1980)
L. analis (Mutton snapper)					0.120	0.87	0.20	0.67	807.5		Cuba	Baisre and Paez (undated)

*References are in Source Document

Table A-16. Yield-per-recruit parameters for sea basses and groupers (Serranidae).

SPECIES	t_c	t_r	t_o	t_λ	K	Z	M	F	L_∞ (mm)	LENGTH-WEIGHT RELATIONSHIP W =	GEOGRAPHIC AREA	SOURCE*
C. striata (Black sea bass)			0.1855	10	0.222		0.27		350	$2.654 \times 10^{-5} L^{3.0237}$	North and South Carolina	Mercer (1978)
						0.60 - 0.83	0.30	0.30 - 0.53			South Carolina and Georgia	Low (1981)
				10	0.088				625		South Carolina	Cupka et al. (1973)
E. morio (Red grouper)	1		-0.449		0.179	0.322			672	$4.3441 \times 10^{-5} L^{2.9287}$	Central West Florida	Moe (1969)
	3		0.090574	25	0.11269	0.48	0.20	0.28	928	$1.4791 \times 10^{-4} L^{2.5895}$	Mexico	Melo (undated)
					0.159	0.48	0.33	0.15	802		Mexico	Baisre and Paez (undated)
E. drummondhayi (Speckled hind)	3.3		-1.92	15	0.088		0.09-0.30	0.21 - 0.31	1105	$1.1 \times 10^{-8} L^{3.073}$	North and South Carolina	Matheson (1981)
E. niveatus (Snowy grouper)	3.3		-2.32	17	0.063		0.06-0.30		1350	$7.0 \times 10^{-8} L^{2.755}$	North and South Carolina	Matheson (1981)
E. guttatus (Red hind)	3		-0.44	8	0.180		.20		420		Caribbean, Florida Keys, Bermuda	Burnett-Herkes (1975)
	2				0.240	0.68-0.90			520	$1.76 \times 10^{-5} L^{2.960}$	South Jamaica Shelf	Thompson and Munro (1974b)
E. cruentatus (Graysby)			-0.94	10	0.13		0.13		415	$0.0121 L^{3.0821}$	Curacao	Nagelkerken (1979)
E. fulva (Coney)					0.63				340	$0.729 L^{2.574}$	Caribbean	Thompson and Monro (1974b)
M. microlepis (Gag)			-1.127	>13	0.122		0.20		1290	$1.2 \times 10^{-8} L^{2.996}$	North and South Carolina, Georgia, Northern Florida	Manooch and Haimovici (1978)
M. phenax (Scamp)	1		-3.91	21	0.067				1090	$2.4 \times 10^{-8} FL^{2.910}$	North and South Carolina	Matheson (unpubl. data)
E. striatus (Nassau grouper)	4		0.488		0.185				974	$0.1393 L^{3.112}$	St. Thomas, U. S. V. I.	Olsen and LaPlace (1978)
					0.09		0.17 - 0.30			$0.0107 L^{3.112}$	South Jamaica	Thompson and Munro (1974b)

*References are in Source Document.

Table A-17. Yield-per-recruit parameters for porgies (Sparidae).

SPECIES	t_c	t_r	t_o	t_λ	K	Z	M	F	L_∞ (mm)	LENGTH-WEIGHT RELATIONSHIP W =	GEOGRAPHIC AREA	SOURCE*
P. pagrus (Red porgy)	5		-1.88		0.096		0.20		763	$2.524 \times 10^{-5} L^{2.8939}$	North and South Carolina	Manooch and Huntsman (1977)
C. nodosus (Knobbed porgy)			-1.746		0.212	0.52			469	$e^{-2.86 + .0073L}$	South Atlantic Bight	Horvath and Grimes (unpubl. data)
C. leucosteus (Whitebone porgy)			-2.639		0.1739					$4 \times 10^{-5} FL^{2.907}$	South Atlantic Bight	Waltz et al. (in press)
S. caprinus (Longspine porgy)				2.5-3.0		1.77-4.61			256	$\text{Log } W = -4.85 + 3.05 \text{ Log } L$	Gulf of Mexico	Geoghegan (1981)

*References are in Source Document.

Table A-18. Yield-per-recruit parameters for grunts (Pomadasyidae).

SPECIES	t_c	t_r	t_o	t_λ	K	Z	M	F	L_∞ (mm)	LENGTH-WEIGHT RELATIONSHIP W =	GEOGRAPHIC AREA	SOURCE*
H. plumieri (White grunt)			-1.007	13	0.1084	0.46 - 0.71	0.40 - 0.60		640	$1.426 \times 10^{-5} L^{3.0229}$	North and South Carolina	Manooch (1977a)
H. aurolineatum (Tomtate)	4		1.28	9	0.22017	0.887			310	$0.86 \times 10^{-5} L^{3.0905}$	North and South Carolina, Georgia Florida to Cape Canaveral	Manooch and Barans (1982)
					0.235				295		Campeche Banks	Sokolova (1969)
H. album (Margate)					0.196	1.0	0.33	0.67	621		Cuba	Baisre and Paez (undated)
H. sciurus (Blue striped grunt)					0.184	1.7	0.32	1.38	497		Cuba	Baisre and Paez (undated)

*References are in Source Document.

APPENDIX B

RESPONSES TO COMMENTS

Section I	Agency
Section II	Public
Section III	Scientific

Section I: Agency

1. Comment: Must specify total benefits and costs of the plan.

   Response: The "no action" alternative (Section 10.19) has been expanded and the benefit/cost ratio ranges from $3.80 to $7.61 for each dollar invested.

2. Comment: Short term impacts must be discussed.

   Response: See the percent "loss" and percent "gain" in the FMP for each year under the expanded "impact and rationale" for each minimum size.

Vermilion snapper	Section 10.3
Red snapper	Section 10.4
Yellowtail snapper	Section 10.5
Black sea bass	Section 10.6
Red grouper	Section 10.7
Nassau grouper	Section 10.8

3. Comment: Discuss distributional impacts.

   Response: Distributional impacts are now under separate headings under each of the species. The importance is emphasized in the expanded section on evaluating minimum sizes (Section 10.2; Figure 10-1). The conclusion for each species is that there are no expected distributional impacts (redistribution among user groups) except those discussed for trawls (Section 10.3) and gray snapper (Section 10.19.4). Emphasis is placed on responses at public hearings; almost everyone agreed with the minimum sizes. Recreational fishermen will still receive the angling "benefits" of catching (then releasing) fish under the minimum size limits. For both recreational and commercial fishermen larger fish are preferred to smaller fish. Black sea bass commercial fishermen presently catch fish equal to or larger than the proposed minimum size of 8 inches total length due to the trap retention size. That is, the majority of fish caught are larger than the minimum size.

4. Comment: Restate OY as the summation of the OY's specified for individual species.

   Response: All references to fishery or complex MSY, OY, DAH, DAP or TALFF have been deleted. These values are now presented in the plan in terms of YPR values for each species. The OY for jewfish is expressed in terms of pounds of fish.

5. Comment: Need a technique to arrive at a numerical estimate of OY to establish a TALFF.

   Response: Numerical estimates of OY are now presented in Section 9.1. TALFF is zero because DAH YPR is less than OY YPR.

6. Comment: A numerical estimate of DAH is necessary to determine TALFF.

   Response: A numerical estimate of DAH is presented for species with minmimum sizes and for jewfish. A TALFF does not exist for other species in the fishery that are not included in OY because there would be a bycatch of the species for which there is no TALFF.

7. Comment: Determination of consistency with Florida, South Carolina, and North Carolina CZM is required.

   Response: The CZM package was sent to the States after the final FMP was approved by the Council. Section 13.1 discusses the interactions with state regulations.

8. Comment: Have future minimum size changes or additional species added by regulatory amendment.

   Response: This has been done in Section 10.2.3.

9. Comment: Regulatory amendment must also adjust OY, DAH, TALFF.

   Response: This has been done in Section 10.2.3.

10. Comment: Mesh size for trawls should apply only to roller trawls.

    Response: Applies only to trawls targeting species in the management unit (Section 10.3). Define trawls that target species in the fishery as those where 25 percent or more of the catch by weight is comprised of species in the management unit. Shrimp trawls, calico scallop trawls and rock shrimp trawls are specifically excluded.

11. Comment: Inadequate information on the effectiveness of a 4 inch mesh to release small vermilion snapper.

    Response: Section 10.3 was expanded and now presents adequate rationale for the 4 inch mesh requirement.

12. Comment: Not much of the FCZ is within the 100 foot depth contour north of Miami Beach to Jupiter Inlet.

    Response: The 100 foot restriction north of Fowey Rocks Light (Miami) was dropped (Section 10.9).

13. Comment: Further consider 60 foot contour recommended by trap fishermen.

    Response: The 60 foot and 120 foot contours were recommended by many at public hearings because 60-120 ft is the most productive bottom in the Florida Keys (South of Fowey Rocks). The Council still recommends the 100 foot contour based on material presented in Section 10.9.

14. Comment: Consider alternative size limits.

Response: Criteria for choosing the size limits are expanded in Section 10.2. It is neither practical nor efficient to make innumerable computer runs on size limits that do not meet these criteria.

15. Comment: Consider alternative OY's.

Response: Optimum yields are simply the result of minimum sizes that meet the IRR and distributional criteria (Steps 1-3, Section 10.2). The steps in this analysis that justify the minimum sizes are in fact the evaluation of OY.

16. Comment: Discuss all other alternatives ever considered.

Response: The administrative record is complete; we believe all the important alternatives are now adequately discussed in the FMP.

17. Comment: Management unit should include the territorial sea.

Response: Regulations apply in the FCZ, statistical reporting applies in the FCZ and territorial sea (Section 5.3).

18. Comment: Clarify what portion of this fishery is in the FCZ.

Response: The major portion of the snapper-grouper commercial fishery is in the FCZ, approximately 98 percent of total regional landings. According to NMFS landings data, 1.5 percent of North Carolina's landings, 0.6 percent of Georgia's, 0.1 percent of South Carolina's, and 4.1 percent of Florida's landings were in the territorial sea in 1980. Recreational landings in 1979 were distributed as follows: 42.3 percent in the FCZ; 33.3 percent in the territorial seas; 6.9 percent in inland waters; and 16.4 percent unknown.

19. Comment: Specify data elements required to monitor the fishery.

Response: Section 10.18 has been expanded to specify the data elements required.

20. Comment: FMP will have a significant impact under Regulatory Flexibility Act. Council does not need to make this determination; delete this section.

Response: Sections 10.20, Paperwork Reduction Act, and 10.21, Regulatory Flexibility Act, have been deleted. NMFS will make these determinations.

21. Comment: Clarify for regulations whether fish are to be landed in the round to enforce size limits.

Response: The FMP now specifies that fish in the management unit are to be landed with heads and fins intact.

22. Comment: Management measures should be tied to stated objectives of the FMP. There are no stated objectives for the SMZ and the trap measures.

Response: Objective number 3, "Promote orderly utilization of the resource" was added.

23. Comment: Since the area to the Dry Tortugas is included in the management unit, there should be some mention of the Federal wildlife refuge (Marquesas Keys-Key West National Wildlife Refuse) and the National Park Service area (Dry Tortugas-Fort Jefferson National Monument). Fort Jefferson limits commercial and head boat harvesting of all species in this complex and is maintained as a pristine, natural coral reef which probably functions as a sanctuary for the early life history stages of groupers and snappers.

Response: These areas are mentioned in the Source Document as background material for the FMP.

24. Comment: Stenotomus aculeatus, the southern porgy, is the scientific name of the species found in the South Atlantic Bight. S. caprinus is the species found primarily in the Gulf.

Response: S. aculeatus is not listed in the American Fisheries Society List of Common and Scientific Names of Fishes from the United States and Canada, 1980 edition. Therefore, the name S. caprinus will continue to be used in the FMP at this time.

Section II: Public

Two series of public hearings were held on the DEIS/FMP. The first 10 hearings were held on an earlier July 1982 draft at the following locations:

August 31, 1982	Cocoa, Florida
August 31, 1982	Key West, Florida
September 1, 1982	Jacksonville Beach, Florida
September 1, 1982	Miami, Florida
September 2, 1982	Savannah, Georgia
September 2, 1982	Palm Beach Gardens, Florida
September 7, 1982	Morehead City, North Carolina
September 7, 1982	Charleston, South Carolina
September 8, 1982	Wilmington, North Carolina
September 9, 1982	Surfside Beach, South Carolina

The plan was revised based on written and public hearing comments. Public hearings on the changes in the plan were then held:

December 7, 1982	Key Largo, Florida
December 8, 1982	Jacksonville Beach, Florida
December 9, 1982	Wilmington, North Carolina

A total of 32 letters were received from the public at Council headquarters commenting on the DEIS/FMP. Approximately 213 persons attended the 10 hearings in August/September while approximately 76 attended the 3 hearings in December.

COMMENTS AND RESPONSES

SIZE LIMITS

1. Comment: Species other than the five mentioned in the plan should have minimum sizes placed on them.

   Response: A minimum size for yellowtail snapper has been added to the plan. The rationale for minimum sizes on other species that were analyzed and rejected is found in Section 10.19.

2. Comment: There is no tolerance for measurement error associated with specified minimum sizes. This might be appropriate in situations where the fish are brought in singly, but it is neither practical nor efficient to accurately measure each fish as it is brought aboard with longlines or trawls.

   Response: This is to be left to the discretion of enforcement officers.

3. Comment: Head boats should be exempt from the black sea bass minimum sizes.

   Response: In order for minimum sizes to increase yields in the future, all sectors of the fishery must comply with the regulations.

4. Comment: Party boats catching black sea bass should have in front of each fishing station an 8 inch measurement on the rail.

   Response: How party boats inform customers of fishing regulations will be left up to the individual captains.

5. Comment: A captain should decide whether a dead fish should be kept.

   Response: The plan is specific in stating which fish have minimum sizes placed on them. Those that are undersized must be released.

6. Comment: Include information in the plan on whether the spawning stock is protected by minimum sizes.

   Response: The plan now has information on size at spawning for the six species being regulated (Section 8.1.2).

7. Comment: Because survival of fish brought up from depths over 60 feet is poor, minimum sizes will result in many dead, wasted fish.

   Response: The survival of the six species being regulated was considered in the analyses and long-term yield still increases. Sections 10.3-10.8 give the expected survival rate of the six regulated species.

TRAWL MESH SIZE

1. Comment: Eight inches is a better minimum size for vermilions.

2. Comment: Four inch stretch mesh should be enough to comply with the law and any fish caught should be kept.

3. Comment: Four inch stretch is too big; small vermilions are valuable in the market.

4. Comment: The measure on trawl mesh size is unclear as to the type of vessels involved. The wording is also unclear about vermilion snapper that may be retained.

5. Comment: Roller trawl mesh size (4 inches) does not release all 12 inch vermilion snappers and could cause sorting problems if other minimum size possession requirements apply to trawls.

   Response to Comments 1-5:
   Data support the 4 inch mesh regulation even though relatively small numbers of vermilion below 12 inches are still retained. Preliminary RV *Georgia Bulldog* data show that removing a 2 and 3/4 inch bag liner (which results in 3 and 1/2 inch stretch mesh) reduced the catch from 185 pounds/trawl to 13.4 pounds/trawl (92.8%; Cruise #3, May 1981). On cruise #5 (June 1981) removing a small mesh bag liner (resulting in 3 and 1/2 inch mesh) reduced the

catch from 263.3 pounds/trawl to 62.1 pounds/trawl (76.4%). Vermilion snapper under 12 inches were still retained, but no vermilion over 12 inches were caught because they were not present in the areas fished. Red snappers and black sea bass caught by trawl would have to be measured. The Council decided that the mesh size regulation would be the most effective method of releasing small vermilion snapper. The regulation specifies the type vessels to which it applies.

FISH TRAPS

1. Comment: Numerous recommendations for changes in the prohibition area for traps were received as follows:

Shoreward of the 60 foot contour south of Jupiter Inlet Light
Shoreward of the 120 foot contour south of Jupiter Inlet Light
Shoreward of the 60 foot contour south of Broward Light
Shoreward of the 120 foot contour from Fowey Light south
Shoreward of the 60 foot contour south of Fowey Light
Shoreward of the 100 foot contour south of Ft. Pierce Inlet
Shoreward of the 600 foot contour south of Cape Canaveral

Response: Fish traps north of Fowey Light to Jupiter Inlet Light, if confined to seaward of the 100 foot contour, would be in territorial waters. Fish traps south of Fowey Light in the Florida Keys and north of Jupiter Inlet Light are predominantly in the FCZ. To avoid any conflict with the State of Florida, the proposed measure was rewritten to specify the 100 foot contour in the FCZ south of Fowey Light.

2. Comment: The 100 foot contour would put small fish trap boats out in sea lanes with large vessels and place them in danger. Also, this would increase the possibility of losing gear. Fishermen would be forced into nonproductive areas off the reef slopes, and kept out of the greatest portion of the Tortugas fishery.

Response: The most productive fishing area occurs on the outer reef break from 60 feet to 120 feet south of Fowey Light. Small fish trap boats are already prohibited in inshore, territorial waters.

3. Comment: Arguments that traps should be eliminated because of hooks snagging trap buoys are not true.

Response: This reference to navigation and snagged hooks has been deleted from the plan.

4. Comment: Trappers south of Cape Canaveral would like to be able to pull their fish traps at night.

Response: Originally trappers south of Cape Canaveral asked that this restriction on pulling traps at night be placed in the plan as a safeguard for their traps. This measure was not changed.

5. Comment: Regulations should specify the time required for escape panels to degrade. This regulation should apply to all traps.

Response: Regulations will specify the time during which panels should degrade and this will apply to all fish traps in the South Atlantic FCZ.

6. Comment: The FMP should distinguish between black sea bass traps and snapper-grouper traps off Florida. The 1.5 inch hexagonal and 1x2 inch rectangular mesh used for black sea bass result in capture of small fishes in southern Florida water. A minimum mesh size of 2 x 4 inches rectangular should be used south of Cape Canaveral.

Response: The mesh size limit was selected to prevent traps with smaller mesh from being used.

7. Comment: Fish trap mesh size of 1x2 inches prohibits the development of any alternative materials or practices. Various mesh sizes are recommended.

Response: Any mesh shape is acceptable as long as the opening is equal to or larger than a 1.5 inch hexagon. In the FMP evidence is given that black sea bass smaller than 8 inches were not retained generally in the traps with the specified mesh size.

8. Comment: Traps should be prohibited in Federal waters. Allowing unrestricted use of fish traps in the FCZ will make Florida regulations difficult to enforce.

Response: All fishery management plans must be consistent with the seven National Standards specified in the MFCMA. Prohibiting trap fishing would not be consistent with National Standard 4 which states that, if management measures assign or allocate fishing privileges, the allocation shall be fair and equitable to all such fishermen.

9. Comment: If traps are allowed on the heavily used outer reef break regions (60-120 foot), a limited resource will be inequitably allocated to a very small sector of the entire user group, the trap fishermen, due to the extreme efficiency of fish traps.

Response: There are insufficient data on long-term use of fish traps in U.S. waters to prohibit trap fishing altogether.

10. Comment: The contention that traps are more efficient than hook and line fishing is debatable, but attacking traps because of their efficiency is counterproductive because a major goal of the fishing industry is increasing its economic and energy efficiency.

Response: The Council recognizes that fish traps are efficient and have adopted an "allow and regulate" position. Fish trap regulations are designed to minimize adverse impacts while allowing use of traps.

11. Comment: Degradable panels establish a management strategy without sufficient scientific justification.

Response: The best available information indicates that wire fish traps will continue to catch fish if lost (referred to as Ghost traps). The degradable panels will allow for escapement of trapped fish.

12. Comment: Because there is "documented conflict" is no reason to place fish traps beyond the 100 foot contour. The "conflict" is based on a misinformed public.

Response: The Council has chosen to mitigate competition along the narrow shelf in South Florida by separating the user groups. In this way trapping can occur seaward of the 100 foot contour, and diving and hook and line fishing can occur shoreward of the 100 foot contour without encountering fish traps.

POWERHEAD PROHIBITION

1. Comment: Powerheads should be allowed because they are used for protection, they kill fish instantly, they are not environmentally harmful, and commercial divers have a large financial investment in their gear and vessels. Powerheads should not be classified with explosives and poisons.

2. Comment: Powerheads should not be allowed to take any fish; they should be allowed for protection only.

Response to (1) and (2):
The Council deleted the prohibition on powerheads after reviewing the many comments received on this issue. To protect jewfish, a measure placing a prohibition on the taking of jewfish with a speargun or powerhead is proposed.

3. Comment: Landing statistics on jewfish are inaccurate. Divers want to be able to land jewfish. A size limit or bag limit on jewfish would be more equitable. Jewfish are the most valuable grouper meat in Key West. There is no reason to separate jewfish from other groupers. Aesthetic value alone is not enough to prohibit the taking of jewfish; if there is a problem with the resource then restrict harvest.

Response: NMFS landing statistics are the most up-to-date statistics on commercial fish available. The Council evaluated the biological, social and economic data available and has concluded that protection of jewfish is justifiable to increase the aesthetic enjoyment of recreational diving.

ROLLER TRAWLS

1. Comment: Roller trawls damage live bottom and should be phased out or banned, especially until studies now going on are completed.

2. Comment: Roller trawls take large numbers of small fish non-selectively. Since there are only 25-30 roller rigged vessels taking 16 percent of the total catch in the fishery, the economic consequences from banning their use is small compared to possible damage to the resource, the live bottom habitat, or the recreational fishery in Florida.

Response to (1) and (2):
The Council placed the highest research priority on roller trawl studies and reviewed preliminary results from a Georgia DNR study. Prohibition on roller trawls in a specific area is incorporated in the Coral FMP.

SPECIAL MANAGEMENT ZONES

1. Comment: The requirements for establishing a Special Management Zone (SMZ) around artificial reefs are too complicated and take too much time.

2. Comment: Establishing a SMZ around artificial reefs could lead to partitioning areas of the ocean for private use.

Response to (1) and (2):
The Council simplified the requirements for SMZ establishment. Developers may choose among broadly defined public uses and all individuals of specified user group categories have public access. Constraints imposed on a SMZ will prevent an otherwise common property resource from being partitioned to an identifiable user group.

GENERAL

1. Comment: Seriola zonata, the banded rudderfish, should be added to the species management list.

Response: The banded rudderfish (a small jack) is not commercially or recreationally important at the present time.

2. Comment: Prohibit the taking of any species in the snapper-grouper fishery by any means other than hook and line.

Response: The National Standards will not allow this.

3. Comment: Growth overfishing (Section 7.0, paragraph 1) is not justified under any circumstances and should not be permitted. As sportfishermen, we do not believe in or condone overfishing by any name.

Response: The ranges of yield (Secton 10.2.1) and criteria for evaluating minimum sizes (Section 10.2.2) are the basis for Council decisions as to whether or not growth overfishing is justified. In instances where the mortality of released fish is high, minimum sizes are not effective and other techniques will be proposed as plan amendments.

4. Comment: In addition to the minimum size limits used in the Council's recommendations, we would also endorse and recommend bag limits and closed seasons for spawning where a species population has been determined to be declining, and total closed seasons for species with populations proven to have seriously declined.

Response: There is no evidence that any species covered by this plan are in a state of recruitment overfishing. Minimum sizes are proposed as a first line technique to prevent growth overfishing. Time/area closures and quotas will be used as second line techniques for species with high release mortality.

5. Comment: We recommend revising of the management objectives of the FMP (Section 7.0) to establish a goal of limiting the total annual catch by species to those levels that the fish can replenish on an annual basis so as to maintain each species total population at its natural level.

Response: Quota management for the total fishery cannot prevent overfishing of individual species. Rejected Management Measure #23 (Section 10.19.23) describes why this approach will not work.

6. Coment: The snapper-grouper fishery should be managed by a zone-allocation system. Management should fairly allocate the resource between all user groups. Additional data need to be collected on the fishery as well as the biology of snapper-grouper complex species to justify management criteria.

Response: Rejected Management Measure #23 (Section 10.19.23) explains the shortcomings of quota management. Zone-allocation is subject to the same shortcomings and is also very costly in terms of enforcement costs and data requirements. Research needs are outlined in Section 11.0.

7. Comment: A system should be implemented to discourage or prohibit recreational anglers and spear fishermen from marketing their catch.

Response: Any management measure designed to address this issue would be expensive and difficult to enforce. In addition, the question of the Council having authority to regulate the ultimate disposition of a product has not been clearly resolved.

8. Comment: Permit or license all commercial vessels with a substantial fee.

Response: This is one of the measures considered and rejected by the Council (Section 10.19.25).

SECTION III: SCIENTIFIC

1. Comment Use of the YPR-IRR techniques based on parameters taken in one area could result in regulations which are justified only for that area.

   Response: In the future, sensitivity analyses will be done to indicate what happens with different growth, mortality and fishing pressure.

2. Comment: Estimated fishing mortality (F) is the most crucial but least reliable value in the YPR-IRR analyses. It varies over time and by location.

   Response: To avoid immediate and future problems, YPR-IRR analyses on minimum sizes should be based on documented growth, mortality, and release survival rates, but if theoretical fishing mortality (F) has not been estimated other qualitative information (e.g. public hearing with yellowtail snapper) should be used. The minimum sizes that have been chosen in all cases correspond to the criteria of stabilizing YPR over the widest range of fishing mortality (Section 10.2.2) rather than maximizing YPR for a given mortality which is much more sensitive to an accurately estimated fishing pressure.

3. Comment: Natural mortality (M) may change for long-lived fish (e.g. grouper). Mid-life values may be lower than those used in the analysis which would make size limits more favorable. Recruitment may be non-constant.

   Response: Changing mortality values are outside our modelling capabilities at this time, but we will work on the problem looking towards future modifications of the plan. We are also artificially restricted by other assumptions such as constant recruitment. All of these modifications will be future refinements and improvements.

4. Comment: How can current fishing be near MSY in 1979 if the existing YPR in Table 8-2 is approximately 66 percent of the maximum YPR?

   Response: We have removed all references to "complex" status. It is not necessary; the plan regulates by species.

5. Comment: Yellowfin grouper, black grouper, and gag, and Nassau and red grouper are not sufficiently similar to expect YPR to be similar by analogy.

   Response: In these cases, the only similarities that are compared are age, growth, and mortality parameters. Since these parameters are similar, the species are evaluated by analogy. Their habitat preferences, home range, and color are not being compared.

6. Comment: Elaborate on the criteria for choosing minimum sizes. Why weren't several alternative sizes for each species analyzed and the benefits and costs for each alternative discussed?

Response: The criteria for choosing minimum sizes are presented in Section 10.2. The objective of the plan is to stabilize yield for specific species over an expected range of fishing pressure. This is the theoretical yield, derived from a YPR analysis. It is not derived by experimentation. The benefits and costs are estimated from data in the YPR appendixes (Appendix A).

7. Comment: In Section 8.1.9, Probable Future Conditions, it is stated that without regulations, growth overfishing will significantly reduce potential yield and recruitment failures could occur. In the YPR appendix, the yield without regulations remains constant over 20 years.

Response: A table of the differing equilibrium values from Appendix A will be placed in the No Action Section, 10.19.1 (Table 10-3).

8. Comment: An ex-vessel price response equation showing price flexibility is needed.

Response: An ex-vessel price response equation is neither available at this time, nor needed for proposed management measures.

9. Comment: In the YPR tables in Appendix A it would be more helpful if the results were presented with the age of first capture varying within a given F rather than F varying within a given age at first capture.

Response: That is the way the NMFS computer prints the program. We shall search for alternative printing formats.

10. Comment: There are problems with using the Beverton-Holt YPR model for reef fishes. Incomplete recruitment cannot be accounted for with this model. This model also relies on von Bertalanffy growth parameters which are derived from theoretical back-calculated size at age. Young fish of many species do not follow this growth curve. Also, the YPR approach ignores economic considerations.

Response: This is still the best method available. The IRR analysis (Section 10.2.2) is the economic consideration.

11. Comment: The three percent IRR concept does not seem to include a measure of variability or confidence intervals. The existing YPR data should be analyzed to determine if the data are accurate enough to justify considering levels as low as 3 percent.

Response: The criteria presented in Section 10.2.2 establish a threshold of 3 percent IRR. In all cases the actual IRR was greater than 3 percent. Sensitivity analyses will be done in the future.

APPENDIX C

WRITTEN COMMENTS

Section I	Agency Comments
Section II	Public Comments

C-2

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Washington, D.C.

OFFICE OF THE ADMINISTRATOR

August 13, 1982

Dear Reviewer:

In accordance with provisions of the National Environmental Policy Act of 1969, we enclose for your review our draft environmental impact statement/fishery management plan and regulatory impact review for the Snapper/Grouper Complex of the South Atlantic Region.

Any written comments or questions you may have should be submitted to the responsible official identified below by October 5, 1982. Also, one copy of your comments should be sent to me in Room 5813, U.S. Department of Commerce, Washington, D.C. 20230.

RESPONSIBLE PERSON

Mr. David H. G. Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

Phone: 803/571-4366

Thank you.

Sincerely,

Joyce Wood

Joyce M. T. Wood
Director
Office of Ecology
and Conservation

Enclosure

SECTION I: AGENCY COMMENTS

C-4

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1229
GALVESTON, TEXAS 77553

REPLY TO
ATTENTION OF:

SWGED-E

23 August 1982

Mr. David H. G. Gould
Executive Director
South Atlantic Fishery Management
Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

RECEIVED
AUG 27 1982
SOUTH ATLANTIC FISHERY
MANAGEMENT C...
CHARLESTON, S.C. 29407

Dear Mr. Gould:

This is in response to your letter dated 13 August 1982, which provided a copy of the draft environmental impact statement/fishery management plan and regulatory impact review for the Snapper/Grouper Complex of the South Atlantic Region for our review and comments.

We have no comments on the document. The opportunity for review is appreciated.

Sincerely,

for JOSEPH C. TRAHAN
Chief, Engineering
and Planning Division

Copy furnished:
Ms. Joyce M. T. Wood
Director
Office of Ecology and
Conservation
U.S. Department of Commerce
National Oceanic and Atmospheric
Administration
National Marine Fisheries Service
Washington, D.C.

DEPARTMENT OF THE AIR FORCE
REGIONAL CIVIL ENGINEER, EASTERN REGION (HQ AFESC)
526 TITLE BUILDING, 30 PRYOR STREET, S.W.
ATLANTA, GEORGIA 30303

REPLY TO ATTN OF: ROV2

30 August 1982

SUBJECT: Draft Fishery Management Plan, Regulatory Impact Review and Environmental Impact Statement for the Snapper-Grouper Complex of the South Atlantic Region

TO: South Atlantic Fishery Management Council
Attn: Mr. David H. G. Gould
Executive Director
Suite 306
Southpark Building
1 Southpark Circle
Charleston, South Carolina 23407

Execution of the subject management plan will not impact on Air Force operations in the South Atlantic Region. Thank you for the opportunity to review this document. Our point of contact is Mr. Winfred G. Dodson, telephone number (404) 221-6821/6776.

Thomas D. Sims

THOMAS D. SIMS
Chief
Environmental Planning Division

Cy to: US Dept of Commerce/Ms. Wood

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

4PM-EA/GM

SEP 30 1982

Mr. David Gould
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

Dear Mr. Gould:

We have reviewed the Draft Environmental Impact Statement /Fishery Management Plan for the Snapper/Grouper Complex of the South Atlantic Region. On the basis of our review, a rating of LO-1 was assigned. That is, we do not anticipate any significant adverse environmental consequences from the proposal and no further information is requested.

If we can be of any further assistance, please do not hesitate to call.

Sincerely yours,

for R. B. Rogers
Sheppard N. Moore, Chief
Environmental Review Section
Environmental Assessment Branch

United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW

Southeast Region / Suite 1384
Richard B. Russell Federal Building
75 Spring Street, S.W. / Atlanta, Ga. 30303

October 8, 1982

ER 82/1388

Mr. David H. G. Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

Dear Mr. Gould:

The Department of Interior has reviewed the draft Environmental Statement/Fishery Management Plan, and Regulatory Impact Review for the Snapper-Grouper Complex of the South Atlantic Region as requested by Joyce M. T. Wood, Director of the Office of Ecology and Conservation for National Oceanic and Atmospheric Administration, by letter of August 13, 1982.

General Comments

We assume that "catch" as referred to in this report refers to harvest and not total mortality due to fishing. Although not stated, it is also assumed that surplus production modeling will be used for stock assessment during the future when good catch per unit effort data are available. This assumption is made because some of the research needs for more accurate yield per year analysis have been listed as Low Priority Needs (page 64) and harvest statistics are listed as High Priority Needs (pages 63 and 64). We recommend that the plan contain some type of monitoring during the interim period (until about 10 years of adequate harvest statistics can be assembled) to determine if the management measures enacted by the plan are accomplishing the desired objectives.

Specific Comments

Page 3, Table S-1, Porgies-Sparidae: It is doubtful that "longspine porgy" (Stenotomus caprinus) will exist in the area of consideration for this impact statement (South Atlantic). S. caprinus is confined to the Gulf of Mexico and is replaced in the South Atlantic Bight by the "southern porgy" (S. aculeatus); which itself, is replaced north of Cape Hatteras by "scup" (S. chrysops).

Page 5, 5.2.3, Porgies: The "southern porgy" (S. aculeatus) was the dominant species (numbers caught) in most MARMAP trawls and represents an underutilized species of the region and is probably a major by-catch to trawlers operating offshore of South Carolina and Georgia.

Page 6, 5.3 and 5.4, Management Unit and Rationale for Choosing This Unit: Since the area to the Dry Tortugas is included in the management unit, there should be some mention of the Federal wildlife refuge (Marquesas Keys-Key West National Wildlife Refuge) and the National Park Service area (Dry Tortugas-Fort Jefferson National Monument). Fort Jefferson limits commercial and head boat harvesting of all species in this complex and is maintained as a pristine, natural coral reef which probably functions as a sanctuary for the early life history stages of groupers and snappers.

Page 8-9, 8.1.1.3, Porgies: The range for the "scup" (S. chrysops) is Nova Scotia to Cape Hatteras; "southern porgy" (S. aculeatus) ranges in the South Atlantic Bight (Cape Hatteras to Cape Canaveral) and it is rarely found shoreward of the 5-fathom contour; "longspine porgy" (S. caprinus) is confined to the Gulf of Mexico, over mud bottoms from Pensacola, Florida, to Yucatan, Mexico.

Page 10, 8.1.2.3, Porgies: There are no references in literature that suggest sexual dimorphism in the genus Stenotomus. Hyperostois has been found in S. caprinus but is not sexually related.

Generally, we felt that the YPR method to manage this fishery is the most reasonable available. We support the priorities for current and future research which emphasizes research into early life histories of species within the complex. The lack of data required for adequate stock assessment using YPR techniques is substantial and must be improved for yield strategies to function properly.

Thank you for the opportunity to comment on this document.

Sincerely,

James H. Lee

James H. Lee
Regional Environmental Officer

cc: Joyce M.T. Wood
NOAA

Administrative Record

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

NOV 4 1982 F/SER71:RCD

NOV 8 1982

Mr. David H. G. Gould
Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, SC 29407-4699

Dear David,

Enclosed are comments resulting from the National Marine Fisheries Service review of the Draft Fishery Management Plan, Regulatory Impact Review, and Environmental Impact Statement for the Snapper-Grouper Complex of the South Atlantic Region (July 1982). Comments are divided into two categories, critical issues and substantive issues. Critical issues are those that may affect the approvability of the fishery management plan.

If we can be of any assistance in addressing these issues, please contact us.

Sincerely yours,

for Jack T. Brawner
Regional Director

Enclosure

cc:
GCSE - Craig O'Connor, w/enclosure
F/SERx3 - Sandie Lamer, w/enclosure

COMMENTS

Draft Fishery Management Plan for the Snapper/Grouper Complex

1. CRITICAL ISSUES

A. Compliance with Executive Order 12291.

Section 2 of Executive Order 12291 requires, in part, that regulations be based on adequate information concerning the need for, and consequences of, the action. Section 2 also states that regulatory action shall not be undertaken unless potential benefits to society outweigh the potential costs.

The plan adequately addresses the need for the regulatory action but is deficient in both assessing the consequences and specifying total benefits and costs. Section 10.0 of the plan incorporates the Regulatory Impact Review (RIR) and should thoroughly discuss all impacts resulting from the proposed measures including the vermilion snapper trawl fishery. The information in Appendix A regarding the short-term impacts resulting from imposition of size limits should be summarized in Section 10.0. Impacts on specific user groups should also be assessed as completely as possible. Finally, all costs and benefits associated with preparation and implementation of the plan should be estimated (in terms of dollars where possible) so that the relative cost effectiveness of the plan can be determined. Identification of this information will also be required to determine consistency with national standard 7.

B. Clarification of optimum yield (OY) and domestic annual harvest (DAH).

Section 9.1 provides a statement of OY for the entire complex which implies that all species are included. Since at this time there is no overall OY for the entire complex, we suggest deleting the phrase "for the complex", and restating OY as the summation of the OYs specified for individual species. A technique for the annual numerical estimate of this OY should be provided for use in establishing the total allowable level of foreign fishing (TALFF). There should also be a mechanism for periodic reassessment of the OY specification (see Substantive Issue #2A).

Section 303(a)(4)(A) of the Magnuson Act requires the assessment and specification of the capacity of and extent to which U.S. fishing vessels, on an annual basis, will harvest the specified OY. The discussion of DAH in Section 9.4 of the plan clearly conveys the fact that capacity and effort are increasing significantly. Perhaps, however, it would be preferable to begin the Section by stating that in recent years the effort expended by the U.S. fleet has resulted in growth overfishing of the species for which OY is specified. Next, document the increasing effort, and finally assess and specify whether the U.S. fishing vessels have the capacity and intent to harvest the specified OY.

A numerical estimate of DAH is needed to determine TALFF. Since OY will apparently be specified in terms of the yield for certain species (i.e., those with size limits) the estimate of DAH should also be restricted to the same species. Presumably, OY for the first year of plan implementation will be somewhat less than recent landings because of the imposition of size limits.

C. Compliance with the Coastal Zone Management Act of 1972 (CZMA).

A determination of consistency of the plan with coastal zone management programs of North Carolina, South Carolina, and Florida is essential for compliance with CZMA. The Council should send a copy of its revised plan to the coastal zone management program official of each of these States with a finding of consistency and request State comment.

2. <u>SUBSTANTIVE ISSUES</u>

A. Incorporation of Framework Measures.

Since the plan clearly indicates that many additional species are expected to experience growth overfishing in the near future, we suggest that the Council consider incorporating a regulatory amendment procedure to facilitate future management actions (e.g., size limits, quotas, closures). The procedure outlined in Section 10.2.1 (Criteria for Triggering Council Decisions on Individual Species) and Section 10.2.2 (Method of Evaluating Minimum Limits) are an excellent beginning point. The regulatory amendment should also provide for reassessment and specification of OY, DAH, and TALFF as additional species are added.

B. Requirement of a Minimum Mesh Size for Trawls.

Management measure 10.3 requires that all trawl nets that fish for species in the fishery have a minimum of four-inch stretch mesh. The determination of which participants are in fact fishing for species in the fishery (as opposed to those trawling and having an incidental catch of such species) will pose a significant enforcement problem. We were under the impression that originally this measure was intended to apply only to the vermilion snapper fishery where roller trawls were the dominant gear used. In that case the mesh size could be required specifically for roller trawls, and the measure could be more easily enforced. If the measure is to apply to all trawls that fish for species in the fishery, some method of determining a "directed fishery" will be necessary.

Is there adequate information regarding the effectiveness of this mesh size to justify the burden that will be imposed on the fishermen? Recently, the Marine Extension Service at the University of Georgia conducted a cruise to assess the impact of using a trawl with a 4-inch stretched mesh cod end. The results indicated that significant numbers of vermilion snapper less than 12 inches in length were retained. We understand the Council's intent to increase the minimum harvestable size of vermilion snapper; our concern is about the effectiveness of the 4-inch mesh in achieving the desired result. We suggest that the Council reconsider this measure to ensure that potential benefits outweigh the potential burden imposed on the fishermen and the government.

C. Prohibition of Traps Inside the 100-foot Contour South of Jupiter Inlet Light.

It appears that only a small portion of the area inside the 100-foot contour would be in the fishery conservation zone (FCZ), particularly in the area north of Miami Beach. Also, trap fishermen testifying at the public hearings stated that the major impact of this measure would be loss of productive fishing grounds--a substantial adverse impact. They suggested using the 60-foot contour, of which even less area would be in the FCZ. Perhaps the utility and legality of this measure should be reconsidered in view of this new information.

D. Consideration of Alternatives.

All alternatives that the Council has considered (e.g., size limits, alternative OYs) should be specified and discussed. We are not suggesting that any new alternative be included, but rather that all alternatives already considered in the administrative record be documented in the plan.

E. Management Unit.

The management unit should include the territorial sea, particularly since MSY and OY are based upon assessment of stocks ranging throughout the territorial sea and FCZ. The plan should also clarify what part of the fishery is in the territorial sea and what in the FCZ.

F. Statistical Reporting.

Section 10.15 of the plan should specify the data elements (e.g., size, age, sex) that must be reported under the proposed system.

We suggest the language on reporting be revised as follows:

Page vii - last paragraph:

"Management measures include mandatory reporting using representative sampling at the level necessary to provide stock assessment information;..."

10.15 <u>Statistical Reporting</u>:

"Statistical sampling methods will be used to collect the size and age data required for YPR analyses from the commercial, for-hire and recreational fisheries. The relatively small number of participants in the commercial and for-hire fisheries makes it difficult to select a representative sample of individual fishermen or dealers. Thus, all commercial and for-hire fishermen and commercial dealers will be required to record, or make available for recording, data for a sample of their fish on a portion or sample of their fishing trips. For the recreational fishery, where the number of participants is large, a representative sample of individual fishing trips will be used to obtain fish for size and age determination."

G. Regulatory Flexibility Act (RFA).

The proposed management measures will have a significant impact under the RFA. Although the plan must contain all of the information necessary to determine whether or not the plan is significant or insignificant under RFA, the Council is not required to make the actual determination; therefore, Section 10.20 could be deleted.

Commandant
United States Coast Guard

16214.61

SEP 20 1982

Mr. Don Leedy
Office of Resource Conservation
and Management
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Washington, D.C. 20235

Dear Mr. Leedy:

This is in response to Mr. Roland Finch's request of 18 August for comments on the Draft Fishery Management Plan (FMP) for the Snapper-Grouper complex of the South Atlantic Region.

In the process of reviewing the FMP, we observed the cost-benefit of implementing this plan is not clearly depicted as required by Executive Order 12291. No other discrepenies were noted.

We cannot agree with the concept presented in Mr. Fuss's letter estimating the cost for sea enforcement (copy enclosed). In our opinion there has to be a minimum deterrance at sea for all snapper- grouper fishermen. Enforcing only against vessels using traps will encourage the others to ignore the regulations and encourage them to disregard other federal laws (such as importation of illegal substances). The proposal to enforce against 100% of all vessels using traps is a problem. Identifying and locating these 68 vessels scattered among a possible 1375 other vessels would require excessive underway time which is not cost effective.

Minimum enforcement should be a 90% shore 10% ratio for all vessels. To accomplish this the Coast Guard would need to contact 137 vessels annually utilizing WPB's, requiring a minimum of 23 days underway. Our estimated cost of enforcement is $125,000.

For further explanation please address comments or questions to LT Bill CHAPPELL at (202) 755-1155 commercial or FTS.

Sincerely,

B. F. THOMSON, III
Commander, U.S. Coast Guard
Chief, Fisheries Law Enforcement
Division
By direction of the Commandant

Copy to:

CCGD7 (oil)
NMFS Southeast Region
(Mr. Charlie Fuss)

SECTION II: PUBLIC COMMENTS

South Carolina Wildlife & Marine Resources Department

RECEIVED AUG 12 1982 SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL CHARLESTON, S.C. 29407

James A. Timmerman, Jr., Ph.D.
Executive Director
Edwin B. Joseph, Ph.D.
Director of
Marine Resources Division
Charles M. Bearden
Director of
Office of Conservation
Management, and Marketing
Victor G. Burrell, Jr., Ph.D.
Director of
Marine Resources
Research Institute

10 August, 1982

Dr. Jackson Davis
South Atlantic Fish. Mgt. Council
Southpark Bldg., Suite 306
1 Southpark Circle
Charleston, S.C. 29407

Dear Jack:

Thanks for sending the hearing announcements and copies of the latest snapper-grouper plan draft. We are circulating them to the commercial sector.

I think the latest draft is reasonable given the data base. Although some of the numbers still bother me from a technical perspective, they're of no practical concern.

A couple of items arouse my curiousity and I'd like some background on them. Now the growth overfishing label is being extended to speckled hind, gag, scamp, and red porgies (wasn't it not too long ago that everyone felt comfortable that we didn't have growth overfishing for much of anything north of the Fla. Keys?) I would concur that speckled hind (probably) are showing indications of growth overfishing (recall Matheson's year-by-year catch curves and the low individual mean size, Figs. 28 and 29 in mine and Ulrich's reef fish guide). I don't see how the data indicate growth overfishing for the others, though. I don't know of any data on observed present size in the fishery that suggest growth overfishing regionwide for gag, scamp, or red porgies. Please inform me as to how this interpretation was reached and what the data base was.

The existing YPR column in Table 10.1 bothers me. I don't object to the definition of age liable to capture, but I don't accept the manner in which it's being used in the YPR calculations, from either a technical or practical standpoint. I've pointed out the limitations of the Beverton-Holt YPR model for reef fishes before and I won't reiterate my reservations about its applicability. I could reluctantly accept some of this stuff if proper values for the age at recruitment were being used, i.e. averages of the ages where recruitment is incomplete. Most of this stuff assumes that the age of recruitment is 1.0 years - totally inconsistent with observed catch curves. The value for red porgy, in contrast (3.0 years), is too high by the same standards (see Fig. 7 in our reef fish guide). The problem is more

APPARENT WHEN YOU LOOK AT THE AVERAGE INDIVIDUAL WEIGHTS IN THE EXISTING CATCH. FOR EXAMPLE, WHAT DATA SHOW THAT THE MEAN WEIGHT OF BLACK SEA BASS CAUGHT INSHORE IS 0.18 LB? THE DATA I'VE SEEN INDICATE THAT THE AVERAGE SIZE OF INSHORE SEA BASS IS AROUND 130 G (0.29 LB) AND THAT THE FISH RETAINED ARE LARGER THAN THAT. THE VALUES LISTED FOR SEVERAL OTHER SPECIES, E.G. GAG AND SCAMP, ALSO DON'T CONFORM WITH DATA IN THE SOURCE DOCUMENT.

BEST REGARDS,

Bob

R. A. LOW

FLORIDA SPORT FISHING ASSOCIATION

P.O. BOX 1216, CAPE CANAVERAL, FLORIDA 32920

August 31, 1982

South Atlantic Fishery Management Council
1 Southpark Circle Suite 306
Charleston, S.C. 29407

Gentlemen:

Attached is the statement prepared for presentation to the public hearing held in Cocoa, Florida on August 31, 1982 on the Fishery Management Plan for the Snapper-Grouper Complex, South Atlantic Region.

Sincerely,

John F. Minor, Jr.
Chairman
Conservation Committee

STATEMENT prepared for presentation to the public hearing held by the South Atlantic Fishery Management Council at Cocoa, Florida on August 31, 1982 regarding the Fishery Management Plan for the Snapper-Grouper complex of the South Atlantic Region.

My name is John Minor. I am the past president and present conservation chairman of the Florida Sport Fishing Association of Cape Canaveral. I am the designated spokesman for that organization

Among the members are a number of fishermen who fish extensively for the bottom dwelling fishes covered by this plan and I have consulted with them in developing this statement. We are to a man convinced that unlimited use of bottom roller trawls and fish traps is devastating to this fishery. We are amazed that an organization which calls itself a fishery management council can produce a management plan which will only manage to destroy the fishery.

A careful review of the plan once you have waded through the semi-scientific mumbo-jumbo reveals that the only restrictions placed on commercial exploitation are a restriction on traps inside the 100-foot contour in south Florida and a very small minimum size limitation on four species. There is no limit on the number of traps, the size of the traps, the location or placement of the traps. The damage done to the fragile coral structures by traps and trawls is virtually ignored (postponed until the development of a Coral Fishery Management Plan).

One of the reasons given for not prohibiting the use of roller trawls was the considerable economic loss to be incurred by the owners of these trawls. No consideration was apparently given to the tremendous loss to the people occasioned by the habitat destroyed by these trawls. Consideration could have been given to the present owners by prohibiting any new equipment entering the fishery and requiring the present activity to be phased out over a reasonable period of years.

The restriction against placing traps inside the 100-foot curve in south Florida was placed in the plan as a sop to the more populous area of the state. I can assure the council that serious conflicts will arise if the inshore reef areas off Fort Pierce, Sebastian Inlet, and Cape Canaveral are covered with traps as this plan permits. Such areas as the 8A reef and Pelican Flats are now heavily fished by both commercial and sports hook and line fishermen. Traps and their buoys would seriously impede this fishing and I do not believe that the present user groups would tolerate it regardless of fishery management plans.

The people of Florida have already spoken on this issue. Possession and use of the traps permitted by this plan are illegal in the State of Florida. In this day of President Reagan's "New Federalism" it is truly amazing to see a group of Federal Bureaucrats come to Florida and announce a plan openly in defiance of State Law. This is a state's rights issue and I cannot really believe that Secretary of Commerce Baldridge and President Reagan will allow such a plan to go into effect against the will of the people of Florida.

SOUTHEASTERN FISHERIES ASSOCIATION, INC.

ALABAMA • FLORIDA • GEORGIA • LOUISIANA • MISSISSIPPI • NORTH CAROLINA • SOUTH CAROLINA • TEXAS

EXECUTIVE OFFICES: 124 WEST JEFFERSON STREET • (904) 224-0612 • TALLAHASSEE, FLORIDA 32301

ROBERT P. JONES – RES. PHONE 385-7626 GEORGE T. PATRENOS, JR. – RES. PHONE 386-6652

August 31, 1982

Mr. David Gould, Executive Director
South Atlantic Fishery Management Council
1 Southpark Circle
Charleston, South Carolina 29407-4699

Dear Mr. Gould:

The following comments represent the thinking of the Southeastern Fisheries Association pertaining to your Snapper/Grouper Plan, and we request that they be made part of the permanent record of this FMP.

First of all, the Council is to be complimented on the development of such a good work product. The staff work was excellent, and we are very much aware of all the work that goes into the establishment of an administrative record.

The Snapper/Grouper complex is in need of federal management right away for the reasons cited in the plan including growth, over-fishing in the nearshore area and user conflicts based on gear.

The management measures coupled with your statistical reporting system should make this a very workable plan and accomplish all that the Council has set out to do in the early stages.

We believe that the trap restrictions proposed are fair even though most of the hoopla against traps has been for political reasons rather than any scientific determination.

Please put us down as supporters of your FMP and call on us for any additional testimony that might be needed to state our position any better.

Sincerely yours,

Bob Jones, Executive Director
eds
cc: SFA Officers, Directors, Past Presidents
    Mr. Wayne Swingle

SEP 3 1982
SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL
CHARLESTON, S.C. 29407

To: Dav... H.G. Gould
South Atlantic Fishery
Managment Council
Charlestown, South Carolina.

From: Ben C Hartig
Commercial Fisherman
Marine Biologist
150 Pineview Rd. #C-5
Jupiter, Fla. 33458

Introduction:

I attended the hearing on your management plan for the Snapper/Grouper Complex held at the Northeast County Courthouse Complex at Palm Beach Gardens, Florida on September 2, 1982. Unfortunately many of the fishermen from our area had not heard about the meeting and did not attend.

I have been trying to complete my Masters Thesis on Age, Growth and Reproduction in the Mutton Snapper, Lutjanus analis, for the past 4 years. Fortunately, it looks as if it should finally be finished by the 1st of the year. I am also a full time commercial fisherman with snapper and grouper making up a large percentage of my living.

I was given a copy of your source document and Reviewer's copy at that meeting. I've read each document and thought you might be interested in my comments since I have a rather unique background being a commercial fisherman and a scientist combined.

My comments will mostly deal with my fishing experience from the local area from Boynton inlet to the south and St. Lucie inlet north. I have lived in Florida since 1957 when I moved here from Maryland at the age of 7. As a kid I fished inshore waters and gradually worked up to Pier fishing where I worked and literally lived for about 5 years. I have worked on area drift boats, have my ocean operators license and have been a captain for a short while on a 65' snapper boat. I have owned my own boat for the past 7 years.

In our area, fishing is mostly done by "day boats" which leave to go fishing in the early morning and return home each night. We are lucky to have the shelf break and Gulf Stream only 3-4 miles offshore of Jupiter Inlet. However due to the close proximity of the fishing grounds we also have a heavy fishing pressure.

In 1978 I started taking samples of Mutton snapper at ~~[illegible]~~ biweekly intervals throughout the spawning season and monthly thereafter, In that year and previous years when conditions were right you could almost be guaranteed of catching 250 pounds on the average. In 1981 and 82 if you caught 50 pounds you had a good day. More about the decline of the Mutton snapper will be published after the 1st of the year when my thesis data is released.

Your documents provided some interesting reading for me. The compilation of all the snapper-grouper literature was a task in itself. Below I will comment on the work as I went thru it:

The Jupiter area is a rather unique type habitat. It is a transitional zone between true coral reef type area and hard line bottom habitats. South of Jupiter inlet there is a distinct shelf break in about 120' of water with 3 or 4 large North-South ~~[illegible]~~ situated reefs as you move inshore. North of the inlet the Continental shelf starts to move offshore and the shelf break becomes broken at best and nonexistent in most areas. Instead of three or four reef tracts running for miles there are broken areas of rock of varying sizes from single rock piles to tracts of a mile or more but not continuous as in the south. It is at this juncture where species composition of the reefs start to change. Yellowtail snapper drop out (in commercial quantities) north of the inlet. They are more or less replaced by vermillion snapper to the north. It is interesting to note that south of Jupiter vermillion snapper are found offshore of the shelf break usually in about 150 feet of water whereas north of the inlet they become common on the 80' reefs where yellowtails are not present. Farther north, about Ft. Pierce, the Mutton snapper become scarce being replaced by the Red snapper.

In this transitional zone many fish come to spawn. Possibly due to current eddies created by the eastward movement of the continental shelf. Large spawning aggregations of Mutton snapper, gag grouper, amberjack, King mackerel and other species have been observed returning every year to spawn mainly in the spring and summer. I've really gotten off tract and I'll return to the business at hand.

8.1.1.8 (P.9) One important jack was omitted from your species list, the Banded Rudderfish, (Seriola zonata) this species occurs in our area in early spring (March-April) in large schools on our reefs. The fish are ripe when they arrive and they leave in late spring rarely being seen in the interim.

8.1.3.2 (P.12) I have reservations about your statements that Yellowfin and Black grouper are expected to be similar to gag grouper and that Nassau and Red groupers are sufficiently similar to expect YPR for Nassau to be the same as red groupers "by analogy".

1.) Yellowfin groupers are mainly insular species and they do not occur in commercially or recreationally important numbers within the FCZ

2) Black's are important within the FCZ however they are markedly different from gags in their habitat preference, home range, spawning aggregations and again are primarily insular species being more common around the Keys and Tortugas.

3) Gag's are the only true continental species of this grouping and depend largely on grass beds for nursery areas.

4) Nassau and Red groupers have different habitat preferences. Nassau's prefer higher relief areas whereas Reds are commonly in low relief hard bottom - pot hole - type areas.

5) Also the Nassau grouper is principally an insular form where the Red - although widespread - is also more of a continental type grouper.

8.15.2 (P.17) "Interspecific competition is probably more prevalent between sea basses and groupers than snappers because of the high degree of similarity in food habits, habitat, distribution and size between family members." This is an erroneous statement because interspecific competition between snappers is just as great or greater than sea basses and groupers in our area.

8.1.6 (P.19) In our area fishing pressure on tilefish has increased dramatically in the past 2 years.

8.1.9 (P.21) There already is intense competition between user groups and fishing methods on the narrowing shelf south of Cape Canaveral. This is the first year longlines have appeared in our area and the power reel fishermen are not taking it lightly.

This is as good a time as any to go into my feelings on what has happened to fishing the past 20 years. When I was young and fishing from bridges and sea walls one of my favorite haunts was the fish houses where the netters and kingfishermen unloaded their catches. I worked packing spanish mackerel and bluefish for $1.25 an hour many a day during the winter run. Always dreaming some day I might also work on the ocean. In those days the net boats were 25' to 30' feet in length, there were no power rollers and there were no airplanes for spotters. Your catch was limited by the size of your boat - and your <u>skill</u> as a fisherman in spotting fish and manuvering your net around them. Bottom fishermen used land lineups and depth recorders were very expensive and loran was unheard of. Today net boats are up to 85' some with purse seines all with power rollers and all they do is call the "spotter" plane to find the fish for them and to tell them how to deploy the net. Your skill as a fishermen is no longer needed. Bottom fishermen now have more advanced and less expensive depth recorders and loran is the rule instead of the exception enabling fishermen to go back exactly to the same spot which is especially devastating when spawning aggregations of fish are found.

Fishing on the whole has become too efficient for its own good. And that is why today when other more efficient ways of catching fish are introduced you hear more and more contraversy. The trap issue I thought was dead when Florida passed its anti trap bill however NMFS has seen fit to allow their use outside of state waters. We do not need another method of harvesting bottom fish. Our stocks are already in a "stressed condition" due to increased fishing pressure by traditional means. We also do not need longlines! They are also more efficient means of catching species within the snapper-grouper complex. Here again traps and longlines are methods of fishing which require low fishing skill to be efficient. Whereas power-reelers have to have some knowledge of how to fish and they have to wait for the right conditions to fish effectively. Traps and longlines can fish almost anytime; and day in and day out will catch more fish than traditional methods. Also it is hard to make it as a line fishermen - the skill involved is a self limiting factor - many don't make it and drop out of the industry. Whereas the longline and traps are a numbers game - if you have enough traps or fish enough hooks you're going to make it - skill or not. I know I am biased because I grew up in a world of fishermen where now I fish in a sea of mechanized radio fishermen. We've already gone too far too fast and if we don't go back to some more traditional methods or limit entry into the industry the majority will starve themselves right out of the business. More people every year are competing for fewer fish - a dead end proposition. But there is hope through good sensible management policy where you all come in. It has got out of hand from the self-regulating industry it once was and we need regulations now! The worst thing is the fact that the data is not available to make the sound decisions needed. This is where we may be able to help each other. Instead of getting my education quickly and going right into a job I have been getting my education on the ocean while fishing and working on my degree for several months a year while the fishing was slow from September to January. I want to do more research and hope to work both the fishing and research together as I did with my thesis on the Mutton snapper. Its got out of hand again back to basics.

8.2.2 (P.25) "Large numbers of juvenile groupers and some snappers are found in grass and algae beds." A fellow student and partner of mine has just finished his data collection on a yearly survey of 2 grass bed locations in the Jupiter area. Our findings indicate that your statement should read, "large numbers of juvenile snappers and some groupers" are present in collections from our area.

8.4.2 (P28) User groups: In our area significant numbers of gag grouper are powerheaded ~~in~~ during the early spring when spawning aggregations occur. Although against the law under Florida Statutes the practice is still being done so much so that other divers who stopped using powerheads when the law went into effect several years ago now feel the risk is worth the increased catch. The problem is that when a large school of gags are located by divers the powerhead kills the fish without a struggle this attracts other fish in the school. Since the diver does not have to struggle with a fish on the shaft all he has to do is reload the shell and fire again leaving the fish on the bottom until the gags finally wise up. I have seen 1 boat with 3 divers kill as much as 2,000 pounds of ~~gags~~ gags in one day. The divers are now breathing mixed gas and can dive 3 tanks ~~a~~ in up to 135' with an hour between each tank. It has become a much more efficient operation.

In recent years divers have concerted their efforts on the large schools of Greater amberjack which arrive in the ~~spring~~ spring at the shelf break to spawn. Here again powerheads are used and in a similar fashion once one fish is shot the others come in and their curiosity get the best of them. Average catches of 1000 pounds per day are the rule. Enough about ~~the~~ commercial divers - few have any regard for the fishery they're involved with.

8.4.2 (P. 28) Large numbers of boats in Florida converting to longlines - due to increased value of tilefish and the discovery of large numbers of yellowedge groupers in the deeper water in some areas.

8.4.7.1 (P 31) Bottom trawls have never been used in our area; to my knowledge. Although last week while diving off St. Lucie inlet I found the doors + chains from a trawl snagged on an isolated rock outcropping. From my standpoint trawls are a waste, overharvesting juvenile fish worth less in the markets depleting the resource in a much shorter period of time.

8.4.7.5 (P. 33) The large increase in tilefish landings recently is due to increased consumer acceptance = increased demand = increased ex-vessel price = more fishermen fishing for tilefish = longline efficiency = low skill high return fishery = loss tilefish in a very few years due to slow growth rate and overfishing. Only here you can make a difference before gross over exploitation occurs. Catch rates have already decreased in the longline fleet in 3 years. One Ft. Pierce fisherman who was one of the first to start longlining tilefish caught 3 pounds/hook in 1979 in 1982 3/4 Pound/hook

8.7.2 (P.37) I have a hard time with your terms of Recreational vs. Commercial fisherman. In my view anyone who sells his catch is a commercial fisherman. In the landings no distinction is made – so how do you ~~separate~~ distinguish who caught what in the total landing picture? If the recreational angler sells his catch is that figured into the commercial landings?

9.4 (P 39) If the fishing power of a longline is 2x that of power snapper reels and the northern longliners w/ tubtrawls are 10x more efficient than regular longliners and Automatic longliners are 2x more efficient than tubtrawls then the Automated longline is 40x more efficient than power snapper reels – I guess you can kiss the tilefish goodbye.

10.2 (P.40) Your attempt at YPR is somewhat misleading – you plug these numbers into your little computer and out comes a magical number. It does not work that way. I know you are under pressure to come up with some kind of plan but w/o the hard data to use its a waste of my time and yours. Minimum size limits are not the total answer – its quotas, bag limits and limited entry soon or you won't have enough fish left to get a good data base. Should be first line alternatives.

10.2.1 (P41) You state that only the Red hind, graysby and white grunt are not in the range of growth overfishing. The Red hind is primarily an insular species and is not of commercial or recreational importance w/ the FCZ. The graysby does not attain the size nor abundance to be of commercial importance and the white grunt does not have great consumer acceptance to be a target commercial species.

10.3 (P45) More than this is needed - if such few trawlers catch over 80% of the total vermilion snapper catch they are very efficient. Being so effecient nessitates a limited entry fishery.

10.5 (P49) In our area sea bass occur in depths ranging from 175' to 300'. There is no large fishery here but a few of the fishermen can make a pay day when conditions prevail. I don't think these fish will make it if released at these depths.

10.6 - 10.7 Great, should be 12" for every grouper in the complex.

10.8 - Prohibit Fish Traps !

10.14 - Good !

10.15 - Maybe we can work together here.

10.16.2 - Don't penalize one user groups while the others reap benefits. - Leave it @ 12" for everyone ! Make head boats tag undersize fish for future monitoring.

10.16.3 (55) The gray snapper is perhaps our most abundant species. It is most readily available to inshore fishermen of all species in complex. At this time no size limit should be implemented.

10.16.4 The 10" yellowtail size limit should be imposed. Stocks are in an apparent state of decline. The number of larger fish present has decreased in recent years. Smaller fish more evident in commercial catches.

10.16.5 Not commercially or recreationally important in my area. Farther north it becomes important.

10.16.6 The scamp is relatively scarce in our area. Although large numbers of juveniles are seen while diving in some locations.

10.16.7 Gag grouper 18" size limit should be imposed. In our area small gags are subjected to heavy fishing pressure. They are usually caught in 80' of water or less where survival rate upon release might be expected to be high. I have been releasing small gags ~~[illegible]~~ under 3 pounds for a long time and they seem to do alright.

10.16.8. Yellowfin not commercially or recreationally important w/ FCZ.

10.16.9 Should be imposed as soon as possible

10.16.10. – Should never be imposed wherever this fish is found and it is not common w/ the FCZ

10.16.11 – 14 no size limits needed @ this time.

10:16:17. Prohibit Traps! At the very least limited entry should be a mandatory stipulation.

10:16:22 Here again it is time to think about quotas. Unfortunately there is not enough information available to implement quotas at this time. Bag limits for recreational anglers are also a future consideration. Should go hand + hand with minimum size limits.

10.16.23-25.

1). Permit or license all commercial vessels w/ substantial fee.
2) Commercial fisherman should make at least 50% of living from fishing.
3) In order to sell catch must have a license!
4) If you do all of the above you would have limited entry. Otherwise its a viable option.

10.17.2 Major question – how do you propose to enforce these regulations?

10.19 When you figure out what exactly needs to be done. Call us and we might be able to be of assistance.

11.1 Here again we could do some of the research you are interested in.

12.1.2 – Introduce a program of making more artificial reefs.

12.2 Monitoring: Should have standardized fish tickets made up w/ common names of the species. Weigh each species seperately. And give general area where caught – like Mexico – Bahamas – locally etc.

I have several questions I wish you could answer for me.

1) Where do your landing statistics come from?
2) Who supplies them?
3) If a recreational angler sells his catch is it considered part of the commercial landing?
4) How much of your landings reflect Bahama or other foreign caught species?
5) Who and how are these fishery regulations going to be enforced

Hope it was as interesting reading as yours was for me

Ben C Hartig

RECEIVED
SEP 7 1982
SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL CHARLESTON, S.C. 29407

COMMENTS/RECOMMENDATIONS ON THE SNAPPER-GROUPER PLAN BASED ON THE 1 SEPTEMBER 1982 PUBLIC HEARING IN MIAMI, FLORIDA

MY COMMENTS ARE DIRECTED ONLY TOWARD THE DEMARCATION LINE FOR FISH TRAPS BETWEEN FOWEY LIGHT AND THE SOUTHERNMOST POINT OF THE SAFMC's JURISDICTION. SPECIFICALLY, I RECOMMEND THAT THIS LINE BE MOVED FROM THE 100 FT TO THE 120 FT. CONTOUR.

THE RATIONALE FOR MY RECOMMENDATION IS THAT IF TRAPS ARE ALLOWED TO FISH ON THE EXTREMELY HEAVILY USED OUTER REEF BREAK REGION (60 FT. TO 120 FT.), A LIMITED RESOURCE (SNAPPERS AND GROUPERS) WILL BE UNEQUITABLY ALLOTTED TO A VERY SMALL SECTOR OF THE ENTIRE USER GROUP, THE TRAP FISHERMEN, DUE TO THE EXTREME EFFICIENCY OF FISH TRAPS. AT PRESENT THIS REGION SUPPORTS A NUMBER OF HEADBOATS (EACH OF WHICH CARRIES UP TO 7000 ANGLERS PER YEAR TO THE REEF), CHARTER BOATS (20' TO 55' BOATS CARRYING 1 TO 6 ANGLERS), VERY LARGE NUMBERS OF PRIVATE BOATS, AND COMMERCIAL HOOK AND LINE BOATS. THESE GROUPS PRESENTLY COEXIST PEACEFULLY. SNAPPERS AND GROUPERS PROVIDE A LIVING FOR A LARGE NUMBER OF LOCAL RESIDENTS, DIRECTLY IN THE CASE OF HEADBOAT, CHARTER BOAT, AND COMMERCIAL BOAT CREWS AND INDIRECTLY IN THE CASE OF FISH HOUSE OWNERS AND EMPLOYEES, RESTAURANTS, AND A MYRIAD OF OTHER LOCAL PARTICIPANTS IN THE TOURIST TRADE THAT BENEFIT FROM THE PEOPLE DRAWN TO THE FLORIDA REEF TRACT BY GOOD BOTTOM FISHING. THIS ALSO INCLUDES THOUSANDS OF DIVERS THAT ARE ATTRACTED BY THE REEF AND

THE OPPORTUNITY OF SEEING SNAPPER-GROUPER COMPLEX SPECIES IN THEIR NATURAL ENVIRONMENT. THE LAST POINT OF THE RATIONALE IS A COUNTER TO THE ARGUMENT THAT FISH TRAPS ARE NEEDED TO SUPPLY THE PUBLIC WITH SEAFOOD. THIS NEED IS COMPLETELY FULFILLED BY COMMERCIAL HOOK AND LINE, HEADBOAT, CHARTER BOAT, AND PRIVATE BOAT SALES TO FISH HOUSES. FURTHERMORE, BY ALLOWING PAYING CUSTOMERS TO CATCH FISH THAT END UP IN THE MARKET WE ARE MAXIMIZING THE USE OF THE RESOURCE TO A GREATER EXTENT THAN IF THE FISH ARE TRAPPED AND SOLD, BECAUSE THE ACT OF ALLOWING A TOURIST TO CATCH THE FISH INSTEAD GENERATES A LARGE AMOUNT OF REVENUE LOCALLY BY THE AFOREMENTIONED MECHANISMS (COMMERCIAL HOOK AND LINERS ARE AN EXCEPTION TO THIS POINT, BUT THEIR GEAR DOES NOT REMOVE FISH FROM THE REEF NEARLY AS EFFICIENTLY AS TRAPS).

THE ABOVE COMPLETES MY RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION TO THE SAFMC. I AM WELL AWARE OF THE WEAK LINK IN MY ARGUMENT IN THE EYES OF THE SAFMC — WILL FISH TRAPS REMOVE SNAPPERS AND GROUPERS FROM THE REEF SO EFFICIENTLY THAT OTHER USER GROUPS WILL IN FACT BE IMPACTED? TO DATE THERE HAS BEEN INSUFFICIENT STUDY IN U.S. WATERS TO COMPLETELY ANSWER THE QUESTION, BUT I STRONGLY BELIEVE THAT THE SAFMC SHOULD REASON BY ANALOGY RATHER THAN SIT BACK AND WAIT FOR YEARS OF DESCRIPTIVE DATA ON THE MATTER, BY WHICH TIME THE ANSWER COULD WELL BE A POST-MORTEM OF THE FISHERY. THE ANALOGY TO WHICH I REFER IS THE WIDELY

KNOWN CARIBBEAN EXPERIENCE WITH FISH TRAPS. THE FISH TRAP FISHERY OF FLORIDA IS LESS THAN A DECADE OLD, BUT FISH TRAPS HAVE BEEN USED FOR MUCH LONGER PERIODS OF TIME IN, FOR EXAMPLE, JAMAICA AND THE VIRGIN ISLANDS. SNAPPER AND GROUPER RESOURCES IN BOTH AREAS ARE TREMENDOUSLY DEPLETED WHERE FISH TRAPS HAVE BEEN USED.* I BELIEVE THIS CIRCUMSTANTIAL EVIDENCE IS SUFFICIENT FOR THE SAFMC NOT TO RISK THE VIABILITY OF THE FLORIDA KEYS SNAPPER-GROUPER RESOURCE, WHICH IS ALREADY IN VARYING STATES OF GROWTH OVERFISHING, TO A PROBABLE EXTREME ADDITIONAL INCREASE IN FISHING PRESSURE AT THE HANDS OF A RELATIVELY SMALL MINORITY OF FISHERMEN, MOST OF WHOM ENTERED THEIR LIVELIHOOD ONLY SIX OR LESS YEARS AGO.

SCOTT BANNEROT

(CHARTER BOAT MATE, HEADBOAT CAPTAIN, FISHERIES GRADUATE STUDENT AT R.S.M.A.S., U OF MIAMI, 14 YEARS FISHING/DIVING EXPERIENCE IN MIAMI AND FLORIDA KEYS)

* THE BAHAMAS HAVE RECENTLY EXPERIENCED AN INCREASE IN FISH TRAPPING FOR GROUPERS. SEVERE DEPLETION OF YELLOWFIN GROUPERS, MYCTEROPERCA VENENOSA, APPEARS TO HAVE OCCURRED ALONG THE REEF BREAK OFF THE SOUTHERN BERRY ISLANDS FROM THIS ACTIVITY.

National Coalition for Marine Conservation, Inc.

COMMITTED TO THE CONSERVATION OF OCEANIC GAME FISH

P.O. Box 23298
SAVANNAH, GEORGIA 31403
Phone (912) 234-8062

September 8, 1982

Mr. David H.G. Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, SC 29407

Dear Mr. Gould,

Thank you for sending me a draft copy of the Snapper-Grouper Fishery Management Plan (FMP) for the South Atlantic Region, and for the opportunity to comment on that plan.

The major issues in the snapper-grouper fishery, as recognized in the FMP, are overfishing and gear/user conflicts. Most of the species in the management unit are overfished or will be in the near future if present fishing trends are not reversed. More specifically, the problem is overfishing of the younger fish and the resultant reduction in recruitment and future stock size. Gear conflicts exist between recreational and commercial hook-and-line fishermen on the one hand and commercial fishermen using fish traps and roller rig trawls on the other. At the root of these conflicts is, of course, the role of the commercial gear in both overfishing and habitat damage.

The FMP addresses overfishing primarily through minimum size limits for individual species to reduce pressure on juveniles. There are also restrictions on fish traps designed to reduce overfishing of small fish, such as a minimum mesh size. Gear or user conflicts are addressed through a ban on the use of fish traps in that area of Florida which has experienced the most conflict between trappers and hook-and-liners.

These measures should, if enacted along with the other measures in the FMP like the requirement of biodegradable doors and/or fasteners on fish traps, limit fishing pressure and lessen some of the confrontations between fishermen. But the FMP, in my opinion, does not go far enough. It is deficient in that it does not adequately address the problems associated with roller rig trawls and fish traps.

A ban on the use of roller trawls was considered and rejected because of economic considerations; in other words, the capital investment in the gear by vessel owners is high. It is also claimed that not enough is known about the effects of roller trawls on the fish stocks. The serious problems with roller trawls taking large numbers of small fish and being non-selective in what they take cannot, however, be so easily dismissed. If indeed we do not have definite evidence of the effects of this gear on overall fish stocks, we certainly do, through experience, know the devastating effects that they can have on local populations and their availability to traditional fisheries. Furthermore, there are only 25-30 vessels equipped with roller rigs, a small segment of the industry which nonetheless takes 16% of the total catch in the snapper-grouper fishery. The economic ramifications of banning their use, then, may be small compared to the possible damage to the resource, the live bottom habitat, or the much more valuable recreational fishery in Florida. If protecting the investment of those already active in the roller rig fishery is important (and since they are shrimp fishermen almost to a vessel it amounts to little more than another subsidy for the shrimp industry), then the FMP should at the very least do something to limit the entry of more roller rig trawls into the snapper-grouper fishery.

Fish traps were banned in Florida waters to protect that state's investment in its marine resources and the valuable recreational and tourist industries dependent upon them. This prohibition is now in force. Allowing the unrestricted (in terms of numbers) use of fish traps in the FCZ, which the draft FMP does, will make the Florida regulations very difficult if not impossible to enforce. This may or may not be a concern of the South Atlantic Council. But it would seem to me prudent and on the side of reason that the number of traps that a vessel may fish or possess should be regulated.

It is my hope that in the preparation of the final FMP for snapper-grouper the South Atlantic Council will consider stronger restrictions on the operation of roller rig trawls and fish traps in the FCZ.

Thank you.

Sincerely,

Ken Hinman

Ken Hinman
Executive Director

cc: Frank Carlton
Chris Weld

Jesse L. Webb
4665 S. E. Manatee Terrace, Stuart, Florida 33494

SEP 17 1982
SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL CHARLESTON, S.C. 29407

South Atlantic Fishery
Management Council
1 Southpark Circle
Suite 306
Charleston,
S.C. 29407

Dear Council:

In connection with the FMP for the Snapper-Grouper Complex, the Summary Draft forwarded me indicates in Section 10.8 that Fish Traps are prohibited shoreward of the 100 foot contour SOUTH OF JUPITER INLET LIGHT.

I urge that you amend that Section to prohibit the traps shoreward of the 100 foot contour to SOUTH OF THE FT. PIERCE INLET, for the reasons listed below -

1- the inner and outer Six Mile Reefs (70 foot depth) between Jupiter Inlet and St. Lucie Inlet (appx. 14 M north of Jupiter) seem to be probably the most productive bottom along the Southeast Florida Coast.

2- both Reefs are utilized extensively by the Commercial Hook and Line Group, Recreational Fishermen, Charter Fishermen, and Divers, 7 days a week. I have personally on several occassions observed twenty vessels fishing these Reefs at the same time.

3- prior to the Florida ban of traps this area was the location of severe, serious conflict and contraversy between the User Groups identified in paragraph 2 and the one (1) Trap Boat which covered the Reefs with traps.

4- the Impact and Rationale Statements included in Section 10.8 probably are more appropriate for this area than any other area along the Southeast Florida Coast.

page two
South Atlantic Council

5- the Six Mile Reef between St. Lucie Inlet and Ft. Pierce Inlet (appx. 19 M. north) is a good, productive Reef.

6- it is utilized extensively by Charter and Party Boats, by six (6) Commercial Hook and Liners, by a large number of Recreational Fishermen and by Divers.

7- prior to the Florida ban of traps this area was the location of conflict and contraversy between the User Groups identified in paragraph 6 and the one (1) trap boat which set in the area.

8- the Impact and Rationale Statements included in Section 10.8 certaily are appropriate for this area.

Please note that the conflict and contraversy between St. Lucie and Ft. Pierce Inlets was less than between Jupiter and St. Lucie ONLY because the Trap Boat set fewer traps in that area.

Very truly yours,

Joe Webb

September 15, 1982
JW/wc

Don De Maria
P.O. Box 884
Key West, Fla. 33040
Sept. 20, 1982

Mr. David Gould
So. Atlantic Fishery Mgt. Council
So. Park Bldg. Suite 306
1 Southpark Circle
Charleston, S.C. 23607

Mr. Gould;

I recently read over the summary of the Fishery Management Plan for the snapper grouper complex of the South Atlantic and feel I should comment on some of the proposals.

Many of the proposed restrictions I agree with. Being a commercial fisherman I would like to see my livelihood protected. Your plan is a step in the right direction.

There is one proposal that I do not agree with #10.14. I do not feel enough research has gone into it. I have heard some of the comments that were made at the August 31st public meeting in Key West at the Holiday Inn.

I have been commercially spear-fishing for almost ten years. I cannot agree with prohibiting powerheads. Explosives and poisons (other than quinaldine used in the correct amount for collecting tropicals) should definitely be illegal. It should be illegal to spear any fish over thirty pounds with anything but a powerhead. The chances of wounding a fish and it going off to die are much less with a powerhead. You have to get much closer to the fish to detonate a powerhead than to shoot a spearshaft in it. I can hit a large grouper or jewfish from at least twenty feet away with my speargun and a regular spear. There is no telling where I will hit the fish but it will stick in. The same gun with a powerhead at that same distance it's doubtful I could hit that same fish and even more doubtful the powerhead would go off. It certainly would not stick in the fish as it is much to blunt. I have to be real close to the fish maybe eight to ten feet at the most to detonate the powerhead. The chances of making a "kill shot" at that distance as opposed to twenty feet are much greater. That same fish if shot with a spear-shaft from twenty feet would more than likely go off and die somewhere if it was hit any-where else but the brain. You would end up

wounding more fish with a spearshaft that 3
would later die of infection or bleed to death than you would with a powerhead. Prohibiting powerheads would only increase the number of wounded fish.

Lines or cables on spearguns are absolutely useless for spearing jewfish on wrecks. There is no way a diver can hold onto a three hundred pound fish, speared in the side, from going into the wreck and breaking the line. Spearing jewfish with a spear and not a powerhead is equivalent to hunting deer with a twenty two rim fire cartridge and we do have laws prohibiting that.

I also disagree with the comment made at the meeting that jewfish are of no food value. If this is true I would like to know what the fishhouses of Key West have done with the thousands of pounds I've sold them over the last few years and why they are on the menu of many restaurants in Key West. Even the heads, backbones and livers are consumed by the local people.

I seriously doubt that jewfish attract smaller groupers and snappers.

The wrecks I dive where there are alot 4
of jewfish have very few grouper and snapper. While the wrecks that have a few jewfish or none at all have alot more. I do not think that fishing pressure has anything to do with this because many of these places no one else goes to.

I will have to agree that jewfish add to the aesthetic enjoyment of recreational diving. We have marine sanctuaries set aside for those who want to view unmolested fish in their natural habitat. There are no recreational divers that go to the places we do. Most of the places I dive are between seventy five to one hundred fifty miles from Key West in the Gulf. They are one hundred forty to one hundred seventy five feet deep and many times dirty. I have never seen recreational divers on any of these places. They are out of their reach, to deep, and visibility is usually very poor.

Another advantage for powerheads is that it is a much more humane way of killing fish than sticking it with a shaft. When we slaughter cattle. we do not conduct it like a bullfight, chasing the cow around and sticking it with small swords until it bleeds to death Why should we do it with jewfish? 5

Before you pass this proposal to prohibit powerheads I feel more research should be conducted. I will be glad to assist in any way along those lines. I am sure that I am spearing more jewfish than anyone. I know where the heaviest concentrations are and where and when they spawn. I have kept detailed records thru the years. I can also take you to many restaurants that serve jewfish to prove its food value.

If you want the opinion of a very qualified man in the fisheries field please contact Dr. Uwate, E.W.C. Box 1114, 1777 East West Road, Honolulu, Hawaii, 96848 - phone 808-988-4267. He has been diving with me and I believe he will agree with me on my opinion of the use of powerheads.

Sincerely,

Don DeMaria

Don DeMaria

FLORIDA COOPERATIVE EXTENSION SERVICE
JNIVERSITY OF FLORIDA
FOR SEA GRANT COLLEGE OF THE STATE UNIVERSITY SYSTEM OF FLORIDA

SEA GRANT

MARINE ADVISORY PROGRAM
REPLY TO:

P. O. Box 2545
Key West, Florida 33040

September 21, 1982

MEMORANDUM

To: South Atlantic Fishery Management Council Meeting

From: Jeffrey A. Fisher, Monroe County Extension Director

Subject: Summary Minutes 23 June Meeting Concerning Jewfish

I have some problems understanding the discussions of the Council members at their 23 June 1982 meeting.

One concern regards Item 10 (jewfish issues). I noted that a vote was taken on the basis of that discussion and therefore decisions were made. I have questions regarding the validity of your discussion.

I did not know that there is "no food value connected with the jewfish." I have been personally eating jewfish for 25 years. They are often available in Keys fish markets. Seafood dealers will buy jewfish--from sport and commercial fishermen alike. They are, in fact, of considerable value as a food, highly sought after, and served on the tables of restaurants and homes in south Florida and elsewhere.

Perhaps I misunderstood the statement. Did you mean the meat had no nutritional value for humans? If that was the meaning, I demand to be informed of the studies that document this. I can't imagine the meat of jewfish being any less nutritious than snapper or mackerel or beef cattle.

Now to the question of taking jewfish. Spearing jewfish is difficult at best. Often times, large jewfish are seen with 2 or 3 spears in them, obviously ill and physically unable to function, resulting in slow death and wasted meat for food. Divers would quickly confirm the large number of fish which are hit by spear that meander away unfound.

As far as not seeing "the big jewfish with the frequency that they used to exist," I wonder if that is not true for shrimp, mackerel, snappers, groupers, dolphin, turtles, lobster, etc. Can that kind of reasoning really be the basis for a gear restriction without knowing the facts?

Powerheads do kill--effectively. Hooks and spears do the same but not as effectively. They damage, hurt, dismember and torture as well. Powerhead just kill!

I request that, in your minutes, you replace the word "powerhead" with either "spear" or "baited hook" and examine the flimsy nature of those discussions. Decisions must be made on more sound footing. You are affecting the lives and livlihood of <u>other</u> people.

The classic example is the issue of fish traps. I cannot say in my capacity if they are right or wrong, good or bad, resource depleting or just another harvest technique. But I can say that the emotion, heresay, and subjective banter I have heard from both sides indicate that before "bigger and better" regulations or bans are promulgated we had better examine the real questions, the actual effects, and the substantive data. Since we have not done that we continue to make decisions that affect the fun or livlihood of people in a way that is uncharacteristic of our society. Fish traps are not a mere "social issue." They represent a misunderstood and unresolved dilemma in fishery resource use.

Decisions already made about fish traps, powerheads and similar items may be correct ones—but, they may be wrong. And no one on any Fishery Management Council or any other place can state with any degree of certainty that we have decided wisely. Please correct me if I have failed to grasp the meanings of your discussions and decisions. Thank you.

Jeffrey A. Fisher

JAF/bv

C-47
September 22, 1982

Mr. Bruce Austin
1 Southpark Circle
Suite 306
Charleston, S.C. 29407

Dear Bruce,

In regard to the Fishery Management Plan reviewed and discussed on the evening of September 2, 1982, at the N.E. County Courthouse in Palm Beach Gardens, Fl. We recommend a change, or more precise definition, or clarification in the summary draft, page 54, section 10:14. The Use of Poisons, Explosives, and Powerheads for Taking Fishes of the Snapper-Grouper Complex is Prohibited Throughout the Management Area.

We are in complete accord with section 10:14 in reference to the prohibition on the use of poisons and explosives in the snapper-grouper fishery, however, we urge the Management Council to differentiate between the use of powerheads to take jewfish and the use of powerheads to take gray grouper and further, to permit the use of powerheads for the taking of gray grouper. Our rationale for this recommendation is as follows:

1. With the use of a spear point to take gray grouper there is a 30-40% fish loss. The fish tear holes in themselves big enough to get off the spear. These fish end up getting away and dying.

2. With the use of powerheads to take gray grouper there is only a 2-3% fish loss.

3. We can only dive one hour or less a day, total time, as opposed to the hook and line fishermen who can fish all day. The depth we dive and decompression considerations automatically limit our time on the bottom and

therefore limits our catch.

4. Any one spot can only be dived two or three times in a day because the fish stay out of spear gun range after being dived on two or three times. This further limits any one spot from being over fished.

5. The method of spearfishing for gray grouper is more beneficial to the gray grouper stock with respect to the perpetuation and reproduction of the grouper stock because the diver has total control over the size of the fish taken. Compared with the diver, the hook and line fisherman has little control over the size or type of fish he catches. If the hook and line fisherman catches an undersize grouper by the time he gets it to the surface it is dead.

The diver- spearfisherman never has this problem.

6. Gray groupers are migratory in our area of concern and therefore can only be taken approximately three months a year. This further limits our catch.

7. Jewfish are a very small percent of the annual yearly income of any diver. Even when the jewfish migrate into our area many markets won't buy them and the markets that do, pay such a low price that the fish is not worth the trouble or time to take. Due to the small amount of money that can be made by taking jewfish we don't believe any diver would be financially hurt by maintaining the present law on the use of powerheads to take jewfish.

8. Jewfish are very dumb as opposed to gray grouper. Jewfish will just sit there and let a diver shoot them. Gray grouper will not sit still and let the diver shoot them. Gray grouper are difficult to shoot. This is where the distinction should be made on the use of powerheads in relation to these two different fish.

9. Safety is a major concern for all divers when spearfishing for gray grouper. With the use of spear points there is much more blood and wounded fish vibrations. The

grouper that has been speared with a spear point will rarely be killed outright, and through the wounded fish fighting to get away more and more blood and vibrations are emitted into the water. This draws sharks and therefore endangers the diver. I personally know two divers who have been bitten by sharks while spearfishing for gray grouper.

With the use of powerheads to take gray grouper the fish is killed instantly and therefore there is no wounded fish vibrations and far less blood emitted into the water to attract sharks.

We believe the above rationale provides valid reasons for the use of powerheads to be permitted for the taking of gray grouper and also rebutts the various arguments that the use of powerheads will decimate the grouper stock and that the use of powerheads is an inhuman method of taking gray grouper. We, again, urge the F.M.C. to adopt our recommended change in section 10:14 of the F.M.P. for our above stated reasons.

Please inform me of any changes made in the F.M.P.

Respectfully yours,

John Hill

J M Wait

To: South Atlantic Fishery Management Council

Being a fish trap fisherman from Ft. Lauderdale, Florida, your RFMP is of particular importance to me. Management measure 10.8, "The use of fish traps is prohibited shoreward of the 100 ft. contour, south of Jupiter Inlet Light," should be changed to the 60 ft. contour south of Jupiter Inlet Light. In your rationale for this management measure it states: "The traps were deployed (before being banned) primarily at inshore areas of known relief which were also intensively utilized by both recreational and commercial hook and line fisherman. These groups have vigorously opposed traps because the buoys reportedly interfere with navagation and because their hooks are snagged on traps." Contary to this rationale, all of the trap fishermen in our area presently fish outside of 100 ft. We don't fish any more shallow than that for fear of our gear being destroyed since there is no law on fish traps in the F.C.Z.

With the passage of this plan our traps will be protected by management measure 10.12. As for buoys being a hazard for navagation and hooks snagging on them, I have heard every other argument for the last five years on fish traps but I have never heard anyone complain about that. Every fisherman that uses fish traps in my area does so without the use of buoys.

More of your rationale says: "Sport divers have claimed that traps set on or near shallow reefs capture and kill excessive amounts of tropical reef fish and destroy living coral although new data from a N.M.F.S. study showed no coral damage from traps."

Part of the Fla. D. N. R. study on fish traps, done in the Fla. Keys, was done on shallow water trapping and it did not document capture and killing of excessive amounts of tropical reef fish. As for the coral, the N.M.F.S. study which involved a submersible, actually looking at traps on the bottom and the biologists observed no coral damage.

Just because there is a "documented conflict" is no reason to put fish traps out beyond the 100 ft. contour. The "conflict" is based on a misinformed public that has lied to by various sports organizations and the media.

I recommend this RFMP be implemented as soon as possible before we are all put out of business by the Fla. Dept. Of Natural Resources.

Based on the reasons I have given, I also recommend that the 100 ft. contour be changed to the 60 ft. contour, south of Jupiter Inlet Light.

Sincerely,

Richard B. Nelson Jr.

Box 525
Little River S.C.
Sept 24, 1982

South Atlantic Fishery Management Council
1 Southpark Circle Suite 306
Charleston, S.C. 29407

Dear Sirs:

On September 9th I attended the Seminar held in Surfside Beach. And while I am always leery of more Government programs, I was very impressed with the presentation by your staff.

We heard from fishermen from just about every Category and each spoke According to his own views and what would be most beneficial to him. Due to the large turnout and number of speakers, I did not speak very long. I would like to go into more detail at this time.

I am 54 years old and have fished all my life, as my father and grandfather before me. I have seen all species of our marine life depleted like most other natural resources and I think it is long past the time Something was done to preserve one of our most precious Resources.

I have seen our Marine life habitats destroyed in the name of progress. I have also seen it destroyed in the name of preservation.

We have an on-going feud between trawlers, netters, trappers, party boaters and sportsmen with private boats. By weight of "sheer numbers vote" the sportsmen almost always get their wishes passed to law. By the same token, by these "sheer number voters" many undersized fish are killed and usually wasted by being thrown away when they reach shore.

I have been the owner and operator of five shrimp boats and I know for a fact that trawls destroy the bottom as well as many small fish and other marine life.

I have used traps and except for bait traps, this is probably the most harmless type of fishing I have ever encountered, as long as proper size traps are used. In the past, and also currently, I take fishing parties and I must admit that this, along with trawls and purse seining, is the most destructive of all fishing.

All hook and line fishing is destructive, in as much as there is no discrimination as to size caught. For instance, I have seen the size of hooks used to catch Black Bass reduced from a 4/0 to a 1/0 and less in order to catch smaller fish. Day after day I see boats containing from six to one hundred fifty people come in twice daily with stringers of sea bass seventy five to eighty per cent under the eight inch proposed limit. In Little River and Murrell's Inlet alone there's probably two thousand people daily going fishing. With only six small fish per person, this amounts to a tremendous fish kill. Add to this the hundreds of private boats and the number grows by another twenty per cent.

Purse seiners do not discriminate between edible fish and menhaden, and all go for fertilizer.

I'm sure no one, including myself, has an answer for all of these problems, but I will outline the ideas I do have.

#1- Trawls in their present form should be barred from any bottom in which marine growth can be dislodged.

#2. Party boats catching sea bass (black bass) should have in front of each fishing station on the rail an eight inch measurement of some sort so that each passenger can measure his or her own fish. This should be explained to them en route, and also the penalty involved for not complying. 4/0 hooks should be used. Private boats, of course, would be harder to patrol or enforce. However, if they are included in the law also and checked whenever possible, the news of a few fines would keep most in line.

#3. I believe as you seem to that the door on a trap should be of a material that comes apart quickly. I also believe that when these things are enacted into law, they should apply to everyone, regardless of the reason for their fishing, such as personal use, for sale, or whatever.

Thank you very much for letting me have my say. If I may be of service to you, please do feel free to call on me.

Yours very truly,
Walter L. Muntz

Capt. Tom Swatzel
322 Waccamaw Drive
Garden City, SC 29576
September 22, 1982

South Atlantic Fishery Management Council
One Southpark Circle, Suite #306
Charleston, SC 29407

Dear Sirs:

I would like to make a statement concerning the Draft Snapper-Grouper Complex Management Plan in accordance with the public hearing I attended September 9, 1982, at the Holiday Inn, Surfside Beach, South Carolina.

I want to go on record as being in agreement with all of the proposed regulations, with the exception of the four-inch mesh regulation for roller rigged trawlers. I am against roller rigged snapper-grouper trawling in any manner. The "live bottom" areas off of South Carolina are being destroyed by the trawls. There is no logic in a mesh regulation if the surviving fishes (if there truly are any viable survivors) have no bottom areas left to live and feed upon.

The Council should take a closer look at the effects of roller rig trawling upon the "live bottom" areas within the South Atlantic Region and act swiftly to eliminate the roller rig trawl as a means of snapper-grouper fishing.

Your consideration on this important issue will be greatly appreciated.

Sincerely,

Tom Swatzel

Capt. Tom Swatzel

TS/kc

JOHN ROBERT SMITH, M. D.
250 PROFESSIONAL BUILDING
250 DIXIE BLVD., SUITE 203
DELRAY BEACH, FLORIDA 33444
AREA CODE 305
276-0336
276-0337

September 27, 1982

South Atlantic Fishing Management Council
South Park Circle, Suite 306
Charleston, South Carolina 29407

Gentlemen:

I am a very avid SCUBA diver. I am writing this letter to make you aware of my opinion about power heads.

It is my understanding that the law is very vague about this subject. If this is correct, the situation should certainly be clarified.

Power heads are important to the serious diver. They are essential in defending oneself against sharks. They are also important in hunting large fish such as large grouper.

I hope your organization will see fit to clear the air on the issue of power heads so that the manufacture, sale and ownership of this important piece of equipment will be perfectly legal.

Very truly yours,

J R Smith

J. R. Smith, M.D.

JRS/ls

SOUTH ATLANTIC FISHERY MANGEMENT COUNCIL
1 SOUTHPARK CIRCLE, SUITE 306
CHARLESTON, SC 29407

Dear Sirs:

We the undersigned do believe that powerheads should be included as a reasonable method of harvesting fish.

We believe jew fish or other fish considered to be endangered should not be caught with powerheads, a provision protecting these fish is in order but a blanket policy of no powerheads is unreasonable.

Powerheads cause less damage to the reefs than nets, fish traps or boat anchors. Commercial divers seldom anchor their boats.

Powerheads add safety to spearfishing, increase productivity, and reduce the number of wounded fish lost by 95%. Fish on a shaft and in a catchbag produce shark attracting vibrations until they are dead.

We have large investments in our equipment. We make our entire living from spearfishing. It seems that the new laws are pushed by the sportsman to eliminate the commercial diver.

Our equipment is designed for diving and further restrictions on diving will force us out of the market.

NAME	ADDRESS	PHONE NUMBER
Edmund [illegible]	P.O. Box 2325 Delray Beach Fla 33441	(305) 499-4639
David [illegible]	157 Longfellow Dr P.S 33461	(305) 965-5881
Paul Olson	1410 Beta Court N Lake Clarke Shores Fla. 33406	(305) 582-5144
Steve Maynard	3650 Palm Dr. Riviera Beach, FL 33404	(305) 845-2310
George [illegible]	P.O. Box 3497 Lantana, FL. 33462	(305) - [illegible] - 4325
Michael W. McFarland	3530 Collin Dr. West Palm Beach, Fl. 33406	(305) 968-1005
[illegible]	3576 Collin Drive W. Palm, Fl.	305-967-4513
John McDonough	4300 Diamond Rd. L.W. Fla.	(305) 968-5983
Benjamin Kalsa Jr.	2789 Florence St. W.P.B FLA.	968-6084

Jerome Broz P.O. Box 504 305 588 1789
Lake Worth, Fl

Mike Kinkead 1308 W LANTANA 305 585 6211

ED BROZ P.O. BOX 6405
LAKE WORTH 305 964-0392

Jamie Broz 22 Harbor Dr.
Lake Worth Fl. (305) 588-1789

Curt Rhodes 514 No. Dixie 305 845-8442
West Palm Beach

Joe Cote 545 Silver Beach Road
Riviera Beach Fl 305 848 4537

Cecil Key 305-622-8629
731 Jacana Way
No. Palm Beach, Fl.

Thomas Siegfried 411 Winter Lane 305-622-5598
Lake Park Fla.

Lee Cuccuzza 8590 Kelso Dr. Lake Park, Fla.
305 622 0592

Donald E. Shelhamer
4537 Mathis Street
Lake Worth, Fla. 33461
305-964-4626

SOUTH ATLANTIC FISHERY MANGEMENT COUNCIL
1 Southpark Circle, Suite 206
Charleston, S. C. 29407

Dear Committee Members:

I am Donald Shelhamer commercial diver. I have lived in West Palm Beach area most of my life and have been spearfishing for my total lively-hood for the past five years. I have fifty thousands dollars invested in my specialized aquipment for spearfishing commercially. I am very disturbed about banning the use of powerheads in the taking of fish.

I submit to the committee points why I oppose this section:

PERSONAL SAFETY UNDER THE WATER

Speared fish create vibration and grunting sounds which do attract sharks. By the depth I dive, I am forced to carry my catch with me in a bag. Powerheads are screwed onto the spear shaft and are shot the same way as a spear tip shaft, but with 95%

instant kill rate. This instant kill rate eliminates dragging around a bag of thrashing grunting speared fish. I am very vulnerable to shark attack during a fight with a spear tip shafted fish. This is no sport it is serious business.

ECONOMICS AND PURE WASTE

Approximately 30% of all shafted fish get away. Most are seriously wounded and die. Powerheaded fish once shot are bagged 98% of the time.

GROUPING POWERHEADS WITH EXPLOSIVES

Do you group Deer, Duck, Squirrel, hunters with dynamiters? We are using 357 magnum powerheads not bombs. Powerheads are not destructive devices that tear up chunks of the reef. If I miss my target and happen to hit the reef solidly very miniscule damage occures, certainly much less than simply anchoring your boat.

REMOVAL OF JEW FISH BY USE OF POWERHEAD

The jew fish seems to be a focal point in sportsman lobbie groups as to why banning powerheads. If this fish is endangered put it on the list and ban it totally. I am not opposed to giving just don't take it all!

Commercial spearfishermen are limited by too many laws both man made and nature made. We are limited to depth, time down (1½ hours per day) visibility of water and many other factors of weather. This is a tough business. My safety and lively-hood are going on the line with this section. I'm already on the endangered species list, lets not let my breed die.

Sincerely,

Donald E. Shelhamer

Donald E. Shelhamer

Richard A. Wilson
161 Longfellow Drive
Palm Springs, Fla. 33461

SOUTH ATLANTIC FISHERY MANGEMENT COUNCIL
1 Southpark Circle, Suite 206
Charleston, S. C. 29407

Dear Committee Members:

I am one of the many commercial divers on the Southeast Florida coast, who makes his entire living from spearfishing. I have over $80,000.00 invested in equipment. This equipment is of a special nature, to accomodate my particular type of fishing.

Commercial divers are very selective in the size and type of fish they take. The depth of the water limits our bottom time and the areas we can fish. Water visibility limits the days which we are able to dive. We must carry our catch with us on the bottom and carry powerheads for protection. All these things force us to only kill larger fish worth the amount of time we have on the bottom.

I have used powerheads for many years. They are a clean and effective method to selectively harvest fish. They only kill the fish they hit. They reduce the threat of shark attack because the diver isn't fighting a live fish on the bottom. As you all probably know sharks use the vibrations of distressed fish in locating their prey. We have already had one diver attacked and bitten on the head because he was fishing with only a spear. Enclosed you will find a newspaper clipping related to this. Hank was at times and still is my dive partner.

The leading complaints of powerheads opponents are that they destroy reef fish, destroy large chunks of reef, allow people to kill every large fish on the reef system and are the reason for the decline of the jew fish.

The powerheads we used were 357 or smaller and only killed the fish we shot. Reef fish seldom were close enough to be bothered. We shoot fish, not reef and 95% of the time we hit the fish in the head. The large fish on the reef usually live in water deeper than we can effectivly fish. This leave the one and only primary reason powerheads have been banned, the jew fish. They are big, dumb, and fairly easy to hunt. Divers can easily dispose of one with a powerhead. Some people worry that they are over fished.

If the jew fish is over fished then limits should be initiated to allow them to increase. These can be accomplished by limiting fishing methods such as powerheads.

Please don't allow your sympathy for this one type of fish to close out an entire method of fishing.

We would all be happy to have a regulated powerhead law which prevents the taking of jew fish. Powerheads used to take food fish could be regulated as to power. This will prevent damage to the edible portion of the fish and damage to the reef. A limit of 1500 foot pounds would include all practical powerheads except the 12 guage which is only used for protection. This would be self enforced by the fact that the fisherman can not sell damaged fish to the fish houses.

If the committee believes the number of fisherman using powerheads should be limited to prevent over fishing, a permit could be required to control this method of taking fish.

Powerheads should not be grouped with explosives. This is a method sportsmen have used to help inhibit commercial fishing.

Respectfully,

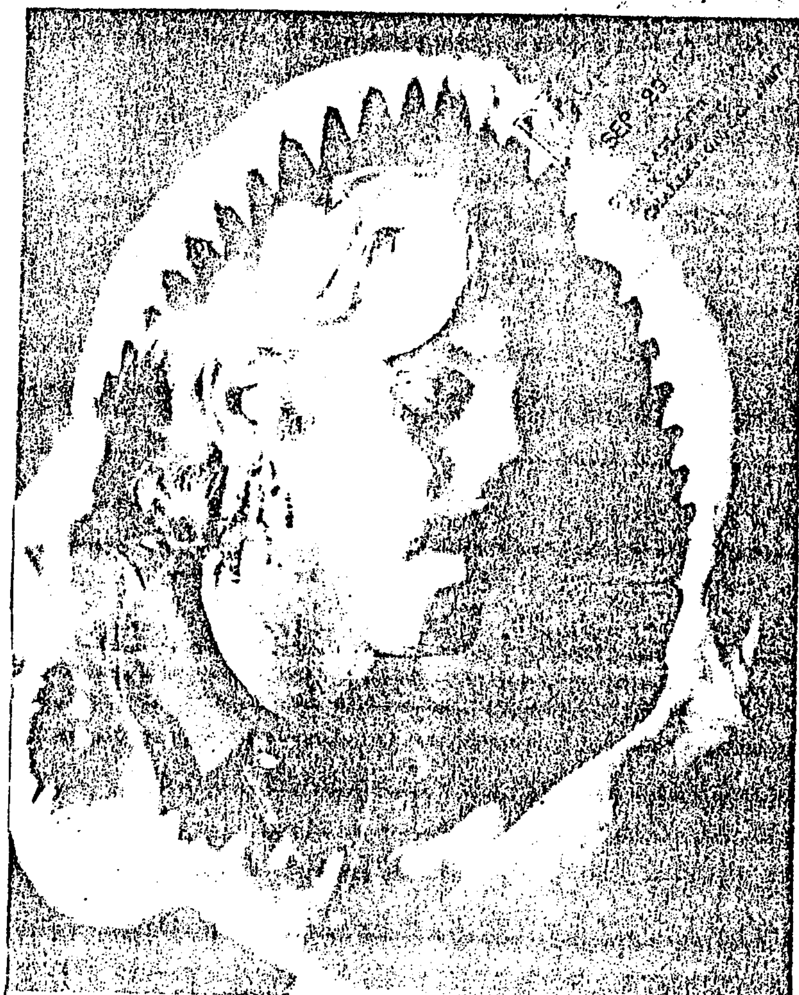
Richard A. Wilson

Richard A. Wilson

RW/lw

1-305-967-3401

IF you have Any questions please call.



Staff Photo by Ron Lindsay

Newberger Shows Stitches From Shark Attack

Shark Attacks At Fort Pierce

By JEFFERY KAHN
Post Staff Writer

FORT PIERCE — Black fear came out of the murky ocean depths and struck here yesterday.

Hitting unseen, it left its victim, a scuba diver who had been spear fishing about 10 miles off the coast, with deep gashes and puncture wounds — the indelible mark of a shark attack.

"I never saw it," said the terrified 25-year-old victim, Hank Newberger of Palm Springs.

"It must have come from behind. When it hit me, it felt like 200 men ramming into me at full speed. But even though I didn't see it, I knew what it was. I could feel him biting my head."

Treated at the emergency room at Fort Pierce Memorial Hospital, Newberger said he was lucky to have survived the attack. "I got out with my life. 30 stitches in the neck and head and 9 teeth mark the shark left as a reminder."

A veteran of eight years of diving, Newberger said his quick reaction prevented a more serious outcome.

"Me and my buddy, Mike Kinkead of Lake Worth, were spear-fishing at the Horseshoe. It's a reef about 10 miles offshore. We'd been down about 35 minutes and I had shot four grouper and had just shot a fifth. Just as I was bringing it in, he hit me from behind.

"I knew when he hit me what it was. I just knew. It flooded my mask and knocked me down into the mud, about 65 feet down. I tell you, if my mask had been knocked off I might have panicked, but I cleared my mask and got my senses real quick.

"Right away, I threw away my bag of fish and scrambled for the nearest rock ledge and crawled underneath. I didn't know where it was. I was losing air real fast because when I got knocked down, a stone got lodged in my regulator. Soon as I cleared my mask and saw how bad I was bleeding, I swam for my buddy. He didn't realize what had happened but as soon as he realized the blood was from me, we grabbed our gear and surfaced." An hour-and-a-half after the attack, Newberger arrived at the hospital, where officials said he was treated for severe bite wounds.

"Because of the size of the bite and the suddenness of the attack, he had to be a shark. At the minimum, it was 6 feet. He bit the top of my head and my neck below my ear, some four inches down. Jaws that size got to come from a shark 6 feet or bigger."

Asked why he thought the shark hadn't returned, Newberger said it was because the shark had gotten what it was after.

"I go spear-fishing maybe three or four times a week sometimes and I've been harassed by a shark before. Usually, you see them before they try to take your catch. You just give them the fish — you don't have any choice — and they leave you alone. This time, though, he just made a mistake about what it was he was after. He got what he wanted, though. My bag of grouper was gone."

Despite what happened — just the thought of which has become a national nightmare since the movie, "Jaws" — Newberger remains unintimidated. He joked that the incident was revenge for his second-place finish in the Jaycees' annual shark fishing tournament two years ago. And he said the shark jaw he has mounted in his living-room picture window will remain a fine fixture there.

"Sure, I'll go diving again. I think Mike Kinkead and I handled it very well. The stitches come out in a week and then I can go diving again."

East-West Center

Pacific Islands Development Program

1777 EAST-WEST ROAD HONOLULU, HAWAII 96848 CABLE: EASWESCEN TELEX: 743-0119

September 29, 1982

RECEIVED
OCT 6 1982
SOUTH ATLANTIC FISHERY
MANAGEMENT
CHARLESTON, S.C.

Mr. David Gould
Executive Director
South Atlantic Fishery Management Council
South Park Bldg. Suite 306
1 South Park Circle
Charleston, South Carolina 23607

Dear Mr. Gould:

The summary draft of the Fishery Management Plan, Regulatory Impact Review, and Environmental Impact Statement for the Snapper-Grouper Complex of the South Atlantic Region has been brought to my attention by Mr. Don De Maria, a commercial fisherman under your jurisdiction. He has asked me to comment to you on this draft summary, especially on Area 10.14: The Use of Poisons, Explosives and Powerheads. Before I do, permit me briefly to introduce myself.

My academic background includes Political Science (B.A.), Marine Biology (BS), Icthyology (M.S.), Business (MBA), and Economic Fisheries (Ph.D.). I am currently the Aquaculture Coordinator for the Pacific Islands Development Program of the East-West Center in Honolulu. I am involved with NMFS, Honolulu Lab through a Market Research Company (SMS Research) which has contracts to do NMFS's recreational fishing study, wholesale and retail fish market studies for Hawaii. I have also worked as a fisheries consultant to Southern California Edison's Fish Impingement Studies. In addition, back in my college days I worked collecting tropical fish for a Company based in West Palm Beach, as well as commercial fishing in Jacksonville, Tampa, West Palm Beach and the Keyes area (your management area).

I have some basic comments to make in regards to this management plan and the request I received to comment on it.

First, the rationale for managing the whole snapper-grouper complex is based on partial data from 17 of the 69 species involved. Actual documented cases of over fishing is nine. If catch quantity, or relative dollar value could be indicated, a better feel is possible for the relative (economic/social) importance of species listed in Table 5-1.

The impression I get by comparing Table 5-1 (Species List) with 8-1 (Species with Known Recruitment Parameters) is that there are enormous holes in biological and catch data. Is efficient and meaningful management of the entire complex possible with so many unknowns?

...2.

Mr. David Gould
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September 29, 1982

Second, in 10.14 a blanket ban is imposed on use of all poisons, explosives and powerheads in taking fishes of the snapper-grouper complex. The impact of poisons and explosives is well documented, and the need for habitat preservation is justified. However, the statement: "Prohibiting the use of powerheads will prevent the removal of large jewfish from reefs and artificial habitats," is a little naive. Spearfishing sports divers will continue to follow the "hunting mentality" and impale this fish (even without powerheads). They may not be the ones actually removing (harvesting) the fish (as the fish would probably swim off and die), but certainly will be instrumental in the fish's disappearance from the reef area.

In the "rationale" of 10.14 is the sentence: "The selective removal of jewfish or other large reef fish from reefs and artificial reefs with powerheads reduces the aesthetic enjoyment of recreational diving." Any intensive fishing activity (especially spear fishing) in the area of intensive recreational diving would decrease fish stocks and therefore reduce the aesthetic enjoyment to the recreation (sight seeing) divers. That is the rationale for setting up marine preserves and sanctuaries where all fishing activities (spear, net, hook and line) are banned. This statement as it stands can be tightened up. The implications as it reads now are a bit misleading.

The rationale for 10.14 continues with "large jewfish attract smaller grouper" (also in 10.18). Could you provide documentation of this for me? I don't recall ever coming to that conclusion in the commercial spear fishing activities I was involved with in the Southeast. Is this documented in the literature, or just an impression/opinion from someone?

As for the "documented cases" of Jewfish removal, I have no doubt that when these fish come into recreational diving waters (within a few miles of the coast) they are subject to incredible fishing effort which would probably negate any mortality coefficient they (jewfish) as a population should possess.

One problem I have with the total ban on powerheads is the impact this will have on harvest of larger grouper/snapper. As presented in Mr. De Maria's letter to you (September 20, 1982), the actual catch rates will probably decrease, with an accompanying dramatic increase in number of maimed, diseased and dying fish. As Mr. De Maria indicates, you don't manage a deer population by allowing hunters to use 22 caliber rim fire rifles. In Alabama, even shot guns are banned in deer hunting unless shells with buck shot or slugs are used.

I'm not arguing for the total ban of spear fishing in the entire FMZ, but would like to point out there exists appropriate harvest methods for each species. When well managed, these methods can be used to achieve optimum harvest levels of the living resource (in this case large groupers/snappers).

......3.

Mr. David Gould
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Alternative strategies for managing large grouper (jewfish) may include:

1) Banning spearfishing in areas of high recreational diving (as in most of the Florida Keyes);

2) Banning the use of powerheads (except for protection) in recreational diving areas;

3) Establishing a partition in the resource (similar to 10.8) between commercial and recreational spear fishing interests. (Mr. De Maria's commercial fishing activities are primarily more than 5 miles offshore, beyond the range of most recreational diving activities).

As for the request to comment on the draft management plan, I am a little shocked that a commercial fisherman in your region of management would feel that academic credentials, no matter how removed from Atlantic fisheries, would carry more weight with the Council than the opinions of an individual who has devoted his life's work to the region and the resource.

I hope that the Council, as the center for fisheries management in the South Atlantic, will take the time to meet and appreciate the people who interface daily, the renewable resources it has the mandate and task of managing.

I believe that the Council will be pleasantly surprised at the amount of knowledge and information available to them through this and other segments of the user population.

For the Council's information, Mr. De Maria probably has the most extensive and on-going collection of biological and catch data on the jewfish (*Epinephelus itajara* compared to any Agency or department which deals with fishery resources in the region. In this case, an interchange between manager (Council) and user (Mr. De Maria) would go a long way to fill in the data gaps on one hand, and to establish a more positive image of concern and responsiveness on the other.

If you have comments or need clarification on anything presented here don't hesitate to contact me.

Sincerely,

K. Roger Uwate

K. Roger Uwate, Ph.D.
Aquaculture Coordinator
Fellow, PIDP

cc: Mr. De Maria

Mr. David Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Circle, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

RECEIVED OCT 4 1982

29 September, 1982

Dear Mr. Gould,

This letter is intended as a comment on the Draft Fishery Management Plan for the Snapper-Grouper Complex of the South Atlantic Region prepared by your office.

I am a lifelong resident of Florida and am employed professionally as a biologist by the Federal Government. I am a member of the Gulf of Mexico Fishery Management Council Tropical Reef Fish Advisory Panel. With large scale population shifts to this state and ever increasing recreational and commercial pressure on inshore and offshore fish populations it is imperative that an adequate data base be obtained to determine the extent of recruitment and growth overfishing in the snapper-grouper complex and to prepare for future problems. Minimum size limits and possibly quotas are inevitable for many species and the mechanisms for imposing these need to be streamlined for effectiveness. Increased efficiency by fishermen is also inevitable and the priority of the Council has to be the accumulation of data necessary for decision making. It is obvious that the Council is very cautious in imposing size limits or quotas but I am certain that a majority of individuals in the industry prefer that the Council err on the safe side as concerns the future of these fish stocks.

In regard to your proposal for fish traps it has been documented in many locations and studies that indiscriminate use of fish traps results in the harvest of many non-target species of reef fish with impacts to the reef ecosystem (predator-prey relationships, symbiotic relationships, effects of grazers, etc.) about which we have very little knowledge. Based on this non-selectiveness, the presence of hard bottom coral habitats in depths greater that 100', the stated desire of the people of Florida to legislate fish traps out of adjacent waters and the lack of enforcement that is characteristic of all fields of environmental and fishery regulation I recommend that the Council yield to the desires of many and prohibit the use of fish traps in federal waters adjacent to the state of Florida. The Gulf Council would then follow with a similar ban in Gulf waters adjacent to Florida. The economic loss would be insignificant to a fishery which does not now exist and a major future problem would be avoided be the Council. The present day problem of extensive trap poaching in the Florida Keys should be a signal to the Council that enforcement of this depth related regulation will be impossible and fish traps will begin appearing again in large numbers in shallow waters of the reef tract.

Thank you for consideration of these comments.

Sincerely,

CKruer

Curtis R. Kruer
P.O. Box 633
Big Pine Key FL
33043

Dade Sportfishing Council, Inc.
A Non-Profit Organization
18201 N. W. 68th Avenue • Hialeah, FL 33015

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13631 SW 102 Avenue
Miami, Fl. 33176
September 30, 1982

South Atlantic Fishery Management Council
1 Southpark Circle, Suite 306
Charleston, SC 29407

Dear Sirs:

Attached are the recommendations of the Dade Sportfishing Council on the proposed Fishery Management Plan for the Snapper-Grouper Complex.

The recommendations have been approved by the Board of Directors of the Dade Sportfishing Council. The council consists of the seven major sportfishing clubs in Dade County and represents the most active of the sportfishing interests in South Florida.

At the SAFMC public hearing in Dade County, some commercial fishermen proposed revising the FMP's recommendation concerning the minimum depth for fish traps from 100 feet to 60 feet. We oppose fish traps at any depth and would consider fish traps at 60 feet as far worse than fish traps at 100 feet. Also, the commercial fishermen are obviously hoping that your federal regulations will authorize fish traps in Florida federal waters and therefore allow them to circumvent Florida's fish trap ban that they have opposed so vigorously and unsuccessfully over the past few years. Please consider the fish trap regulations of your FMP carefully as this subject is of the utmost importance to the Florida sportfishermen and fish traps in federal waters would represent a tragedy to us.

If you have any questions concerning the recommendations you may reach me at the above address or at A/C 305-255-0820.

Sincerely,

Donald W. Doan
Secretary
Dade Sportfishing Council

CC: C. Bruce Austin
G. S. McIntosh, Jr.

J. O'Hara Smith

DADE SPORTFISHING COUNCIL 9/24/82
RECOMMENDATIONS ON
THE PROPOSED SAFMC FISHERY MANAGEMENT PLAN FOR THE SNAPPER-GROUPER COMPLEX

The following recomendations are those of the Dade Sportfishing Council of Miami, Florida concerning the SAFMC's proposed Fishery Management Plan for the Snapper-Grouper Complex dated July, 1982:

1. Fish traps should be totally banned from federal waters adjacent to the coast of Florida. Florida has voted to ban fishtraps from state waters and the federal government should not abridge the will of the Florida people by allowing them in federal waters off the Florida coastline.

2. Growth overfishing (Section 7.0, paragraph 1) is not justified under any circumstances and should not be permitted. As sportfishermen, we do not believe in or condone overfishing by any name.

3. We do not agree with the council's IRR method of evaluation which can find that a species is overfished and decide to do nothing to eliminate this overfishing (Section 10.2.2). We believe any evidence of overfishing should result in restrictions being placed on the catch until the overfishing is eliminated.

4. We recommend stiff laws and penalties for any damage to fish habitat (coral reefs, grasses, etc.) caused by mobile fishing gear. In a few hours, one carelessly used net can cause damage that can take nature decades to repair.

5. We recommend that all snappers, groupers, and wrasses be carefully monitored for evidence of overfishing and if overfishing is found in any species, immediate size limit restrictions placed on the catch to eliminate it. We beleive these species to be very vulnernable to overfishing and are probably overfished at the present time.

6. In addition to the minimum size limits used in the council's recommendations, we would also endorse and recommend bag limits and closed seasons for spawning where a species population has been determined to be declining, and total closed seasons for species with populations proven to have seriously declined.

7. Spearfishing of species in the snapper-grouper complex should be investigated by the council and restricted in some fashion. Jewfish, groupers,and wrasses are extremely vulnerable to spearfishing and some restrictions of this practice are necessary to protect these species.

8. The designation of artificial reefs as special management areas is an excellent idea and we wholeheartedly endorse the proposal.

9. We endorse the size limits placed on the 5 species as proposed by the FMP.

10. We recommend implementation of size limits on the other 8 species designated in the FMP as overfished.

11. The banning of powerheads, poisons, and explosives are excellent ideas which we endorse.

12. We recommend revising of the management objectives of the FMP (Section 7.0) to establish a goal of limiting the total annual catch by species to those levels that the fish can replenish on an annual basis so as to maintain each species total population at its natural level.

ORGANIZED FISHERMEN of FLORIDA

ORGANIZED FISHERMEN OF FLORIDA

P.O. BOX 740, MELBOURNE, FLORIDA 32901
(305) 725-5212

October 1, 1982

OCT 6 1982
SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL
CHARLESTON, S.C. 29407

Mr. David Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

Dear David:

I would like to commend the Council and its staff for the fine work you have done on the fishery management plan for the Snapper-Grouper Complex. This plan and its speedy implementation will do much to help the Snapper-Grouper resource as well as the fishermen in our region.

There are, however, a few items which I believe need to be added to the plan in order for it to achieve its goals. The main omission I see in the plan, and perhaps this can be taken care of in the regulations, is regarding the size limits. There is no tolerance for measurement error in what a person is allowed to have. The management measures state that all of those particular species less than the specific size must be released. This might be appropriate in situations where the fish are brought in singly, but it is not practical nor efficient to accurately measure each fish as it is brought aboard when longlines or trawls are used for harvest. I would, therefore, recommend that a 10 percent allowable by-catch of undersized individuals, by weight, be provided for in the Plan. This would not alter the effectiveness of the management measures. It would, though, keep the fishermen from being subject to the penalties provided under Federal law for having three or four undersized fish in a two-thousand pound catch. I do not believe the Plan intended to subject the fishermen to that kind of accuracy, as it would be unreasonable and burdensome.

I would also request that you add Yellowtail Snapper to the list of species which have a minimum size in the Plan. Twelve inches would be the preferred size. There is widespread support for this measure, as I believe was evident at the public hearings. This measure would help the resource while only minimally affecting the users.

The last item I would like to comment on is the area in which fish traps are prohibited. The northern area, Jupiter Inlet Light to Fowey Rocks is reasonable and a good measure. However, the 100 foot prohibition south of there is of much greater impact than the EIS indicates.

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October 1, 1982
David Gould, Executive Director
South Atlantic Fishery Management Council

Outside of the 100 foot contour there is relatively little fishable bottom when you account for depth and current, so it is more than just how much farther they must travel. The real impact is whether or not the trappers will be able to utilize the area in which they are allowed to fish. It is my recommendation that south of Fowey Rocks Light the prohibited zone be inshore of the 60 foot contour. This will achieve the desired protection without adversely affecting any one user group.

The Organized Fishermen of Florida greatly appreciates the opportunity to comment on the Snapper-Grouper Plan and I hope that these comments will be of help to the Council in its efforts to finalize this vital plan.

We look forward to the implementation of this Plan.

Sincerely,

Jerry H. Sansom, Executive Director
Organized Fishermen of Florida

NATIONAL WILDLIFE FEDERATION

1412 Sixteenth Street, N.W., Washington, D.C. 20036 202—797-6800

October 4, 1982

Mr. David H. G. Gould
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, SC 29407

Dear Mr. Gould:

Enclosed please find the comments of the National Wildlife Federation on the Snapper-Grouper Fishery Management Plan of the South Atlantic Region. We are pleased to submit our comments and hope they provide helpful guidance in developing a final management plan that is acceptable to all involved in the snapper-grouper fishery.

Sincerely,

Rudolph A. Rosen

Rudolph A. Rosen, Ph.D.
Fisheries Resource Specialist
Fisheries & Wildlife Program

NATIONAL WILDLIFE FEDERATION

1412 Sixteenth Street, N.W., Washington, D.C. 20036 202—797-6800

Comments of the National Wildlife Federation to the South Atlantic Fisheries Management Council on the Fishery Management Plan, Regulatory Impact Review, and Environmental Impact Statement for the Snapper-Grouper Complex of the South Atlantic Region

30 September 1982

Submitted by

Rudolph A. Rosen, Ph.D.
Fisheries Resource Specialist
Fisheries and Wildlife Program
National Wildlife Federation

NWF COMMENTS ON THE SNAPPER-GROUPER PLAN

The National Wildlife Federation (NWF) appreciates the opportunity to offer comments on the Fishery Management Plan, Regulatory Impact Review, and Environmental Impact Statement for the Snapper-Grouper Complex of the South Atlantic Region.

NWF is a private, not-for-profit conservation-education organization with over four million members and supporters, and affiliate organizations in the 50 states, Guam, Puerto Rico, and the Virgin Islands. Many of our members and members of our affiliate organizations enjoy the fisheries resources of our estuaries and oceans. NWF has consistently advocated the wise use of our fisheries and has staunchly supported U.S. management of fisheries resources within the 200-mile limit.

The Snapper-Grouper Plan offers a scientifically-based means to manage the fishery. We commend the Council in its effort to ensure that the limited quantitative data available on snapper-grouper complex species were used in developing management measures.

However, this plan will do little more than begin the process of managing the snapper-grouper resource. The overall snapper-grouper fishery in the South Atlantic is addressed, but major conflicts in the fishery and severe resource degradation have traditionally occurred in fairly limited and well defined areas. The plan does little to address user group conflicts, and does nothing to address the sedentary or localized nature of snapper-grouper species and the associated fishery.

A paucity of basic data is evident. Simple fishery statistics, such as age and growth data, are lacking for all but 17 of the 69 species to be managed by the plan. Sufficient data to estimate mortality are available for even fewer of the species. Throughout the plan, a lack of data seems to provide rationale for maintaining present fishery practices, regardless of obvious problems.

Specific comments addressing several general topics in the plan follow:

Fish Traps

Fish traps are a highly efficient and cost/effort-effective gear. Their attractiveness as a fishing method has led to a tremendous rise in use. In southern Florida, the number of fish traps increased to the point where overfishing and user group conflicts forced the State of Florida to restrict trap use. Numerous studies have documented the efficiency of traps fishing reef fish. Large numbers of fish, often representing a high percentage of those available to capture, can be removed by only a few traps briefly fished. Fish traps are easily placed in position on, or nearby reefs, and because most reef fish are sedentary, large numbers of fish can be removed quickly.

Reefs concentrate many snapper-grouper complex species. Therefore, reefs are favored by marine recreational anglers as well as commercial fishermen. Because of the high mobility of commercial fishermen, once a reef is fished to the point where catch per unit effort makes further fishing unprofitable, commercial fishing operations can be moved to another location. However, most recreational anglers do not have such mobility and continue fishing in accessible locations regardless of whether catch per unit effort is high or low. Many recreational anglers left with poor fishing as a result of overfishing by commercial traps have become adamantly opposed to trap fishing.

Conflicts between trap fishermen and recreational anglers are most severe south of Cape Canaveral, Florida; there is strong need to restrict the use of traps in waters adjacent to southern Florida. Such restrictions presently appear unnecessary elsewhere.

The plan does not adequately address Florida's present fish trap regulations (Section 370.1105, Florida Statutes) that prohibit the use and possession of fish traps (except under certain circumstances). Since Florida's law preceded the Snapper-Grouper Plan, the Council's decision to "overlook" Florida's trap management regulations is inconsistent with the Magnuson Fishery Conservation and Management Act (MFCMA). Section 303(b)(5) of MFCMA specifies that Fishery Management Plans "incorporate (consistent with the national standards, the other provisions of this Act, and any other applicable law) the relevant fishery conservation and management measures of the coastal states nearest the fishery."

Excessive mortality of undersized or nontarget species has been cited as associated with trap gear. Three major forms of mortality occur:

Gas embolism -- fish in traps are subject to injury and death from gas embolism when traps are rapidly hauled to the surface from depths greater than 60 feet.

Handling stress -- undersized or non-target fish are sorted from the desirable portion of the catch and are discarded as bycatch. Some handling-related mortality will occur.

Trap induced -- fish may die while confined in traps due to predation, abrasion, or physiological stress. Lost traps may be responsible for some level of continuing mortality. (We recognize that all fish that become confined in traps do not die; ingress and egress of fish occur at some rate. However, mortality in excess of that which occurs naturally can continue while traps remain intact. We agree with the Council's decision to require biodegradable/ corrodible panels on door hinges in traps. Such panels or hinges will reduce the potential total mortality of fish due to confinement in lost traps.)

The significance to the fishery of gas embolism, trap mortality, and handling stress is unknown. Incidence of such mortality can be reduced substantially by increasing trap mesh size, thereby excluding many undersized fish and some non-target species from the catch. The Plan proposes that traps have a minimum mesh of 1 x 2 inches. Because 1 x 2 inch mesh is the size used in the majority of traps today, no additional protection to the stock is afforded by provisions of the plan. We recommend that, at a minimum, mesh size be greater than 2 x 2 inches. An unpublished study by the Florida Department of Natural Resources and the National Marine Fisheries Service conducted in 1979-1980 indicated that even 2 x 2 inch mesh retains small-sized fish (personal communication, R. H. McMichael). The results further indicated that mesh sized 2½ x 2½ inches would allow small yellowtail and grouper to escape and 2 x 2 inch mesh would retain, at or below the recommended minimum size, those species for which the Snapper-Grouper Plan has proposed minimum size limits.

The 1 x 2 inch trap mesh size will not conserve the resource and appears inconsistent with three National Standards of MFCMA (Sec. 301(a)(1,2,5): (1) The trap fishery appears directly responsible for <u>overfishing</u> snapper-grouper complex species in localized areas (primarily in southern Florida) (FCMA, Sec. 301(A)(1)). The best available scientific information does not indicate that fish traps under the proposed regulations would cause no harm. Florida law restricts the use of fish traps in general in Florida. This measure was adopted to conserve the resource after intense public pressure erupted when depleted reef fish populations were linked to an increased use of fish traps. (2) The proposed minimum mesh size for traps will lead to wasting a larger portion of the resource than necessary (Sec. 301 (a)(2)). (3) Scientific data do not indicate a 1 x 2 inch mesh is the most efficient mesh for the size and species composition of fish available to capture and the minimum size regulations of the plan (Sec. 301(a)(5)).

The U.S. market for snapper-grouper species favors a large-sized fish; the plan seeks to increase yield per recruit by restricting harvest of small fish. The mesh size of traps should be matched accurately to this goal and to the goal of conserving a maximum portion of the nonharvestable (by regulation) or unwanted (by demand) resource. Studies directed toward these goals have not been conducted. Therefore, in all areas adjacent to Florida waters, we feel the use of fish traps should be prohibited until (1) a system of regulating the trap fishery is established that prevents overfishing and provides equitable allocation of fish among user groups; (2) the mesh size of traps is evaluated and adjusted to achieve maximum efficiency as regards bycatch and fish mortality; and (3) consistency issues with Florida's trap restrictions are resolved. An NWF resolution adopted in 1981 is attached that calls for prohibiting the use of fish traps until reliable and unbiased studies can document the effects of fish traps, particularly on reef populations and on reefs themselves. NWF strongly supports fisheries management based on valid scientific information that conserves, yet distributes fairly, fisheries resources among users. The Snapper-Grouper Plan's recommended trap regulations are not based on such management criteria.

Live-Bottom Habitat Damage

Studies conclusively documenting the effects of traps and roller-rigged trawls on live bottoms have not been conducted. Therefore, an assumption that use of such gear inflicts insignificant habitat damage presently is unsupported. Traps can be placed directly on soft or hard coral and roller-rigged trawls can be dragged over live bottoms. The Snapper-Grouper Plan states that restrictions on gear fishing live-bottom habitats will be provided for in the Coral Management Plan (presently under development). Although we would prefer that live-bottom habitats receive protection immediately, we understand that the Snapper-Grouper Plan addresses only the snapper-grouper resource. Therefore, we agree that live-bottom habitats may be best protected by the Coral Plan. Loss of live-bottom habitat will surely result in the degradation of our reef fish resource. Alternate, non-damaging gear is available to harvest fish inhabiting live-bottom areas. We urge the Council to identify areas of live-bottom habitat as rapidly as possible and implement the Coral Plan, thereby restricting the use of destructive gear in live-bottom habitats.

Artificial Reefs

Artificial reefs or fish attraction devices (FADs) are built for varied reasons. We concur with the Council's proposal not to impose blanket restrictions on their use. However, the continued construction and placement of FADs requires that developers be assured that FADs are used for purposes for which they were intended. The proposed system to zone FADs by establishment of a Special Management Zone (SMZ) appears unwieldy. We understand SMZ establishment for each FAD will require an amendment to the plan; public hearings will be required and delays of many months to a year will be incurred with no assurance to developers that FADS will be zoned for the intended use.

We suggest the Council simplify requirements for SMZ establishment. Developers should be able to choose among allowable, broadly defined public uses as established by the Council (e.g., rod and reel angling, spear fishing, underwater observation). FADs should be open to the public; i.e., all individuals of specified user group categories. NWF does not advocate that FAD use be restricted to private groups.

"Recreational" Commercial Angling

We ask the Council to implement a permit or licensing system that discourages or prohibits recreational anglers and spear fishermen from marketing their catch. Sale of fish constitutes a commercial enterprise and should be permitted or licensed as such. A system restricting "recreational" commercial fishing should not impede sale of fish by legitimate commercial fishermen.

Yield Per Recruit Model

Protection will be provided snapper-grouper complex species throughout the management area by regulating the minimum size at harvest. Data were available to evaluate the effects of minimum size regulations for 17 species; minimum size regulations were recommended for only 8 species. All other snapper-grouper species will not benefit from the size at harvest recommendations of the plan. However, given the data available for plan development, size restrictions may be the easiest and most scientifically verifiable means to manage the resource on a region-wide basis. Management provisions of the plan are insufficient to manage localized portions of the snapper-grouper resource. Some fisheries must be regulated by a zone-allocation system. We recognize that sufficient data were unavailable to determine allocation limits or zones for the fishery.

Regulating the minimum size at harvest will afford no protection to stocks in areas subject to high fishing pressure. South of Cape Canaveral, the intensity of the fishery demands that catch restrictions be placed on species most sought by commercial and recreational users. Even though total yield may remain constant under the minimum size regulations, at high levels of fishing mortality (F), catch per unit effort may decrease drastically. When fish are vulnerable to gear at early ages, even high size limits will yield no appreciable benefit to fish subjected to high F. The probability of such young fish being hooked or caught in the fishery is great and any advantage to the fishery from the size regulations may be offset by the increased likelihood of mortality from handling/capture-related stress.

Data used to estimate mortality rates provided little more than ball park figures for the management area. For example, F for the overall management area was often assumed equivalent to that obtained by relatively recent studies conducted in a limited portion of the management area or studies conducted outside the management area (F is strongly affected by changes in the fishery such as have recently occurred in some portions of the management area). Natural mortality (M) was estimated by extrapolation from growth data (the precision of the technique is unknown for the species considered by the plan). In all, data were available, or could be reasonably estimated, for 17 of the 69 species for which the plan was developed.

Fortunately, within the range of reasonably expectable M and F, the yield per recruit models remain constant enough to provide acceptable prediction of the effects of the proposed management measures. When these fisheries are subjected to high levels of F, the yield/recruit model is of little use.

The yield per recruit model does not address the effects of an intense localized fishery. Therefore, we urge the Council to consider the minimum size at harvest proposals of this plan as interim. We request the Council to develop the data base from which to implement a management scheme based on zoning the management area and allocating harvest between users.

Summary of NWF Recommendations

o Fish traps should be prohibited in waters adjacent to Florida until a responsible management plan for trap use is developed.

o Live-bottom habitats should be afforded immediate protection from destructive fishing gear.

o Requirements should be simplified for establishing Special Management Zones around artificial reefs.

o A system should be implemented to discourage or prohibit recreational anglers and spear fishermen from marketing their catch.

o The snapper-grouper fishery should be managed by a zone-allocation system. Management should fairly allocate the resource between all user groups. Additional data need to be collected on the fishery as well as the biology of snapper-grouper complex species to justify management criteria.

o Data should be collected to manage all species of the snapper-grouper complex. Those species for which management or data collection seems unwarranted should be eliminated from consideration by the plan.

MARINE EXTENSION SERVICE
UNIVERSITY OF GEORGIA

SOUTH YARDS P. O. BOX 517 BRUNSWICK, GEORGIA 31520 (912) 264-7268

October 4, 1982

David H. G. Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
1 Southpark Circle
Charleston, South Carolina 23407

Dear Dave,

Outlined below are my comments made at the public hearing on the Snapper-Grouper plan in Savannah September 2, 1982:

Error:

Summary-draft. page 12, step #2, "For all species in the complex larger fish are more valuable per pound than smaller fish for commercial fishing." This is quite often reversed as in the case of red snapper. Note the enclosed fish receipt for 3/11/82. 2 to 4 lb. and 1 to 2 lb. red snapper brought $2.75 per lb. whereas those fish 12 lbs. and over brought $2.50 lb. and on the 3/3/82 receipt 2 to 4 lb. reds brought $3.00 whereas 12 lbs. and up brought $2.75. Also on the receipt for 2/22/82 4 to 8 lb. reds brought $3.25 while those 12 lbs. and above brought $3.00.

Also grouper quite generally bring an across the board even price regardless of size.

Trap Fishing:

It is highly discriminatory to eliminate one group of a three-user group from waters inside the 100 ft. contour. All three groups want to fish there because of one simple reason, that is where the fish are. The argument that bouys interfering with navigation and fish hooks snarling on traps is quite weak.

This rule would also put the commercial man out in the Gulf Stream along the east coast and into the shrimp grounds on the west coast. This inshore limit should be 60 feet.

On page 21, under article 10.6 - Impact - States that sport fishermen claim both coral damage and killing of excessive amounts of reef fish. It also states a NMFS study showed no coral damage and I understand a Harbor Branch and/or a NMFS study showed very little or no continuous fishing from ghost traps. I would think that these two facts should eliminate any reference to these concerns in the plan. These concerns of sportfishermen are obviously based on misconceptions and magnified by extensive newspaper coverage.

Artificial Reef:

Banning fishermen from designated sport fishing areas seems highly discriminatory for the following reasons:

a. sport fishermen are allowed to fish on all those grounds that a commercial fisherman can use, but a commercial fishermen cannot fish on all sport fishing grounds.
b. if artificial reefs are constructed outside of the 100 ft. contour, then commercial trap fishermen are being restricted in a so called unrestricted area.

BRUNSWICK, GA.

c. no grounds have been designated solely as commercial fishing grounds.

Prohibiting Roller Trawls in Limited Areas:

This proposal should be carefully watched because the blanket delineation of areas with known coral outcroppings for protection reasons would inevitably include good fishing grounds with no consequential bottom habitat.

If the people concerned with critical habitat would or could give accurate loran readings as to the location of these areas, then most fishermen would avoid them for fear of gear damage or loss.

Use of Powerhead:

Powerheads should be required for the taking of jewfish. Too many of these fish have been observed with one to several spears in them. Powerheads would insure a kill and not allow these large fish to linger and die.

Size Limit:

Yellowtail:

A ten inch limit should be imposed because sport fishermen receive approximately $.65 for fish 3/4 lbs. and below. This inducement could encourage gross overfishing.

Jewfish:

A 100 lb. minimum size would prevent the complete or nearly complete overfishing on wrecks and reefs.

Sincerely,

Dave

David L. Harrington
Marine Fisheries Specialist

BUS. TEL. (212) 962-7652 **WEEKLY BILL** HOME TEL. (516) 360-0908
Ask For Bobby

Behrens Seafood
SHRIMP
WHOLESALE FISH DEALER
154 BEEKMAN ST. NEW YORK N.Y. 10038

CK#1399
$ 8,958.56

Bryan Fisheries Corp.
P.O Box 609
Richmond Hill, Ga. 31324

3/11 1982

DATE	WGT		PRICE	TOTAL	
		TO BALANCE			
✓	41	Congr eels	.20	8	20
✓	685	2/up Pink Snapper	1.20	822	—
✓	879	1-2 " "	.70	615	30
✓	1000	1/under " "	.50	500	—
✓	2955	2/under Silver Snapper	.45	1329	75
✓	560	2/up. " "	.60	336	—
✓	2350	Grouper	1.25	2937	50
✓	152	2/4 Red Snapper	2.75	418	—
✓	33	1/2 " "	2.75	90	75
✓	829	12/up "	2.50	2072	50
✓	145	1/2 B-Liners	1.75	253	75
✓	200	3/4-1 "	1.40	280	—
✓	92	Blue Sisty	.60	55	20
✓	178	1¼-2 C Bass Bellies	1—	178	—
✓	34	1/2 "	1—	34	—
✓	112	2/up "	1—	112	—
✓	90	3/4-1¼ "	.60	54	—
		3	Freight	1138	39

10,335 ALL CLAIMS FOR ALLOWANCES MUST BE MADE ON DAY GOODS ARE BOUGHT. 10096.95
NOT RESPONSIBLE FOR DELAY, DAMAGE OR NON-DELIVERY BY TRANSPORTATION CO. 1138.39

8958.56

CRUISE 17

~~Bryan~~ Fishermen's Cooperative, Inc.
P.O. Box 609 - Richmond Hill, Ga. 31324 - Phone (912) 727-2126

TRIP SHEET NO. 1007

Boat Georgia Bulldog Captain
Owner University of Georgia Catch Received
Trip Started 2-19-82 Trip Completed March 3, 82

Ubrangle

NO. BOXES	DESCRIPTION	COUNT	WEIGHT	LBS. HEADED	LBS. GRADED	PRICE	AMOUNT
2	Pink Snapper	1 +un	75			.50	37 50
0	B/line	3/4 +un	25			65	16 25
1	Trigger fish		20			40	8 00
12	Gag grouper		912			125	1140 00
1	Black drum		45			0	—
0	Red Snapper	2-4	8			300	24 00
6	Red Snapper	2 dun	426			275	1171 50
4	B/line	3/4 dun	346			65	224 90
1	B/line	1-2	15			200	30 00
1	B/line	3/4-1	76			150	114 00
18	Silver Snapper	2 dund	1812			65	1177 80
6	Silver Snapper	2 dare	600			65	390 00
	PROCESSING CHARGES		6335 1120			TOTAL	4333 95

Tax 1008 $1395.00

5,728.95

SHRIMP: Packing: lbs. at ¢ per lb.
Heading: lbs. at ¢ per lb.
Grading: lbs. at ¢ per lb.
FISH: Packing: lbs. at ¢ per lb.

TOTAL AMOUNT

SUPPLIES AND DISBURSEMENTS

CHECK/VOUCHER INVOICE NO.	DATE	PAID TO	AMOUNT
		Freight @ 11¢ x 6230	685 30

TOTAL AMOUNT 685 30

NET DUE: ☐ BFC ☐ Boat Account on Trip Sheet No.

NET DUE TO: ☐ COOP ☑ BOAT ACCOUNT Ck# 4638 NET AMOUNT 5043 65

Fishermen's Cooperative, Inc.
609 - Richmond Hill, Ga. 31324 - Phone (912) 727-2126

TRIP SHEET NO. 1001

University of Georgia ______ Captain ______
Bulldog ______ Catch Received ______
Started 2-9-82 ______ Trip Completed 2-22-82

NO. BOXES	DESCRIPTION	COUNT	WEIGHT	LBS. HEADED	LBS. GRADED	PRICE	AMOUNT
	Grouper		136			1.30	176.80
	Red Snapper	[illegible]	39			3.00	117.00
	Red Snapper	4-8	37			3.25	120.25
	Pink Snapper	2 dn	196			.60	117.60
	Pink Snapper	2 + up	55			1.20	66.00
	Silver Snapper	2 dn	199			.60	119.40
	Silver Snapper	2 + up	49			.75	36.75
	Blackfish	½-1½	75			.70	52.50
	Blackfish	½ + dn	29			.40	11.60
	Blackfish	1½-2	70			1.25	87.50

PROCESSING CHARGES 885 lbs TOTAL 905.40

SHRIMP: Packing: ______ lbs. at ______ ¢ per lb. ..... ______
Heading: ______ lbs. at ______ ¢ per lb. ..... ______
Grading: ______ lbs. at ______ ¢ per lb. ..... ______
FISH: Packing: ______ lbs. at ______ ¢ per lb. ..... ______

TOTAL AMOUNT

SUPPLIES AND DISBURSEMENTS

CHECK/VOUCHER INVOICE NO.	DATE	PAID TO	AMOUNT
885 lbs	11¢	Freight on Shipment	97.35

TOTAL AMOUNT

NET DUE: ☐ BFC ☐ Boat Account on Trip Sheet No. ______

NET DUE TO: ☐ COOP ☑ BOAT ACCOUNT Ck # 4665 NET AMOUNT 808.05

Gold Coast
Lobster Co.
5210 N. E. 17th Ave.
Ft. Lauderdale, Fla. 33334

10-4-82

Dear Mr. Gould and Council members,

I would like to recommend that the Fishery Management Plan for the snapper-grouper complex in the South Atlantic region be accepted and passed with one changed.

The only change I would recommend for now, deals with the use of fish traps.

I think the one hundred feet contour line south of Jupiter light should be changed to a sixty feet contour or three miles south of Fowey light.

This would most certainly help the fishermen of the Keys due to the extra distance they would have to travel in reaching the fishing grounds.

I would like to commend the Council and yourself for putting together such an excellent fishery plan. It is one that has been needed for a long time and the sooner its passed the better.

Thankyou

Edward C. Lau Jr.

NATIONAL WILDLIFE FEDERATION
1412 Sixteenth Street, N.W., Washington, D.C. 20036 202—797-6800

October 5, 1982

Mr. David H.G. Gould
South Atlantic Fishery Management Council
Southpark Bldg., Suite 306
1 Southpark Circle
Charleston, SC 29407

Dear Mr. Gould:

The enclosed National Wildlife Federation Resolution on fish traps was inadvertently omitted from our recent comments on the Snapper-Grouper Fishery Management Plan. Please include the enclosed with our comments.

Thank you.

Sincerely,

Rudolph A. Rosen, Ph.D.
Fisheries Resources Specialist
Fisheries & Wildlife Program

Encl.

NATIONAL WILDLIFE FEDERATION

1412 Sixteenth Street, N.W., Washington, D.C. 20036 202—797-6800

Resolution No. 4

FISH TRAPS

WHEREAS, fish traps are a method gaining in popularity for the harvest of reef fishes in waters bordering on the Gulf of Mexico and South Atlantic ocean; and

WHEREAS, little biological data exist on the effects of traps on fish populations and limited studies indicate that traps are highly effective but indiscriminate method of taking fish, one with the potential of severly depleting fishery resources; and

WHEREAS, territorial sea reef fisheries have been seriously overharvested, and studies indicate that as catch per unit of effort decreases the fish trap fishermen will move their operations and wreak the same havoc on offshore reef populations; and

WHEREAS, the Florida legislature has banned the possession and use of fish traps in waters under jurisdiction of the State; and

WHEREAS, regional fisheries management councils, dominated by commercial fishing interests, have recommended that no restrictions be imposed on the use of traps in depths of 100 feet or deeper, thus allowing unlimited numbers of traps and no limit on sizes of the traps;

NOW, THEREFORE, BE IT RESOLVED that the National Wildlife Federation, in annual meeting assembled March 26-29, 1981, in Norfolk, Virginia, hereby supports a ban on the use of fish traps in both state and federal waters until reliable and unbiased studies can document the effects of fish traps, particularly on reef populations and on the reefs themselves.

West Palm Beach
586-2212
586-2213

Broward
427-1234

Gulf Stream Seafoods

If It Swims We Sell It!

P. O. BOX 6548

5300 GEORGIA AVENUE WEST PALM BEACH, FLORIDA

October 25, 1982

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL
1 Southpark Circle, Sutie 306
Charleston, S. C. 29407-4699

Dear Committee Members:

In the past Gulfstream Seafood and other Seafood Markets in this area have used fish killed with powerhead. We have found that when used properly, powerheads did not impair the quality of the fish or our ability to market it.

We believe using powerheads to harvest grouper and other large fish to be effective and reasonable.

The divers who fish for us, ice their fish well and take pride in producing a superior product.

Since Florida started enforcing a powerhead ban on food fish the divers catches have dropped off noticeably.

Please reconsider your proposal to ban using powerheads in Federal waters to take food fish.

Sincerely,

George Michaels

George Michaels

SOUTH FLORIDA SEAFOOD, INC.

24 HOUR PHONE SERVICE 659-6655 or 426-0601
1261 OLD OKEECHOBEE RD., WEST PALM BEACH, FLORIDA 33401-6944
WHOLESALE: WPB 659-6655, BOCA. 272-5591, FT. LAUD. 426-0601 / RETAIL: 659-4193

MEMBER
FLORIDA RESTAURANT
ASSOCIATION

MEMBER
PALM BEACH CHEF'S
ASSOCIATION

October 25, 1982

Mr. David B. G. Gould, Executive Director
South Atlantic Fishery Management Council
Southpark Building, Suite 306
Charleston, S. C. 23407

Dear Mr. Gould;

I am addressing the issue of the Fishery Management Plan, Article #1014 which states: The use of poisons, explosives, and powerheads for taking fishes of the Snapper-grouper complex is prohibited throughout the management area.

South Florida Seafood, Inc., licensed in the state of Florida for wholesale/retail distribution of fish and seafood.

Having seen your written document and acknowledging its intent for beneficial purpose, I am making the following comments regarding Article #1014.

Specifically: ....Powerheads for taking fishes of the Snapper-grouper complex....

It is has been our feeling that predominantly the fish brought to us by the use of powerheads capture have been in satisfactory condition for resale and well within the allowable size limits.

In opposition to our experience with hook and line capture which, at times or through consequence of means of capture, are stuck with a fish undersize that conflicts with intent of other areas in your plan.

In opposition to our experience with spear point capture whereby frequently the capture is sloppy and at times defaces the surface of the fish which in turn reduces the useability to the end user.

"We take Pride in our Quality & Service"

The concern for removal of jewfish has not been an issue for us to deal with thus far, as it is not a readily saleable fish for consumption by our business. This may not be a contestable point of your plan.

Respectfully,

Albert K. Kozar, Jr.
Vice- President

COMMENTS ON THE SNAPPER-GROUPER FMP PURSUANT TO ISSUES RAISED AT THE 25-28 OCTOBER MEETING OF THE SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

Scott Bannerot
300 Allendale Rd
Key Biscayne, FL 33149

SEVERAL IMPORTANT ISSUES WERE DEBATED BY THE COUNCIL ON THE MORNING OF 27 OCTOBER DURING THE SESSION ON "DECISIONS ON SNAPPER-GROUPER FMP BEFORE SUBMITTING FOR FORMAL REVIEW." I WOULD LIKE TO SUBMIT THE FOLLOWING AS PUBLIC COMMENT WITH REGARD TO TWO ISSUES: (1) FISH TRAPS (2) PROTECTION OF JEWFISH.

(1) FISH TRAPS -

a. MESH SIZE - IT IS CLEAR FROM READING THE SNAPPER-GROUPER FMP THAT NO DISTINCTIONS ARE BEING MADE BETWEEN TWO COMPLETELY DIFFERENT TRAP FISHERIES THAT OPERATE WITHIN THE RANGE COVERED BY THE PLAN. THESE ARE (1) FISHERY FOR BLACK SEA BASS OFF THE CAROLINAS, GEORGIA, AND NORTHERN FLORIDA AND (2) TRAP FISHERY FOR SNAPPERS AND GROUPERS OFF FLORIDA. DIFFERENT MINIMUM MESH SIZES MUST BE PROMULGATED FOR THE TWO DIFFERENT FISHERIES, BECAUSE THE 1.5" HEXAGON AND 1" X 2" RECTANGULAR MESH USED FOR BLACK SEA BASS RESULTS IN CONSIDERABLE WASTAGE OF GRUNTS, LARGE WRASSES, ANGELFISH, BUTTERFLYFISH AND A HOST OF OTHER SMALL SPECIES WHEN THESE SIZES ARE USED IN SOUTHERN FLORIDA WATERS FOR SNAPPERS AND GROUPERS. SPECIFICALLY I PROPOSE A MINIMUM MESH SIZE OF 2" X 4" RECTANGULAR SOUTH OF CAPE CANAVERAL.

PUBLIC TESTIMONY ON THIS ISSUE WAS HEARD BY THE COUNCIL ON 27 OCTOBER FROM WARREN SERVATT (FAVORED 2" X 4" MIN. SIZE) AND FROM JERRY SANSOM (FAVORED 1" X 2" MIN. SIZE). WHAT DID NOT COME OUT OF THIS TESTIMONY VERY CLEARLY WAS THIS WASTAGE

(FISH TRAPS - MESH SIZE CONT.)

2

ISSUE. BOTH SIZES (2"X4" AND 1"X2") ARE PRESENTLY USED IN THE FLORIDA SNAPPER-GROUPER FISHERY. TRAPS WITH 2"X4" MESH ARE BAITED WITH FISH AND LOBSTER REMAINS; 1"X2" MESH TRAPS ARE REFERRED TO AS "SELF-BAITING" BECAUSE THEY FILL UP WITH SMALL SPECIES, MANY OF WHICH "GILL" THEMSELVES ON THE 1"X2" MESH, AND THE LARGER FISH THEN ENTER THE TRAP.

1"X2" MESH CANNOT BE JUSTIFIED ON THE GROUNDS THAT IT IS NECESSARY FOR CAPTURE OF TARGET SPECIES - NO 12" SNAPPER OR GROUPER COULD FIT THROUGH 2"X4" MESH. 1"X2" MESH CAN ALSO NOT BE JUSTIFIED AS NECESSARY FOR BAITING TRAPS - FISH REMAINS ARE VERY ABUNDANT AND FREE OF COST IN ALL MAJOR AND MINOR LANDINGS IN THE FLORIDA KEYS AND SOUTHERN FLORIDA.

JUSTIFICATION FOR 2"X4" MESH IN LIEU OF 1"X2" MESH DERIVES FROM SEVERAL SOUND BASES: (1) SMALLER SPECIES ARE ECOLOGICALLY IMPORTANT TO THE REEF SYSTEM. THEY SUPPORT POPULATIONS OF THE MORE SOUGHT-AFTER PREDATORS SUCH AS SNAPPERS AND GROUPERS. UNNECESSARY WASTAGE OF BAIT SPECIES IS AN UNSOUND MANAGEMENT PRACTICE. (2) MANY OF THESE SMALLER SPECIES ARE BRIGHTLY COLORED TROPICAL FISH (E.G. TANGS, SURGEON FISH, ANGELFISH, PUDDINGWIFE AND OTHER WRASSES, BUTTERFLYFISH, AND OTHERS) THAT, IN ADDITION TO BEING FOOD SPECIES FOR GROUPERS, ARE EXTREMELY IMPORTANT AESTHETICALLY TO THESE REEFS. THEY ARE AN IMPORTANT FACET OF THE RECREATIONAL DIVING INDUSTRY THROUGHOUT THE KEYS IN THIS RESPECT. WASTAGE OF THESE SPECIES CONSTITUTES A POTENTIAL DISECONOMY OF SCALE INFLICTED ON THE DIVING/SIGHTSEEING INDUSTRY BY THE RELATIVELY SMALL USER GROUP CONSISTING OF TRAP FISHERMEN.

(FISH TRAPS CON'T)

b. DEPTH OF FISHING - THE SNAPPER-GROUPER FMP CURRENTLY PROMULGATES PROHIBITION OF FISH TRAPS WITHIN 100 FT. SOUTH OF CAPE CANAVERAL WHERE THE 100 FT. CONTOUR OCCURS IN THE FCZ AND NOT TERRITORIAL WATERS OF THE STATES. THIS WOULD RESULT IN EXTREME USER CONFLICT SOUTH OF FOWEY LIGHT IN THE FLORIDA KEYS. ON 27 OCTOBER THE COUNCIL DIRECTED THEIR STAFF TO REVIEW THIS IN LIGHT OF CONFLICTING PUBLIC TESTIMONY. THE STAFF SHOULD NOTE THAT THE MAJORITY OF FISHING EFFORT IN THE FLORIDA KEYS BY HEADBOATS, CHARTER BOATS, PRIVATE BOATS, AND COMMERCIAL HOOK AND LINE BOATS FOR SNAPPER-GROUPER COMPLEX SPECIES OCCURS ON THE OUTER REEF BREAK FROM 60 FT. TO 120 FT. MANY POPULAR CORAL PATCHES AND WRECKS ARE FOUND IN OVER 100 FT. THE INTENSITY OF EFFORT IS EXTREMELY HIGH IN THIS DEPTH RANGE ALREADY. THE SPECIES FOR WHICH YIELD PER RECRUIT ANALYSES WERE POSSIBLE THAT ARE THE TARGETS IN THIS ZONE ARE PRESENTLY IN A STATE OF GROWTH OVERFISHING. ALLOWING TRAPS WITHIN 120 FT. WILL ALLOCATE A DISPROPORTIONATELY LARGE "SLICE OF THE PIE" TO A VERY SMALL SECTOR OF THE TOTAL USER GROUP, TRAP FISHERMEN, DUE TO THE EFFICIENCY OF FISH TRAPS RELATIVE TO HOOK AND LINE METHODS (RECREATIONAL OR COMMERCIAL). THIS REPRESENTS AN UNJUSTIFIABLE ALLOCATION OF A LIMITED RESOURCE.

THE SOLUTION IS SIMPLY TO PROHIBIT TRAPS WITHIN 120 FT. THIS WOULD GREATLY MITIGATE THE PROBLEM. FURTHERMORE, THERE ARE CONSIDERABLE NUMBERS OF MUTTON SNAPPERS, VERMILION, YELLOWEYE, AND BLACKFIN SNAPPERS, SNOWY, RED, AND BLACK GROUPERS AVAILABLE OUTSIDE 120 FT. THAT ARE NOT AS INTENSELY FISHED AS THE POPULATIONS OF SNAPPERS AND GROUPERS FROM 60 FT. TO 120 FT.

(2) PROTECTION OF JEWFISH -

THIS MEASURE WAS PROPOSED IN RESPONSE TO PUBLIC COMMENTS IN OPPOSITION TO PROHIBITION OF POWERHEADS. THE ORIGINAL PROBLEM WAS PRIMARILY TO PROTECT THE DWINDLING NUMBERS OF VERY LARGE JEWFISH PRESENT ON WRECKS AND REEFS IN FLORIDA. COMMERCIAL POWERHEAD FISHERMEN FROM WEST PALM BEACH WOULD BE PUT OUT OF BUSINESS BY PROHIBITION OF POWERHEADS; THEIR POINT WAS THAT IF THE PROBLEM IS JEWFISH, THAN SPECIFICALLY PROTECT JEWFISH. THE RATIONALE WOULD BE THE AESTHETIC VALUE ~~TO~~ DIVERS OF SEEING THIS INCREASINGLY RARE FISH, THE OPINION OF VARIOUS KEYS HOOK AND LINE FISHERMEN (MOST NOTABLY BRIAN KEITH, COMMERCIAL FISHERMAN, ISLAMORADA, FLORIDA) THAT PRESENCE OF A LARGE JEWFISH ON A WRECK OR REEF ATTRACTS OTHER FISH INCLUDING GROUPERS TO THAT LOCATION AS THEY MOVE THROUGH THE AREA, AND THE FACT THAT LARGE JEWFISH BRING A VERY LOW MARKET PRICE (30¢ - 40¢ PER LB.) BECAUSE OF THE RELATIVE COARSENESS OF THE MEAT.

TESTIMONY ON THIS ISSUE WAS GIVEN BY BILL MOORE, AN O.F.F. MEMBER, TO THE COUNCIL ON 27 OCTOBER, 1982. HE CLAIMED THAT JEWFISH WERE (1) SELDOM WASTED (2) THE MOST VALUABLE GROUPER MEAT IN KEY WEST AND (3) WERE NOT IN A DEPLETED STATE. HE SUGGESTED A 100 LB. MINIMUM SIZE. I HAVE CONSIDERABLE DIVING, RECREATIONAL, AND COMMERCIAL FISHING EXPERIENCE IN THIS SAME AREA, AND I WOULD TESTIFY THAT (1) THERE ARE A NUMBER OF DOCUMENTED CASES OF LARGE JEWFISH BEING KILLED BY POWERHEADS, HUNG UP ON THE DOCK FOR PICTURES, THEN LEFT TO ROT (2) I HAVE BEEN QUOTED PRICES FOR LARGE JEWFISH (100 LBS OR MORE) OF AROUND

30 ¢ PER POUND. SMALL JEWFISH (LESS THAN 50 POUNDS) DO BRING PRICES COMPARABLE TO OTHER GROUPERS THROUGHOUT THE KEYS, BUT LARGE ONES DO NOT BECAUSE THE MEAT IS OF POORER QUALITY. (3) A 100 LB. MINIMUM SIZE WOULD MEAN THAT THE LARGER INDIVIDUALS FOR WHICH THE RATIONALE IS MOST APPLICABLE WOULD NOT BE PROTECTED. (4) JEWFISH OVER 100 LBS. ARE IN AN EXTREMELY DEPLETED STATE ON THE ATLANTIC SIDE OF THE FLORIDA KEYS. AT ONE TIME THEY WERE COMMON ON WRECKS AND REEFS ON THE 60-120 FT. OUTER BREAK. IN 8 YEARS OF TANK DIVING, INCLUDING TWO YEARS OF INTENSIVE DIVING ON THIS OUTER REEF BREAK AS PART OF A MASTER'S THESIS IN FISHERIES, I HAVE SEEN EXACTLY TWO.

SUGGESTION: PROTECT THE TAKING OF JEWFISH BY SPEAR OR POWERHEADS.

December 1, 1982

Mr. David Gould, Executive Director
South Atlantic Fishery Management Council
One Southpark Circle, Suite #306
Charleston, South Carolina 29407

Dear Mr. Gould:

I wish to make a comment concerning the modified measure, within the Draft Snapper-Grouper Management Plan, that permits the use of powerheads as a means of harvesting fishes.

Powerheads should be prohibited as a means of taking fishes within the snapper-grouper complex because divers are able to selectively remove larger fish from the "live-bottom" ecosystem. Only powerheading can remove most of these large fish because hook and line fishermen are unable to extract them from the cracks and holes they inhabit within rough, rocky bottoms or wrecks.

These large snapper and grouper are the "keystone species" within the bottom complex. Elimination of these pinnacle predators from the ecosystem will lead to a decline in species diversity. As a result, one or two commercially as well as recreationally unacceptable species take over a live bottom area, crowding out marketable species and rendering the area useless for all fishermen.

In addition, individual divers may be limited in the amount of time they can spend underwater; but when they work in teams of three or four, as they do off of South Carolina, the total length of down time is greatly increased, enabling these divers to virtually eliminate all large marketable snapper and grouper in the area.

The Council should also keep in mind that the vast majority of fishermen involved in the snapper-grouper fishery are hook and line fishermen. As a head boat operator out of Murrells Inlet, South Carolina, I am involved in this aspect of the fishery and deeply concerned. The investment by divers in this fishery is minuscule compared to that of hook and line fishermen. I do not want my investment in time and money jeopardized by a very efficient hand full of divers armed with powerheads.

The Council should reconsider prohibiting powerheads as a means of snapper-grouper harvest, as was initially proposed, and act accordingly.

I also want to convey my extreme disappointment in Council for not proposing tougher measures to curb roller-rig trawling within the snapper-grouper fishery.

Sincerely,

Tom Swatzel

Capt. Tom Swatzel

322 Waccamaw Drive
Garden City Beach, S.C.
29576

TS/kc

LOTT TACKLE & MARINA, INC.
631 NORTHLAKE BLVD.
NORTH PALM BEACH, FLA. 33408

12/1/83

DEC 1? 1982

PETITION

Reference: Snapper-Grouper Complex Management Plan (FMP)

In order to improve the Snapper-Grouper population, reduce the fishing pressure, and improve yield in the South Atlantic Management Council, the following undersigned recommend the following action be taken to the proposed NOAAC plan in the State of Florida:

1. The minimum size for Yellowtail Snapper shall be twelve inches total length or one pound gutted weight.

2. Prohibit the possession or use of fish traps shoreward of the 600 foot contour south of Cape Canaveral.

3. The taking of Grouper/Snapper (Jewfish) by any means other than conventional hook and line for commercial sale is prohibited (long line would be illegal). Spearfishing is prohibited for commercial means - powerheads are illegal for both recreational and commercial taking of fish. Spearfishing with powerheads is too fast and efficient and this method of taking Grouper/Snapper does not blend with the intent of the Snapper-Grouper Management Plan to reduce fishing pressures. Spearfishing has inherent advantages that invade the natural habitat of fish, whereas hook and line depends on the feeding habits of fish.

NAME	ADDRESS	OCCUPATION Type fishing Sport or Commercial	DATE
George Lott	631-N. Lake Blvd N.P.B	Retail tackle	12/1/82
Mark L. Cleland	1425 14 CT Sandalwood Est. PBG		12/1/82
[illegible]	846 W/Lex Dr	wholesale house parts	12/1/82
Martin F. Pompili	721 Western Dr N.P.B		
[illegible]	1160 [illegible] Lane Riv. Bch.		12/1/82
Richard [illegible]	911 Poplar Dr L.P. Fla 33403		12/1/82
[illegible]	9657 [illegible] PBG FL 33410		12/1/82
[illegible]	295 [illegible] St PBG 33410	Jeweler	12/1/82
Ed Layman	19 W. Beverly Rd Jupiter	Firefighter	12-1-82
Joseph Domenico	110 Wettaw Lane N. Palm Beach	Charter Boat Captain	12/2/82
S. Bradford Cole	551 N. Military Trail WPB 33406	Fisheries Biologist Fl. Game + F.W. Fish.	12/1/82
[illegible]	412 Lakeshore Dr. N. Palm Bch. FL. 33407	Comm. Fisherman	12/1/82
[illegible]	8830 Golfers Circle PBG		12-1-82

NAME	Address	Sport or Commercial Fisherman	DATE
Rusty Knott	834 13th 11 St	Sport	Dec 8 - 82
Ralph Hoffman	3771 Dogwood ave	Sport	12/8/82
C Parker	712 Tacoma Way NPB	Sport	12/8/82
Neil J Vota	516 W Kalmia DR	Sport	12/8/82
Jack T. Bary	2682 HINDA RD.	Sport	12-8-82
Elmer Zimmer	100 Broadway Rivera Blvd	Sport	12-7-82
Gerald Bunner	909 9th St	Sport	12-8-82
Clifton Williams	1244 W. 27th St	Sport	12-8-82
M Trent	914 Parlam Tree Pomo	Sport	12-8/82
Rick Salmon	388 lighthouse	Sport	12 8/82
Tom Dowling	12/8/82 310 Camellia st P.B.G. Fla		
Bruce Crocker	9287 Suncourt	Lake Park	12/8/82
Jay W Ham	2701 Ave "E"	Riv. Beach Sport	12/8/82
Jeff Forgey	2327 Garden Lane	Lake Park Sport Fla	12/8/82
Brian Forge	2329 Garden Lane Lake Park	Sport	12/8/82
Ralph Kelly	1150 Morse Blvd	Riviera	12/9/82
Jeff Harper	1163 Rainwood Circle P.B.G.	Sport	12-9-82
PAUL DEEHER	3247 GROVE RD. LAKE PARK, FL.	SPORT	12-9-82.
Robert L. Hayes	4161 Oak St P.B.G. Fla	Sport	12-9-82
Terry Tiffany	2294 Haven Rd W.P.B	Sport	12-9-83
Sam McRoberts	52 Balfour Rd. P.B.G.	Sport	12-9/82
Rick Allen	2768 Bay C. Lake Park		12-9/82
Fred Wahingle	1040 TUSCANE PL WINTER PARK FLA		12/9/82
Brian Narbaugh	9218 E. Highland Pines Fl PBG FL.		12/10/82
Scott Narbaugh	Same as ABOVE		12/10/82
J. D. Lewis	604 ~~Lighthouse~~ Dr. NPB.		12/9/82
Lonnie Adams	1036 US Hwy 1 #224 N.P.B		12/9/82

PETITION

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NAME	ADDRESS	OCCUPATION	DATE
Capt. William [illegible]	436 Gull Ct. NPB	Sportfishing Capt	12/1/82
Gary Boland	836 Country Club Drive N.P.B.		12/1/82
Mike MacDougall	9481 Birdwood St P.B. Gdns		12/1/82
Gary Boland	836 Country Club Drive N.P. Beach		12/1/82
John [illegible]	11129 Monet Terrace Lake Park		12/2/82
Tom Schaf	425 Gardens Lakes P.B.G.	Sport Fisherman	12/3/82
Warren Watson	9144 W Highland Pines Dr.. PBG		12/2/82
Scott R. Benela	956 Country Club Dr. NPB		12/2/82
Tom Heisler	2359 Garden Lane Lake Park	Self employed	
[illegible]	1125 [illegible] Blvd. Jupiter Fla		
Alan [illegible]	8011 45th Way N. Lake Park Fla		12-2-82
[illegible] Tuck	2704 Richard Rd. Lake Park, Fl.		12-2-82
[illegible] Dalesso	1873 Ascott Rd	[illegible]	12-2-82
Henry Silverthorne	3625 William St L.P.		12-2-82
D.E. Allen	333½ Foresteria Lake Park,		12-2-82

Name	Address	Sport or commercial fisherman	Date
[illegible]	4856 [illegible] Lk Wth, Fl 33461	Sport	12-4-82
Timothy [illegible]	125 [illegible] Drive L.P.	sport	12-4-82
[illegible]	9207 W. Highland Pines dr. P.B.G.	sport	
Dick Aldred	9113 [illegible] P.B.G.	Sport	12-4-82
[illegible]	131 CROSSING ROAD NPB	Sport	12-5-82
			12-5-82
W K [illegible]	20 GEORADNOR RD JUNO ISLES		12-5-82
Lesie Ryan	1137 Beach DR	Sport	12-5-82
Laura Cameron	9148 Reed Dr. P.B.G.	Sport	12-5-82
RICHARD GUENGA	622 NORTHLAKE	SPORT	12-5-82
JOHN HANSEN	19 WILLOW RD. TEQUESTA	SPORT	12-5-82
Harold Heckendorn	110 Willow [illegible] N.P.B		12-6-82
Chuck Morris	3836 Holiday Rd L.P.	SPORT	12-6-82
Cecil C Key	732 [illegible] Way NPB	SPORT	12-6-82
Tim Durning	12106 165 Jupiter	SPORT	12-6-82
[illegible]	624 Franklin Rd.	Sport	12/6/82
[illegible]	2118 ~~21st~~ [illegible]	Sport.	
[illegible]	821 Lighthouse Dr	Sport	12-6-82
Chris Percy	9657 Ilex Cir. S.		12-6-82
Don Vogel	10136 Daisy Ave P.B.G.	SPORT	12-6-82
Russell [illegible]	917 Evergreen Drive		12-6-82
Joe Albert	1419 No. "M". ST.		12-7-82
Paul [illegible]	725 Hummingbird Way NPB.		12-7-82
[illegible]	566 [illegible] Rd NPB 96		12/7/82
[illegible]	518 Evergreen LAKEPARK		12/7/82
Steve Hill	1150 MOESE BLVD	sport	12/7/82
Robert H. Burrows	1902 Chala Rd., Juno	Sport	12-7-82
Harry R [illegible]	904 PENN TRAIL	Jupiter	12-7-82
Murray Shatt	336 Golfview Rd. No. Palm Bch		12-8-82
Frank [illegible]	2071 Mockingbird Ln N.P.B		
E Mansfield	2071 Mockingbird Lane NPB.		

NAME	ADDRESS	OCCUPATION (Sport or Commercial Fisherman)	DATE
Mary Beth Martin	1425 Sandlwood Est.	Sport Fishing	12/3/82
Robert J. Klein	425 Westwind Lane		12/2/82
Cliff Gruber	4862 B [illegible] Dr WPB		12/3/82
[illegible] Gruber	4862 B [illegible] WPB		12/3/82
[illegible]	312 S. WIND DR		12/3/82
Clifford E. [illegible]	911 Poplar [illegible] Lake Park Fla	Engineering Computing	12/3/82
John T. [illegible]	4065 Ilex Cir N P.B.G. Fla		12/3/82
[illegible]	911 Poplar Drive Lake Park Fla 33403	Engineering Aide (Sport)	12/3/82
[illegible]	9657 Ilex Cir S. PBG.		12/3/82
John V Sigler	401 EXEC. CTR. DR. WEST PALM BEACH	LAB TECH	12/3/82
Perry F. [illegible]	401 EXEC CTR DR WPB	CABLE Tech.	12/6/82
Thera Sigler	401 EXEC CTR. DR G306 WPB		12/3/82
[illegible]	2579 [illegible] Rd Lake Park		12/4/82
JERRY Hall	400 WILMA CIR. RIV. BCH		12/4/82
[illegible]	105 Paradise Harbour Blvd		12/4/82
[illegible]	4143 Hickory Dr P.B.G		12/4/82
Arthur Cohen	Hastings A. 11 W.P.B.		12/4/82
[illegible]	[illegible] A. [illegible] Beach Fl.		12/4/82
Jack [illegible]	34 [illegible]		
Walter [illegible]	3400 OCEAN DR SINGER IS. FL		12/4/82
Robert P. Saveis	3855 G Buttercup Palm Bch Gdns Fla 33410		12-4-82
HERB KETTLEHAKE JR.	719 HUMMING BIRD WAY, N. PLM. BCH.		12/4/82
Sean C Blank	926 ORANGE DRIVE LAKE PARK FL.	SPORT	12/4/82
Jeffrey L. [illegible]	885 Lania Drive Lake Park Fl	845-1402	
[illegible] H. [illegible]	108 Paradise Harbour Blvd N.P.B.	626-7490 Sport	12/4/82
Alison M. [illegible]	108 Paradise Harbour Blvd, N.P.B.	Sport Fishing	12/04/82

Name	Address	Sport or commercial fisherman	Date
Barry L. [illegible]	2418 Hope Ln Lake Park	Sport	12/9/82
Chris Meyer	3670 Dunn Rd. Lake Park	Sport	12/9/82
Anthony Stepanauskas	460 Jupiter Ln. Juno Beach, Fla.		12/9/82
Ray Chance	9553 Keating Dr. Lake Park		12/10/82
Mike [illegible]	301 Ocean Dr. Juno Beach		12/10/82
Robert [illegible]	1308 W. 28 St. Riviera Beach, Fla.		
Jimmy [illegible]	431 Jupiter Lakes Blv. 2123c	Sport	12/10/82
J. H. Crowley	9227 Old Dixie Lake Park		
Jim Cargyll	350 Australian Circle Lake Park		12/11/82
[illegible]	3911 W. Roan Ct / Lake Park, Fl		12/11/82
Jack C. Smith	3911 W. Roan Ct, Lake Park, Fl		12/11/82
Vincent N. Baker	561 Anchorage Dr. N.P.Bch.	Sport.	12-11-82
DeWayne [illegible]	381 Ocean Drive N.P.B		12-11-82
[illegible] Kay	845 Date Palm Dr. L.P.		12-11-82
Herb Kay	1738 15th Ave No Lake Worth		12-11-82
Lee Henson	4225 45th St G9 West Palm Bch, Fla		12-11-82
Steve Waters	3680 William St. Lake Park		12-11-82
Tim McCown	318 5th Street Lake Park		12-11-82
R. U. [illegible]	742 Hummingbird Way NPB		12-11-82
Al Bum	314 [illegible] Dr PBG		12-11-82
S. Buckam	2611 Edgewater Dr Lake Park		12 11 82
M. Racicot	551 Teak Dr Lake Park		12-12-82
C. J. Riley	312 Lake Cir #206 NPB Fla 33408		12/12
R. C. Niederhaus	3543 Burnett Lake Park FL	Sport	12-12-82
Wm Rankin	4925 45 ST WPB	Sport	12/12/82

NAME	ADDRESS	OCCUPATION	DATE
Carrie Lott	2385 Edgewater Dr. L.P.		11-2/82
[illegible]	3032 Cowall DR	INS AGENT	12-2/82
Richard C. [illegible]	326 [illegible] Dr	So. Bell	12-2-82
R.A. O'Brain	110 Shore Ct. N.P.B.		
Wayne Katola	19595 66 Terrace	[illegible]	12-3-82
Skip Milling	P.O. Box 9692, Riviera Beach Fla	Boat Captain	12/2/82
Craig Beisner	150 Riverview Rd #E7 Jupiter, Fla.		12/2/82
P. M. Chase	3939 Bluebell St Palm Beach Gardens, Fla		12/2/82
Curt Frantz	2012 Longwood Rd. W.P.B.		12/2/82
Joe Cofano	1009 Almond Dr North Palm Beach		12/2/82
Andy Ballew	5215 Hood Rd Lake Park		12-2-82
Richard J Haag	3259 D Garden E Dr P.B.G.		12/2/82
Albert C. Oliver	18883 Federal Hwy. Jupiter		
Peter E. [illegible]	425 4th Lane P.B.G.	sport	12/2/82
Beth Iverson	425 4th Lane P.B.G.	sport	12/2/82
[illegible] Dowdy	649 Shore Rd NPB		12/2/82
Edward [illegible]	740 Westwind Drive NPB FL.	SPORT	12/2/82
[illegible]	3228 Grove Drive		12/2/82
[illegible]	945 Westwood Dr		12/2/82
John Konuvale			
[illegible] K. Hansen	28 Yacht Club Dr		12/3/82
John Young	Old Port Cove		12/3/82
A.C. [illegible]	Old Port Cove		12/3/82
A. Gray	12900 S. Shore		12/3/82
R. [illegible]	11638 Elkison W.ts.		12/3/82
[illegible]	151 15th Lane PBG		12/3/82
Harold Reed	Old Port Cove A 304		12-9-82

NATIONAL WILDLIFE FEDERATION
1412 Sixteenth Street, N.W., Washington, D.C. 20036 202—797-6800

December 3, 1982

RECEIVED
DEC 6 1982
SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL
CHARLESTON, S.C. 29407

Mr. David H.G. Gould
Executive Director
South Atlantic Fishery Management Council
Suite 306
1 Southpark Circle
Charleston, South Carolina 29407

Dear Mr. Gould:

The National Wildlife Federation is pleased to comment on modifications in the Draft Fishery Management Plan (FMP) for the Snapper-Grouper Complex of the South Atlantic Region.

We support modification of the FMP to prohibit the use of spearguns or powerheads for the taking of jewfish. Large reef fish, such as jewfish, serve to attract smaller groupers to the reef as well as provide divers with added visual enjoyment of reef resources.

For reefs subject to heavy spearfishing pressure, it is easy to conclude that all large reef fish would rapidly be removed. We are concerned that selective removal of all large reef fish by any method is not in the best interest of either those who frequent reefs for non-exploitive purposes or those hook and line fishermen who seek the opportunity of catching large reef fish.

We suggest that the effects of spearfishing and powerhead use on reef fish resources be examined from both a biological and socio-economic viewpoint. Rational regulation of fishing by divers requires a sound data base; such adequate data do not exist, or were not included in FMP source documents.

However, we do feel that it is inappropriate to ban possession of powerheads, and if a fishery for large reef fish must exist, then we prefer that such fishing be done in the most efficient manner possible. Large fish struck by powerheads are less likely to escape and the use of spears to take large fish can lead to waste as some large fish struck will escape and some level of mortality of struck fish is inevitable.

Mr. David H.G. Gould
December 3, 1982, p. 2

We also wish to clarify our 30 September recommendation that "the Council implement a permit or licensing system that discourages or prohibits recreational anglers and spear fishermen from marketing their catch" (emphasis added). We include recreational divers who use powerheads in the category "spear fishermen". The sale of fish constitutes a commercial enterprise and should be permitted or licensed as such.

The word change in the measure prohibiting the use of fish traps shoreward of the 100 foot contour south of Jupiter Inlet Light is immaterial to our concerns. We wish to reiterate our 30 September recommendation to the Council that the use of fish traps in the snapper-grouper fishery in waters adjacent to Florida should be prohibited until (1) a system of regulating the trap fishery is established that prevents overfishing and provides equitable allocation of fish among user groups; (2) the mesh size of traps is evaluated and adjusted to achieve maximum efficiency as regards bycatch and fish mortality; and (3) consistency issues with Florida's trap restrictions are resolved.

We hope our comments on changes in the FMP will assist the Council in implementing management programs for the snapper-grouper complex.

Sincerely,

Rudolph A. Rosen

Rudolph A. Rosen, Ph.D.
Fisheries Resource Specialist
Fisheries and Wildlife Program

BETTER FISHING FOR YOU!

florida league of anglers, inc.

December 15, 1982

Please reply:
R. A. FRANZEN
215 COCONUT PALM RD.
BOCA RATON, FLORIDA 33432

South Atlantic Fishery Management Council
1 Southpark Circle, Suite 306
Charleston, South Carolina 29407

Re: Modifications of
Snapper-Grouper Complex Plan

Gentlemen:

While this organization does not object to the minimum size for yellowtail snapper or any other species indicated in the plan, it must be emphasized that the minimum sizes as proposed are not conservation measures. They do not increase abundance, the real need. They merely increase the dollar per head value to the commercial segment.

The position of FLA remains that the Florida Legislature has prohibited the use and possession of fish traps and also the use of explosives and firearms on food fish,and landing of damaged by explosives or headless grouper and jewfish is prima facie evidence of a violation; that the proposed plan is inconsistent with the Coastal Zone Management Plan as well as the letter and legislative intent of the FCMA.

For the Council's convenience, the following provisions of the FCMA are called to the Council's attention:

> Section 303 (a) REQUIRED PROVISIONS.--Any fishery management plan which is prepared by the Council, or the Secretary, with respect to any fishery, <u>shall</u>--
> (1) contain the conservation and management measures, applicable to foreign fishing and fishing vessels of the United States, which are--
>
> (C) consistent with the national standards, the other provisions of this Act, and any other applicable law;

Section 307. PROHIBITED ACTS.
It is unlawful--
(1) for any person--
(A) to violate any provisions of this Act. . .

Section 308 provides that the penalty shall not exceed $25,000.00 for each violation.

The Council is also reminded of previous FLA protestations that 3 of the National Standards are violated, namely: 1, 2, and 4. The plan does nothing to prevent overfishing; has buried the best scientific information available contained in the early studies and drafts which indicated that snapper were overfished in some areas and approaching that level in others and that grouper were not far behind;(based upon 1975 figures and pressure has increased since), and that wherever fish traps have been used extensively reef fish populations have been decimated. Also ignored is the fact that Florida has found that enforcement at sea is virtually impossible necessitating landing and possession bans on equipment and product to enhance enforcement capabilities dockside. And finally, the mandate against anyone acquiring an excessive share is ignored in favor of securing special privilege to the chosen few who exploit the resource to the detriment of the resource and all other users.

Inasmuch as the Florida Statutes and Coastal Zone Management Plan prohibit traps and killing food fish with explosives or firearms, the plan obviously violates the mandate of Section 303 that any plan shall be consistent with the national standards and any other applicable law, as well as the consistency mandate of the Coastal Zone Management Act. Consequently, it appears that any Council member voting for this plan would be committing a violation and thus be subject to a fine of not to exceed $25,000.00 for each offense. It also appears that a mandamus action would be available to any citizen or group to compel enforcement thereof.

This also appears to be the case in re the mackerel plan.

I trust that the above comments have been of some help.

Yours very truly,

R. A. Franzen, President

RF/a

The Rod and Reel Club
HIBISCUS ISLAND
MIAMI BEACH, FLORIDA 33139

22 DECEMBER 1982

DEC 29 1982

SOUTH ATLANTIC FISHERY
MANAGEMENT COUNCIL
1 SOUTHPARK CIRCLE, SUITE 306
CHARLESTON, SC 29407

GENTLEMEN:

WE WISH TO ADDRESS OURSELVES TO PARAGRAPH 10.8 OF THE SUMMARY DRAFT OF THE FISHERY MANAGEMENT PLAN FOR THE SNAPPER-GROUPER COMPLEX OF THE SOUTH ATLANTIC REGION (G #41 SG FRAMEWORK 7/82).

WE ARE TOTALLY OPPOSED TO THE USE OF FISH TRAPS IN ALL OFFSHORE AREAS WHERE SNAPPERS AND GROUPERS EXIST. BECAUSE OF THE TOTAL EFFICIENCY OF TRAPS, THEIR USE IS NOT AT ALL CONSISTENT WITH SOLVING THE PROBLEM DELINEATED IN PARAGRAPH 6.1-2.

IT HAS BEEN OUR OBSERVATION THAT ALMOST IMMEDIATELY AFTER THE INTRODUCTION OF SIZEABLE NUMBERS OF FISH TRAPS TO A REEF AREA THAT THE NUMBERS OF SNAPPERS AND GROUPERS ARE DRASTICALLY REDUCED.

COMMERCIAL NUMBERS OF FISH TRAPS IN A REEF AREA, UP TO AND INCLUDING 300 FEET, DO NOT PERMIT A STABLE SNAPPER AND GROUPER POPULATION. THIS IS RECOGNIZED BY THE LAWS OF THE STATE OF FLORIDA.

IT IS, THEREFORE, OUR SUGGESTION THAT FISH TRAPS IN ALL OFFSHORE AREAS UNDER 300 FEET BE PROHIBITED ENTIRELY.

CORDIALLY,

Peter R Tyson

PETER R TYSON
DIRECTOR OF ANGLING

PRT/cc

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 646

[Docket No. 30810-154]

Snapper-Grouper Fishery of the South Atlantic

AGENCY: National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Final rule.

SUMMARY: NOAA issues this final rule to implement the Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic. Currently, a number of the major species in the fishery are being harvested at less than optimal sizes, and certain harvest techniques have resulted in controversy among user groups. This rule establishes (1) minimum sizes for certain species and (2) limitations on the use of certain gear including poisons, explosives, fish traps, and trawls for the taking of fish in the snapper-grouper fishery. The intended effect of this rule is to prevent overfishing, restore to the optimum level those species that are overfished, and promote orderly utilization of the resource.

EFFECTIVE DATE: September 28, 1983.

ADDRESSES: A copy of the combined final regulatory flexibility analysis/regulatory impact review may be obtained from Rodney C. Dalton, Southeast Region, National Marine Fisheries Service, 9450 Koger Boulevard, St. Petersburg, Florida 33702.

SUPPLEMENTARY INFORMATION: The Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic (FMP) was prepared by the South Atlantic Fishery Management Council (Council). The Regional Director, Southeast Region, National Marine Fisheries Service (Regional Director) approved the FMP, with the exception of the management measure prohibiting the spearing of jewfish, on July 28, 1983, under the authority of the Magnuson Fishery Conservation and Management Act (Magnuson Act). This final rule implements the FMP.

The disapproval of the measure prohibiting the spearing of jewfish was based on the finding that it was inconsistent with National Standards 2 and 4 and Section 303(a)(1)(A) of the Magnuson Act. This action required disapproval of the related specifications of optimum yield and expected domestic annual harvest. The Regional Director has advised the Council of this partial disapproval and provided recommendations to the Council that would conform the measure to the requirements of applicable law. The Council's reconsideration of the measure and action on the Regional Director's recommendations may result in amendment to this final rule.

A proposed rulemaking was published on June 10, 1983, (48 FR 26483), initiating a 45-day comment period which ended July 25, 1983. The proposed rulemaking contained information on the snapper-grouper fishery, its economic value, and its relative importance to the recreational and commercial sectors. The major problems in the fishery (i.e., harvesting of fish at less than the optimal sizes, user-group conflicts, and limited fishery data) and the management measures to resolve them were also discussed in detail.

In the proposed rulemaking, § 646.5, Gear identification, was reserved. This section is also being reserved in this final rule, pending development of a region-wide identification system.

Comments and Responses

Fourteen comments were received on the proposed rule, addressing 17 issues. Responses are grouped by general categories.

Prevention of overfishing

Several commenters stated that the regulations would not prevent overfishing. According to the FMP, there is no evidence that any species in the fishery is currently experiencing recruitment overfishing (i.e., insufficient spawning to maintain the stock). A number of species are experiencing growth overfishing (i.e., harvesting of a stock to the point that the harvest is less than the maximum possible). These regulations prevent growth overfishing by imposing minimum size limits. However, several commenters expressed concerns that the size limits would not be effective, because traps are not size selective and released fish would not survive. The procedures in the FMP for evaluating minimum sizes incorporate consideration of survival rates of released fish. The analyses of all size limits imposed indicated that long-term yield would increase for each species, despite the mortality of some released fish. This demonstrates that the regulations will be effective in preventing overfishing of most of the regulated species. The FMP does acknowledge, however, that size limits may not be effective for some species with extremely low survival rates. Data collection and analysis specified in the FMP will aid in evaluating other strategies (i.e., time/area closures and quotas) which could be used to protect these species. Such measures, if necessary, would be incorporated by amending the FMP.

Fish Traps

Numerous commenters, including a state marine fishery agency, two sport fishing organizations, two conservation organizations, a diving club, and several individuals recommended that the use of fish traps be prohibited to avoid overfishing and other adverse impacts on the fishery. Although fish traps are an efficient gear, NOAA believes that the restrictions imposed by this final rule (e.g., area restrictions, size limits, degradable panels, minimum mesh size) are sufficient to prevent overfishing and to mitigate potential adverse impacts associated with use of fish traps. Best available scientific information was not sufficient to justify a total prohibition, and a total prohibition would not result in a fair and equitable allocation of fishing privileges. A prohibition on the use of fish traps, therefore, would be inconsistent with National Standards 2 and 4 and Section 303 (a)(1)(A) of the Magnuson Act.

Several commenters suggested that if fish traps were allowed, they should be allowed only beyond certain geographic boundaries. Proposals included allowing traps outside the 200-foot contour, outside the 50-fathom contour south of Cape Canaveral, and prohibiting traps within a 10-nautical mile buffer zone adjacent to state waters north of Cape Canaveral. During public hearings on this FMP, many additional boundaries were recommended. In preparing the FMP, the Council recognized the necessity of mediating the social conflicts associated with the use of fish traps, particularly along the narrow continental shelf area of south Florida. After carefully considering all proposals and the associated impacts on all user groups, the Council concluded that prohibiting traps inside the 100-foot contour south of Fowey Rocks Light (Miami, Florida) would be the most fair and equitable resolution. NOAA concurs with this decision.

A representative of a conservation organization suggested that the minimum mesh size for traps should be greater than 2 × 2 inches to be consistent with the best scientific evidence and the size limits imposed in the FMP. Another commenter proposed a 4-inch trap mesh size. The FMP states that the trap mesh size is not directly correlated to the minimum size limits. The minimum size limits are the primary management tool for controlling the size of fish harvested and preventing overfishing. The Council has, however, listed studies on the effect of mesh size on size and species composition as a high research priority and will assess the need to modify the mesh size in the near future.

One commenter suggested that the regulations require that the opening (degradable panel) be located on the sides or top of the trap. Most traps are designed with the funnel on one side and the access panel (which frequently will be attached with degrdable hinges) on the opposite side, thus achieving the commenters desired result. NOAA believes further regulation is unnecessary.

One commenter recommended that use of steel cables as trap marker lines be prohibited because of the hazard to navigation. The vast majority of buoy lines are not constructed of steel cable. However, buoy lines are a necessary component of the trap fishery. The material used for the line (i.e., rope versus cable) would not significantly alter the extent of the hazard to navigation, and therefore, does not warrant additional regulation.

One commenter suggested that the boundary for the restriction of pulling traps at night should be south of 28°30' rather than south of 28°24.5' to protect fish havens from traps. This measure merely prohibits pulling traps at night in the specified area. Extending the area to 28°30' would have no significant effect on protection of fish; therefore, the recommendation is not adopted.

As is apparent from the substance and intensity of public reaction to the subject, fish traps are a highly controversial fishing gear. In the preparation of the FMP, the Council considered all the arguments pro and con regarding fish traps and concluded that, within the limitations of its authority under the Magnuson Act, the management regime as proposed was proper. However, the Council likewise recognized that further study is desirable on this gear type and its ecological, economic, and social impact. Further study will be undertaken, and if warranted, modification of the management response to fish traps will be considered.

Powerheads

A number of commenters, including representatives of a state marine fishery agency, a sportfishing club, and a scuba club, and two concerned citizens recommended that the use of powerheads be prohibited. Two commenters suggested that the use of powerheads to take any fish (including jewfish) should be allowed. There is no conclusive scientific information to indicate that the use of powerheads in the regulated area has resulted in any adverse impact on any species that would warrant a total prohibition on use of this gear. Further, the management measure prohibiting the spearing of jewfish has been disapproved because (1) there is insufficient scientific information available to support the measure; (2) it does not result in a fair and equitable allocation of fishing privileges (National Standard 4); and (3) it is devoid of scientific rationale demonstrating its necessity and propriety (Magnuson Act § 303(a)(1)(A)). Therefore, the regulation prohibiting the spearing of jewfish has been deleted from this final rule.

Roller Trawls

A representative of a conservation organization objected to the use of roller trawls along Florida's continental shelf because of potential damage to the fisheries and reef areas. A prohibition on the use of roller trawls was considered but rejected, because less burdensome measures (i.e., minimum mesh size, and size limits) were adopted to mitigate adverse impacts on the fishery, and available evidence of significant habitat damage was inconclusive. Evaluation of the impacts of bottom trawling is identified in the FMP as one of the highest priority research needs. The consideration of prohibiting roller trawls in specific coral reef areas was deferred to the Fishery Management Plan for Coral and Coral Reefs.

Size Limits

Several commenters recommended that minimum size limits be imposed on additional species (i.e., gag grouper and jewfish), and one commenter suggested that the minimum sizes be increased to provide additional protection to the spawning stock. The FMP contains detailed procedures and criteria for evaluating minimum size limits; however, certain basic fishery data such as growth, mortality, and survival rates are essential. Minimum size limits were imposed on all species for which (1) adequate data were available to perform the necessary analysis; and (2) the analysis indicated size limits were warranted based upon the biological, economic, and social criteria in the FMP. The required data were not available to allow evaluation of size limits for jewfish. A minimum size limit for gag grouper was considered but was rejected because the survival rate (after catch and release) was unknown but suspected to be quite low. Survival rates are critical in determining the effectiveness of size limits.

The FMP incorporates a mechanism for timely implementation of additional size limits when data supporting the need for such limits become available. Currently, there is no indication that any species in this fishery is experiencing problems because of insufficient spawning (i.e., recruitment overfishing). The establishment of minimum size limits will control growth overfishing and is expected to ensure adequate spawning.

Enforcement

The United States Coast Guard submitted proposed language to modify paragraphs (a) and (b) of § 646.7, Facilitation of enforcement. The suggested language reflects minor modifications in the procedures the Coast Guard will use in communicating with operators of fishing vessels. This final rule has been revised accordingly. The Coast Guard also noted that since the language in § 646.6 (d), (e), and (f) and § 646.21 prohibits possession or harvesting of undersized fish, any person merely catching an undersized fish would be in technical violation. It was suggested that these sections be revised to prohibit retention of undersized fish. After carefully considering the proposed revisions, NOAA elected to retain the original language and to rely on enforcement agents to distinguish among excusable technical violations and those warranting sanctions under these regulations.

Coastal Zone Consistency

The Florida Department of Natural Resources (FDNR), a sportfishing organization, and a conservation organization questioned the consistency of the regulations with Florida's Coastal Management Program (CMP) to the extent that they allow the use of fish traps and powerheads, and do not impose size limits on black grouper, gag grouper, or jewfish. State law, incorporated into Florida's CMP, prohibits the use and possession of fish traps (with certain exceptions) (Florida Statutes § 370.1105); prohibits the use of explosives or firearms for the taking of foodfish [Florida Statutes section 370.08 (5) and (10)]; and establishes size limits for gag grouper, black grouper, jewfish, red grouper, and Nassau grouper [Florida Statutes section 370.11(2)(a)(8)].

The claim of inconsistency is without legal foundation. Though Federal and State regulations are not identical, identity is not required by the Coastal Zone Management Act (CZMA). The statutory requirement of consistency is qualified. Consistency is required only to the "maximum extent practicable" [CZMA section 307(c)(1)]. This qualified requirement of consistency requires that Federal activities be fully consistent with State coastal zone programs "unless compliance is prohibited based on the requirements of existing law applicable to the Federal agency's operations" [15 CFR 930.32(a)]. In this instance, NOAA is constrained by the Magnuson Act. The coastal zone consistency determination for this FMP, which was submitted to Florida's Office of Coastal Zone Management on April 27, 1983, clearly indicated that the prohibition of fish traps and powerheads and the implementation of size limits on gag grouper, black grouper, and jewfish would violate several of the national standards as well as section 303(a)(1)(A) of the Magnuson Act. Therefore, to the maximum extent practicable, this final rule is consistent with Florida's CMP. The Administrator of NOAA has considered and rejected Florida's request to delay implementation of the FMP.

Specific State Concerns

The FDNR noted that this FMP and the Fishery Management Plan for the Gulf of Mexico Reef Fish Fishery manage essentially the same species but contain dissimilar management measures which cannot both be appropriate. The FDNR suggested that this situation would complicate enforcement, particularly in the Florida Keys. NOAA acknowledges the differences in the two plans but believes that both management approaches are proper. It is reasonable to expect some variation in the two plans as a result of geographical (i.e., latitude and physical configuration of continental shelf areas) and socio-economic differences between the two areas. NOAA agrees that the differing management measures may complicate enforcement in the Florida Keys and anticipates the need for additional at sea enforcement in that area.

The FDNR also commented that these proposed rules would authorize the use and possession of fish traps, without limitation on the number of traps per vessel nor the number of vessels employing traps, and that such regulation will supersede the application of Florida's trap law with respect to fishing beyond Florida's seaward boundary. This is correct. The FDNR further asserts that NOAA's perceived effect of the proposed rules is to nullify Florida's ban on the possession of traps within Florida's boundaries. This is incorrect. It is NOAA's position that Florida's ban on possession of fish traps in state waters is nullified only to the extent that it would interfere with the exercise of a fisherman's right to utilize fish traps in the FCZ (i.e., Florida's ban may not be used to prohibit the transport of fish traps through state waters to and from the FCZ).

The FDNR further asserts that the provisions of § 646.6(g) and § 646.21(c) constitute further restraint on fishing activities occurring within state boundaries. This position is incorrect. The provisions of these regulations establish permissible activities within the FCZ and with regard to fish harvested from the FCZ. The restraints imposed on the landing of fish within state boundaries applies only to those fish harvested from the FCZ. Those fish harvested from the waters within the jurisdiction of Florida will not be affected by the requirements of §§ 646.6(g) and 646.21(c).

In addition, FDNR contends that allowing fish traps in the FCZ will create an enforcement impossibility for Florida within Florida's boundaries and will decimate Florida's prohibition on the possession of fish traps. NOAA agrees that authorizing the use of fish traps in the FCZ will have a substantial impact upon the ability of Florida to enforce its trap prohibition within state waters. NOAA will work with Florida to minimize this impact.

FDNR asserts further that these conflicts (§§ 646.6(g), 646.21(c) and disparate fish trap regulation) between State and Federal law require resolution under section 306 of the Magnuson Act. However, section 306 of the Magnuson Act was not formulated for resolving regulatory conflicts created by Federal supersession. Rather, section 306 addresses the situation where the Federal government concludes that the regulation of fisheries within State waters is not accomplished in such a fashion as to be in furtherance of effective implementation of federal regulations within the FCZ. In this instance, NOAA does not take issue with the manner in which Florida is regulating its fisheries within state waters. As a result, the preemption provisions of section 306 are not applicable.

FDNR urges that the proposed rules be rejected as inimical to the resources that they were designed to protect. NOAA disagrees. The matters set forth in opposition to implementation of the FMP by FDNR are not persuasive. The Council, with NOAA's agreement, has concluded that the approach proposed in the FMP is the proper approach to management of the subject fishery.

Finally, FDNR requested that an administrative hearing, in accordance with Title 5, U.S.C. 553, be held and that the proposed rules be stayed pending the resolution of the issues raised by FDNR. NOAA declines either to grant such a hearing or to delay the effective date of the proposed rules. To grant a further hearing on these rules would serve no useful purpose and would otherwise delay their implementation. Such delay would result in a violation of the provision of section 304(b)(1) of the Act. Furthermore, the matters brought to issue by FDNR, and its comments on the proposed rules, are more properly resolved in the context of Council deliberation for future modification of the FMP.

General Comments

Several commenters, including two conservation organizations and a state marine fishery agency, have stated that the FMP, or various portions of it, are not based on sufficient scientific information. One of the commenters noted that fundamental fishery data were lacking for all but 17 of the 69 species included in the FMP. This data deficiency is acknowledged in the FMP as a major problem in the fishery. Species for which adequate data were not available are not regulated, except for the purpose of data collection. The data collection procedure specified in the FMP is designed to obtain these essential data and, therefore, provide the basis for more definitive management of the additional species.

One commenter suggested that the proposed data collection system was inadequate to meet the requirements of the Magnuson Act. One advantage of the yield per recruit methodology employed in the FMP is that it requires relatively little fishery data. The collection of basic biological data from a sample of commercial and recreational landings will provide sufficient information. Additional fishery data will be obtained from the traditional voluntary landings data. NOAA concludes that this data system satisfies the requirements of the Magnuson Act.

One commenter stated that the yield per recruit model used in the FMP does not adequately address the effects of an intense localized fishery and should be considered an interim solution. It is acknowledged in the FMP that other management strategies (e.g., time or area closures and quotas) may be required in the future; however, under constraints of existing fishery data, the yield per recruit approach was deemed the most appropriate to resolve overfishing of individual species. Data collection and analysis specified in the FMP will aid in evaluating the feasibility and necessity of additional management strategies.

One commenter suggested that the fishing year be changed to September 1–August 31 to avoid potential adverse impacts that would result if quotas were reached and the fishery was closed. There are no quotas established for this fishery; therefore, no change in the fishing year is necessary.

One commenter suggested that spearfishing be listed as a major method for harvesting fish if future quotas are imposed. If quotas are established in the future, the spearfishing sector of the fishery will be considered appropriately in any allocation of quotas.

Changes From the Proposed Rule

For the reasons discussed above, the final rule differs from the proposed rule as follows:

Section 646.6

Paragraph (i) was deleted as a result of NOAA's disapproval of the Management measure prohibiting the spearing of jewfish.

The old paragraphs (j) through (q) are redesignated (i) through (p).

Section 646.7

Paragraphs (a) and (b) were revised to reflect recent changes in the Coast Guard's procedures for communication with operators of fishing vessels.

Section 646.22

Paragraph (a)(3) was deleted as a result of NOAA's disapproval of the management measure prohibiting the spearing of jewfish.

Classification

The Assistant Administrator for Fisheries, NOAA (Assistant Administrator), after considering all comments received on the FMP and the proposed regulations, has determined that the FMP and this rule are necessary for the conservation and management of the fishery and that they are consistent with the Magnuson Act and other applicable law.

The Council prepared a final environmental impact statement for this FMP; a notice of availability was published on August 19, 1983 (48 FR 37702).

The NOAA Administrator determined that this rule is not a major rule requiring a regulatory impact analysis under Executive Order 12291. The Council prepared a regulatory impact review (RIR) which concludes that this rule will result in benefits to the fishermen and to the economy that are greater than the associated Federal Costs to manage the fishery on continuing basis. Benefits that will accrue from implementing the proposed measures come from the minimum sizes on red snapper, vermilion snapper, yellowtail snapper, black sea bass, red grouper, and Nassau grouper. The benefit/cost analysis was performed utilizing a 20-year planning horizon. The benefit/cost ratio is defined as present value benefits divided by present value costs. There are alternative benefit/costs ratios depending on the assumed per pound value of the fish to commercial and recreational fishermen:

Assumed per pound value	Benefit/cost ratio
$0.75	$15,539,462/$4,085,128=3.80
1.00	20,719,283/$4,085,128=5.07
1.25	25,899,104/$4,085,128=6.34
1.50	31,078,925/$4,085,128=7.61

The conclusion is that the return for government investment, in implementing minimum size restrictions for the six fish species, ranges from $3.80 to $7.61 for each dollar invested. Copies of the RIR are available (see **ADDRESSES**).

The Council prepared a regulatory flexibility analysis (RFA) in conjunction with the RIR, as provided by Section 605(a) of the Regulatory Flexibility Act; this analysis is summarized above. On the basis of this RIR/RFA, the NOAA Administrator determined that this rule will have a significant economic impact on a substantial number of small entities. Copies of the RIR/RFA are available (see **ADDRESSES**).

This rule does not contain a collection of information requirement for purposes of the Paperwork Reduction Act.

The Council determined that this rule will be implemented in a manner that is consistent to the maximum extent practicable with the approved coastal zone management programs of Florida, South Carolina, and North Carolina. (The State of Georgia does not have an approved program.) This determination was submitted for review to the responsible State agencies under § 307 of the Coastal Zone Management Act. North Carolina responded and indicated its agreement with the conclusion of the consistency determination. South Carolina did not respond within 45 days, hence its agreement with the Council's consistency determination is presumed under 15 CFR 930.41(a). Florida requested and received a 15-day extension of its comment period and, subsequently, disagreed with the Council's determination. Florida's comments are discussed above. NOAA has concluded that, to the maximum extent practicable, the FMP is consistent with the applicable coastal zone management programs.

List of Subjects in 50 CFR Part 646

Fish, Fisheries, Fishing.

William G. Gordon,

Assistant Administrator for Fisheries, National Marine Fisheries Service.

For the reasons set out in the preamble, 50 CFR is amended by adding a new Part 646 to read as follows:

PART 646—SNAPPER-GROUPER FISHERY OF THE SOUTH ATLANTIC

Subpart A—General Provisions

Sec.

Subpart B—Management Measures

Authority: 16 U.S.C. 1801 *et seq.*

Subpart A—General Provisions

§ 646.1 Purpose and scope.

(a) The purpose of this part is to implement the Fishery Management Plan for the Snapper-Grouper Fishery of the South Atlantic prepared by the South Atlantic Fishery Management Council under the Magnuson Act.

(b) This part regulates fishing for fish in the snapper-grouper fishery by fishing vessels within the South Atlantic portion of the fishery conservation zone (FCZ).

§ 646.2 Definitions.

In addition to the definitions in the Magnuson Act, and unless the context requires otherwise, the terms used in this part shall have the following meaning:

Authorized officers means:

(a) Any commissioned, warrant, or petty officer of the U.S. Coast Guard;

(b) Any certified enforcement officer of special agent of the National Marine Fisheries Service (NMFS);

(c) Any officer designated by the head of any Federal or State agency which has entered into an agreement with the Secretary and the Commandant of the U.S. Coast Guard to enforce the provisions of the Magnuson Act; or

(d) Any U.S. Coast Guard personnel accompanying and acting under the direction of any person described in paragraph (a) of this definition.

Authorized statistical reporting agent means:

(a) Any person so designated by the Center Director; or

(b) Any person so designated by the head of any Federal or State agency which has entered into an agreement with the Secretary to collect fishery data.

Center Director means the Center Director or a designee, Southeast Fisheries Center, NMFS, 75 Virginia Beach Drive, Miami, Florida 33149; telephone 305-361-5761.

Commercial fisherman means a person who sells, trades, or barters any part of his or her catch of fish.

Dealer means the person who first receives by way of purchase, barter, or trade fish from a commercial fisherman.

Fish in the snapper-grouper species means the following species;

Snappers Lutjanidae

Black snapper—*Apsilus dentatus*
Queen snapper—*Etelis oculatus*
Mutton snapper—*Lutjanus analis*
Schoolmaster—*Lutjanus apodus*
Blackfin snapper—*Lutjanus buccanella*
Red snapper—*Lutjanus campechanus*
Cubera snapper—*Lutjanus cyanopterus*
Gray snapper—*Lutjanus griseus*
Mahogan snapper—*Lutjanus mahogoni*
Dog snapper—*Lutjanus jocu*
Lane snapper—*Lutjanus synagris*
Silk snapper—*Lutjanus vivanus*
Yellowtail snapper—*Ocyurus chrysurus*
Vermilion snapper—*Rhomboplites aurorubens*

Sea Basses—Serranidae

Bank sea bass—*Centropristis ocyurus*
Rock sea bass—*Centropristis philadelphica*
Black sea bass—*Centropristis striata*

Groupers—Serranidae

Rock hind—*Epinephelus adscensionis*
Graysby—*Epinephelus cruentatus*
Speckled hind—*Epinephelus drummondhayi*
Yellowedge grouper—*Epinephelus flavolimbatus*
Coney—*Epinephelus fulvus*
Red hind—*Epinephelus guttatus*
Jewfish—*Epinephelus itajara*
Red grouper—*Epinephelus morio*
Misty grouper—*Epinephelus mystacinus*
Warsaw grouper—*Epinephelus nigritus*
Snowy grouper—*Epinephelus niveatus*
Nassau grouper—*Epinephelus striatus*
Black grouper—*Mycteroperca bonaci*
Yellowmouth grouper—*Mycteroperca interstitialis*
Gag—*Mycteroperca microlepis*
Scamp—*Mycteroperca phenax*
Tiger grouper—*Mycteroperca tigris*
Yellowfin grouper—*Mycteroperca venenosa*

Porgies—Sparidae

Sheepshead—*Archosargus probatocephalus*
Grass porgy—*Calamus arctifrons*
Jolthead porgy—*Calamus bajonado*
Saucereye porgy—*Calamus calamus*
Whitebone porgy—*Calamus leucosteus*
Knobbed porgy—*Calamus nodosus*
Red porgy—*Pagrus pagrus*
Longspine porgy—*Stenotomus caprinus*
Scup—*Stenotomus chrysops*

Grunts—Haemulidae

Black margate—*Anisotremus surinamensis*
Porkfish—*Anisotremus virginicus*
Margate—*Haemulon album*
Tomtate—*Haemulon aurolineatum*
Smallmouth grunt—*Haemulon chrysargyreum*
French grunt—*Haemulon flavolineatum*
Spanish grunt—*Haemulon macrostomum*
Cottonwick—*Haemulon melanurum*
Sailors choice—*Haemulon parrai*
White grunt—*Haemulon plumieri*
Blue stripe grunt—*Haemulon sciurus*

Tilefishes—Malacanthidae

Blueline tilefish—*Caulolatilus microps*
Tilefish (Golden)—*Lopholatilus chamaeleonticeps*
Sand tilefish—*Malacanthus plumieri*

Triggerfishes—Balistidae

Gray triggerfish—*Balistes capriscus*
Queen triggerfish—*Balistes vetula*
Ocean triggerfish—*Canthidermis sufflamen*

Wrasses—Labridae

Hogfish—*Lachnolaimus maximus*
Puddingwife—*Halichoeres radiatus*

Jacks—Carangidae

Yellow jack—*Caranx bartholomaei*
Blue runner—*Caranx crysos*
Crevalle jack—*Caranx hippos*
Bar Jack—*Caranx ruber*
Greater amber jack—*Seriola dumerili*
Almaco jack—*Seriola rivoliana*

Fish trap means any trap and the component parts thereof used for or capable of taking finfish, regardless of the construction material, except those traps historically used in the directed fisheries for crustaceans (blue crab, stone crab, and spiny lobster). Fish trap further means those traps used to fish for black sea bass.

Fishery conservation zone (FCZ) means that area adjacent to the United States which, except where modified to accommodate international boundaries, encompasses all waters from the seaward boundary of each of the coastal States to a line on which each point is 200 nautical miles from the baseline from which the territorial sea of the United States is measured.

Fishing means any activity, other than scientific research conducted by a scientific research vessel, which involves:

(a) The catching, taking, or harvesting of fish;

(b) The attempted catching, taking, or harvesting of fish;

(c) Any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or

(d) Any operations at sea in support of, or in preparation for, any activity described in paragraph (a), (b), or (c) of this definition.

Fishing vessel means any vessel, boat, ship, or other craft which is used for, equipped to be used for, or of a type which is normally used for:

(a) Fishing; or

(b) Aiding or assisting one or more vessels at sea in the performance of any activity relating to fishing, including, but not limited to, preparation, supply, storage, refrigeration, transportation, or processing.

Magnuson Act means the Magnuson Fishery Conservation and Management Act, as amended (16 U.S.C. 1801 *et seq.*).

NMFS means the National Marine Fisheries Service.

Operator, with respect to any vessel, means the master or other individual on board and in charge of that vessel.

Owner, with respect to any vessel, means:

(a) Any person who owns that vessel in whole or in part;

(b) Any charterer of the vessel, whether bareboat, time, or voyage; or

(c) Any person who acts in the capacity of a charterer, including, but not limited to, parties to a management agreement, operating agreement, or other similar arrangement that bestows control over the destination, function, or operation of the vessel; or

(d) Any agent designated as such by any person described in paragraphs (a), (b), or (c) of this definition.

Person means any individual (whether or not a citizen of the United States), corporation, partnership, association, or other entity (whether or not organized or existing under the laws of any State), and any Federal, State, local, or foreign government or any entity of any such government.

Powerhead means any device with an explosive charge, usually attached to a speargun, spear, pole, or stick, which fires a projectile upon contact.

Regional Director means the Regional Director, or a designee, Southeast Region, NMFS, Duval Building, 9450 Koger Boulevard, St. Petersburg, Florida 33702; telephone 813-893-3141.

Secretary means the Secretary of Commerce, or a designee.

South Atlantic means that portion of the FCZ along the Atlantic coastal states south of the Viriginia/North Carolina border to the boundary between the Gulf of Mexico and the Atlantic Ocean. The boundary between the Gulf of Mexico and the Atlantic Ocean begins at the intersection of the outer boundary of the FCZ and 83°00′ W. longitude, proceeds north to 24°35′ N. latitude (Dry Tortugas), east to Marquesas Key, then through the Florida Keys to the mainland.

Total length means distance from the tip of the head (snout) to the furthermost tip of the tail (caudal fin).

U.S. fish processors means facilities located within the United States for, and vessels of the United States, used for or equipped for, the processing of fish for commercial use or consumption.

U.S-harvested fish means fish caught, taken, or harvested by vessels of the United States within any foreign or domestic fishery regulated under the Magnuson Act.

Vessel of the United States means:

(a) Any vessel documented under the laws of the United States;

(b) Any vessel numbered in accordance with the Federal Boat Safety Act of 1971 (46 U.S.C. 1400 *et seq.)* and measuring less than five net tons; or

(c) Any vessel numbered under the Federal Boat Safety Act of 1971 (46 U.S.C. 1400 *et seq.)* and used exclusively for pleasure.

§ 646.3 Relationship to other laws.

(a) Persons affected by these regulations should be aware that other Federal and State statutes and regulations may apply to their activities.

(b) Certain responsibilities relating to data collection, issuance of permits, and enforcement may be performed by authorized State personnel under a cooperative agreement entered into by the State, the U.S. Coast Guard, and the Secretary.

(c) These regulations are intended to apply within the FCZ portion of the following National Marine Sanctuaries and National Park unless regulations establishing such Sanctuaries or Park prohibit their application.

(1) Looe Key National Marine Sanctuary (15 CFR Part 937);

(2) Key Largo Coral Reef Marine Sanctuary (15 CFR Part 929);

(3) Biscayne National Park (Title 16 U.S.C. 410gg);

(4) Gray's Reef National Marine Sanctuary (15 CFR Part 938); and

(5) Monitor Marine Sanctuary (15 CFR Part 924).

§ 646.4 Catch monitoring.

Data will be collected by authorized statistical reporting agents from a sample of commercial and recreational catch for YPR analysis. Those fishermen and dealers selected by the Center Director must make their fish available for inspection by those agents.

§ 646.5 Gear identification. [Reserved]

§ 646.6 Prohibitions.

It is unlawful for any person to:

(a) Refuse to make fish available for inspection when requested to do so by an authorized statistical reporting agent, as specified in § 646.4;

(b) Pull or tend fish traps except during the hours specified in § 646.20;

(c) Tend, open, pull, or otherwise molest or have in one's possession aboard a fishing vessel another persons's fish traps except as provided in §646.20(b);

(d) Possess in or harvest from the FCZ red snapper, yellowtail snapper, red grouper, or Nassau grouper under the minimum size specified in § 646.21(a);

(e) Possess in or harvest from that portion of the FCZ south of 35°15′ N. latitude (Cape Hatteras, North Carolina) black sea bass under the minimum size specified in § 646.21(b);

(f) Possess in the FCZ any fish in the snapper-grouper fishery without the heads and fins intact as specified in § 646.21(c);

(g) Land any fish in the snapper-grouper fishery, taken from the FCZ, without the heads and fins intact as specified in § 646.21(c);

(h) Fish for fish in the snapper-grouper fishery with explosives or poisons except as provided in § 646.22(a)(1) and (2);

(i) Fish for fish in the snapper-grouper fishery in the FCZ with trawl nets and fish traps except as specified in §§ 646.20 (a) and (b) or 646.22(b);

(j) Possess, have custody or control of, ship, transport, offer for sale, sell, purchase, import, land, export any fish or parts thereof taken or retained in violation of the Magnuson Act, this part, or any other regulations or any permit issued to a foreign vessel under the Magnuson Act;

(k) Refuse to permit an authorized officer to board a fishing vessel subject to such person's control for purposes of conducting any search or inspection in connection with the enforcement of the Magnuson Act, this part, or any other regulation or permit issued under the Magnuson Act;

(l) Forcibly to assault, resist, oppose, impede, intimidate, threaten, or interfere with any authorized officer in the conduct of any search or inspection described in paragraph (k) of this section;

(m) Resist a lawful arrest for any act prohibited by this part;

(n) Interfere with, delay, or prevent, by any means, the apprehension or arrest of another person, knowing that such other person has committed any act prohibited by this part;

(o) Transfer directly or indirectly, or attempt to so transfer, any U.S.-harvested fish to any foreign fishing vessel, while such foreign vessel is in the FCZ, unless the foreign fishing vessel has been issued a permit under section 204 of the Magnuson Act which authorized the receipt by such vessel of the U.S.-harvested fish of the species concerned; or

(p) Violate any other provision of this part, the Magnuson Act, or any regulation or permit issued under the Magnuson Act.

§ 646.7 Facilitation of enforcement.

(a) *General.* The operator of any fishing vessel subject to this part must immediately comply with instructions or signals by an authorized officer to stop his vessel and instructions to facilitate safe boarding and inspection of the vessel, its gear, equipment, fishing record, and catch for purposes of enforcing the Magnuson Act and this part.

(b) *Communications.* (1) Upon being approached by a U.S. Coast Guard vessel or aircraft, or other vessel or aircraft with an authorized officer aboard, the operator of a fishing vessel must be alert for communications conveying enforcement instructions.

(2) When the sizes of the vessels and the wind, sea, and visibility conditions permit, loudhailer is the preferred method for communicating between vessels. When use of a loudhailer is not practicable and for communications with an aircraft, VHF-FM or high frequency radiotelephone should be employed. Hand signals or placards may be employed by an authorized officer and message blocks may be dropped from an aircraft.

(3) If verbal communications are not practicable, the visual signal "L" meaning "you should stop your vessel instantly," may be transmitted by flashing light directed at the vessel signaled. If the enforcement vessel is equipped with signal flags, the flashing light signal "L" consists of short and long flashes as follows: short-long-short-short (· — · ·); and the code Flag "L" is a square yellow and black flag shown as follows:

(4) Failure of a vessel's operator to stop his vessel when directed by loudhailer, radiotelephone, or flashing light signal "L" shall constitute *prima facie* evidence of the offense of refusal to permit an authorized officer to board.

(c) *Boarding.* The operator of a vessel directed to stop must:

(1) Guard Channel 16, VHF-FM, if so equipped;

(2) Stop immediately and lay to or maneuver in such a way as to permit the authorized officer and accompanying party to come aboard;

(3) When necessary, to facilitate the boarding and/or when requested by an authorized officer provide a safe ladder, man rope safety line, and ladder illumination for the authorized officer and the boarding party; and

(4) Take such other actions as necessary to ensure the safety of the authorized officer and accompanying party and facilitate the boarding.

(d) *Additional Signals.* The following additional signals, extracted from the International Code of Signals, may be sent by flashing light by a vessel of the U.S. Coast Guard when conditions do not permit communications by loudhailer or radiotelephone. Knowledge of these additional signals by vessel operators is not required. However, knowledge of these additional signals and appropriate action by a vessel operator may preclude the necessity of sending the signal "L" and necessity for the vessel to stop instantly. The operator of a vessel who does not understand a signal from a vessel of the U.S. Coast Guard and who is unable to obtain clarification by loudhailer or radiotelephone should consider the signal to be "L."

(1) "AA AA AA etc." (—— ——.— —) is the call to an unknown station. The operator of the signaled vessel should respond by identifying the vessel by radiotelephone or by illuminating the vessel identification required by § 658.6 or other law.

(2) "RY-CY" (— ——— —— — ——) meaning "you should proceed at slow speed, a boat is coming to you." This signal is normally employed when conditions permit an enforcement boarding without the necessity of the vessel being boarded coming to a complete stop or, in some cases, without retrieval of fishing gear which may be in the water.

§ 646.3 Penalties.

Any person or fishing vessel found to be in violation of this part will be subject to the civil and criminal penalty provisions and forfeiture provisions of the Magnuson Act, and to 50 CFR Part 620 (Citations), 50 CFR Part 621, and 15 CFR Part 904 (Civil Procedures), the other applicable Federal law.

Subpart B—Management Measures

§ 646.20 Harvest limitations.

(a) Fish traps may be pulled or tended only during the period beginning one hour before official sunrise to one hour after official sunset in the South Atlantic portion of the FCZ south of 28°24.5′ N. Latitude (Cape Canaveral, Florida).

(b) Fish traps may be tended or pulled only by persons (other than authorized officers) aboard the fish trap owner's vessel(s), or aboard another vessel if such vessel has on board written consent of the fish trap owner.

§ 646.21 Size limitations.

(a) The minimum size limit for the harvest or possession in the FCZ of red snapper, yellowtail snapper, red grouper, and Nassau grouper is 12 inches total length.

(b) The minimum size for the harvest or possession in the FCZ of black sea bass south of Cape Hatteras, North Carolina is 8 inches total length.

(c) All fish in the snapper-grouper fishery subject to minimum size limits specified in this section may be possessed in the FCZ or landed, if harvested from the FCZ, only with the head and fins intact.

§ 646.22 Gear limitations.

(a) (1) Explosives (except explosives in powerheads) may not be used to fish for fish in the snapper-grouper fishery.

(2) Poisons may not be used to fish for fish in the snapper-grouper fishery except as authorized by permit under State or Federal law.

(b) (1) Fish traps must have a degradable panel or a door attached with degradable fasteners or material such as jute or sisal twines which normally deteriorate within 42 days. The opening must be at least as large as the entry ports.

(2) Effective [insert date—1 year after effective date of final rule], fish traps must have a minimum mesh size of 1 x 2 inches or 1.5-inch hexagonal (the distance between parallel sides).

(3) Effective September 28, 1984, trawl nets targeting fish in the snapper-grouper fishery (25 percent or more of the fish on board by weight are fish in the snapper-grouper fishery) must have a minimum stretched mesh size of 4 inches. Shrimp trawls, calico scallop trawls, and rock shrimp trawls are specifically exempt from this requirement.

(4) Fish traps may not be placed shoreward of the 100-foot contour in that portion of the South Atlantic FCZ south of 25°35.5′ N. latitude (Fowey Rocks Light, Florida). Fish traps so deployed will be considered unclaimed or abandoned property and may be disposed of in any appropriate manner by the Secretary (including an authorized officer).

§ 646.23 Specifically authorized activities.

The Secretary may authorize for, the acquisition of information and data, activities which are otherwise prohibited by these regulations.

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