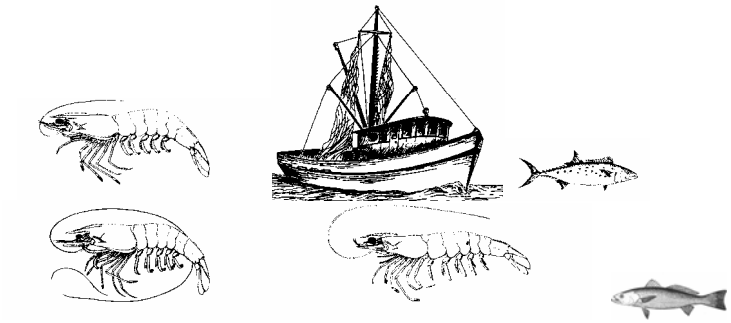
FINAL
AMENDMENT 2
(BYCATCH REDUCTION)
TO THE
FISHERY MANAGEMENT PLAN
FOR THE
SHRIMP FISHERY
OF THE
SOUTH ATLANTIC REGION

INCLUDING A FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, REGULATORY IMPACT REVIEW, AND SOCIAL IMPACT ASSESSMENT



APRIL 1996

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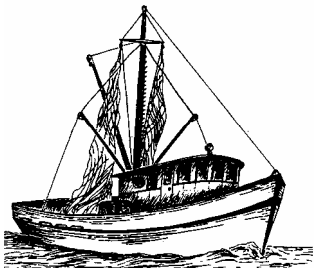

prepared by the
South Atlantic Fishery Management Council

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AMENDMENT 2 COVER SHEET

This integrated document contains all elements of the Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Regulatory Impact Review (RIR), and Social Impact Assessment (SIA). Separate Tables of Contents are provided to assist readers and the NMFS/NOAA/DOC reviewers in referencing corresponding sections of the Amendment. Introductory information and/or background for the SEIS, RIR, and SIA are included with the separate table of contents for each of these sections.

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Name of Action:

(X) Administrative ( ) Legislative

SUMMARY

The Council is proposing to add brown and pink shrimp to the management unit; define overfishing for brown and pink shrimp; define optimum yield for brown and pink shrimp as the amount of harvest that can be taken by U.S. fishermen without annual landings falling below two standard deviations below mean landings 1957-1993; require the use of certified Bycatch Reduction Devices (BRDs) in all penaeid shrimp trawls in the EEZ; and establish a framework for BRD certification which specifies BRD certification criteria and testing protocol.

Scoping meetings on bycatch in the shrimp fishery were held on: February 7, 1995 at the Ponce De Leon Conference Resort in St. Augustine, Florida; on April 11, 1995 at the Holiday Inn Savannah-Midtown, Savannah, Georgia; on May 22, 1995 at the Ramada Inn Conference Center, Wilmington, North Carolina; on May 23, 1995 at the South Carolina Department of Natural Resources Marine Resources Research Institute, Charleston, South Carolina; and at the Palm Beach Gardens Marriott on June 19, 1995 in Palm Gardens, Florida.

Public hearings were originally scheduled between November 27 and December 5, 1995, but were postponed due to the federal government shutdown. Public hearings were rescheduled and held on: January 2, 1996 at the Murrell's Inlet Community Center, Murrell's Inlet, South Carolina; on January 3, 1996 at the Days Inn, Jacksonville, Florida; on January 3, 1996 at the Holiday Inn, Wrightsville Beach, North Carolina; on January 4, 1996 at the Comfort Inn, Brunswick, Georgia; on January 4, 1996 at the Carteret Community College, Morehead City, North Carolina; on January 5, 1996 at the

Holiday Inn Midtown, Savannah, Georgia; and on January 8, 1996 at the Town and Country Inn, Charleston, South Carolina. Final public comments were taken on February 14, 1996, at the Ponce De Leon Conference Resort in St. Augustine, Florida.

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

This integrated document contains all elements of the Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Regulatory Impact Review (RIR), and Social Impact Assessment (SIA). The table of contents for the FSEIS is provided separately to aid reviewers in referencing corresponding sections of the Amendment.

( ) Draft (X) Final

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SUMMARY

The following problem, as stated in the shrimp FMP (Appendix A), is modified and addressed by the Final Supplemental Environmental Impact Statement (FSEIS): (1) Shrimp trawls have a significant bycatch of nontarget finfish and invertebrates, most of which are discarded dead. **This may reduce ecosystem diversity, adversely impact other fauna, and significantly reduce yield in other fisheries directed at these discard species.** In addition, shrimp trawls have a bycatch of endangered, threatened, and/or protected species (e.g., leatherback turtles) that are too large to be excluded by TEDs. **Repeat captures of endangered turtles by shrimp trawls in areas of high turtle and shrimping concentration may be contributing to increased sea turtle mortalities.**

The following new problems are addressed by the Final Supplemental Environmental Impact Statement (FSEIS): (2) Lack of consistent/compatible regulations addressing bycatch in federal waters may result in unenforceable state regulations and preclude effective reduction of weakfish and Spanish mackerel bycatch throughout the range of the species; and (3) There will be a compliance

problem with fishermen participating in a transboundary penaeid shrimp fishery if reduction strategies are not standardized.

The following objective stated in the shrimp FMP is addressed by the Final Supplemental Environmental Impact Statement (FSEIS): (1) Reduce the bycatch of non-target finfish, invertebrates, and threatened, protected and endangered species.

The Final Supplemental Environmental Impact Statement (FSEIS) addresses the following new objectives: (2) Coordinate development of measures reducing bycatch to enhance enforceability of both state and federal regulations with South Atlantic states; and (3) Enhance compliance of trawl fishermen participating in a transboundary penaeid shrimp fishery through standardization of bycatch reduction strategies.

The Council is proposing to add brown and pink shrimp to the management unit; define overfishing for brown and pink shrimp; define optimum yield for brown and pink shrimp as the amount of harvest that can be taken by U.S. fishermen without annual landings falling below two standard deviations below mean landings 1957-1993; require the use of certified Bycatch Reduction Devices (BRDs) in all penaeid shrimp trawls in the EEZ; and establish a framework for BRD certification which specifies BRD certification criteria and testing protocol.

Comments on DSEIS requested by: February 20, 1996

FSEIS to EPA on: December 10, 1996

Comments on FSEIS requested by: January 21, 1997

REGULATORY IMPACT REVIEW

This integrated document contains all elements of the Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Regulatory Impact Review (RIR), and Social Impact Assessment (SIA). A table of contents for the RIR is provided separately to aid the reviewer in referencing corresponding sections of the Amendment.

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INTRODUCTION

The Regulatory Impact Review (RIR) is part of the process of developing and reviewing fishery management plans, amendments and seasonal adjustments, and is prepared by the Regional Fishery Management Councils with assistance from the National Marine Fisheries Service, as necessary. The regulatory impact review provides a comprehensive review of the level and incidence of economic impact associated with the proposed regulatory actions. The purpose of the analysis is to ensure that the regulatory agency or Council systematically considers all available alternatives so that public welfare can be enhanced in the most efficient and cost effective way.

The National Marine Fisheries Service (NMFS) requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: 1) it provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action, 2) it provides a

review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem, and 3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether any proposed regulations are a "significant regulatory action" under certain criteria provided in Executive Order 12866 and whether the proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA). The purpose of the Regulatory Flexibility Act is to relieve small businesses, small organizations, and small governmental entities from burdensome regulations and record–keeping requirements, to the extent possible.

This RIR analyzes the probable impacts on the fishery and habitat of the proposed plan amendment to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region (FMP).

PROBLEMS AND OBJECTIVES

The general problems and objectives are found in the FMP (Appendix A). Problems and objectives addressed by this amendment are found in Section 1.0 of this document. Further exposition of these issues are found in the discussions under each proposed action.

METHODOLOGY AND FRAMEWORK FOR ANALYSIS

The basic approach adopted in this RIR is an assessment of management measures from the standpoint of determining the resulting changes in costs and benefits to society. The net effects should be stated in terms of producer and consumer surpluses for the harvesting, processing/dealer sectors, and for consumers. Ideally, the expected present values of net yield streams over time associated with the different alternatives should be compared in evaluating the impacts. However, lack of data precludes this type of analysis. The approach taken in analyzing alternative management approaches is to describe and/or quantify the changes in short-term net benefits.

Summary of Expected Changes in Net Benefits (Summary of Regulatory Impact Review- RIR)

Table 1a. Summary of expected changes in net benefits.

ACTION	POSITIVE IMPACTS	NEGATIVE IMPACTS	NET IMPACTS
ACTION 1: Add brown and pink shrimp to the management unit.	Allows the Council to manage all shrimp in the South Atlantic region and to take timely action when necessary.	None.	Positive.
Rejected Option			
Rejected Option 1.	None.	Prevents the Council from managing or implementing management measures affecting shrimp species in the South Atlantic region.	Likely negative.
ACTIONS 2 & 3: Define overfishing for brown and pink shrimp. Define optimum yield for brown and pink shrimp.	Enables detection of possible stock declines and facilitates prevention of overfishing or recovery of stocks.	None.	None
Rejected Option			
Rejected Option 1.	None.	Could result in dissipation of economic benefits.	Likely negative.
ACTIONS 4: Require the use of certified BRDs in all penaeid shrimp trawls in the EEZ.	Reduces bycatch and benefits both finfish stocks targeted by other fisheries and the marine ecosystem. Results in cleaner catches, reduced sorting time, and possibly higher quality catch.	Net revenue loss (reduction in efficiency) to shrimp industry could range from $0 to $1.8 million annually.	Likely positive.
Rejected Options			
Rejected Option 1. BRDs by season/area.	Possible increase in long-term benefits due to reduction in bycatch mortality.	Minimal increase in vessel operating cost.	None.
Rejected Option 2. Area/season closures.	Possible increase in long-term benefits due to reduction in bycatch mortality.	Decrease in vessel revenue.	Likely negative.
Rejected Option 3. No Action.	None.	High finfish bycatch resulting in decreased recruitment in those fisheries. Long-term decrease in net benefits.	Likely negative.
ACTION 5: Establish a BRD certification process and specify certification criteria for new or modified BRDs.	Allows for industry development of more efficient and economical BRDs.	None	Positive.
Rejected Option			
Rejected Option 1.	None.	None.	Likely negative.

SOCIAL IMPACT ASSESSMENT

This integrated document contains all elements of the Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Regulatory Impact Review (RIR), and Social Impact Assessment (SIA). A table of contents for the SIA is provided separately to aid reviewers in referencing corresponding sections of the Amendment.

INTRODUCTION

Mandates to conduct Social Impact Assessments (SIA) come from both the National Environmental Policy Act (NEPA) and the Magnuson Fishery Conservation and Management Act (MFCMA). NEPA requires federal agencies to consider the interactions of natural and human environments by using a "systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences…in planning and decision-making" [NEPA Section 102 (2) (A)]. Under the U.S. Council on Environmental Quality's *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* a clarification of the terms "human environment" explained the interpretation to include the relationship of people with their natural and physical environment (40 CFR 1508.14). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect, or cumulative (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment 1994).

Under the MFCMA, fishery management plans (FMPs) must "…achieve and maintain, on a continuing basis, the optimum yield from each fishery" [MFCMA Section 301 (a)(1)]. More recent amendments to the MFCMA require that FMPs address the impacts of any management measures on the participants in the affected fishery and those participants in other fisheries that may be affected directly or indirectly [MFCMA Section 303 (a) (9)]. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the

consequences of such changes need to be examined in order to mitigate the negative impacts experienced by the populations concerned.

PROBLEMS AND METHODS

Social impacts are generally the consequences to human populations that follow from some type of public or private action. Those consequences may include alterations to "the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society...." (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment 1994: 1). In addition, cultural impacts which may involve changes in values and beliefs which affect people's way of identifying themselves within their occupation, communities, and society in general are included under this interpretation. Social impact analyses determine consequences of policy action in advance by comparing the status quo with the projected impacts. Therefore, it is extremely important that as much information as possible concerning a fishery and its participants be gathered for an assessment. Although public hearings and scoping meetings do provide information from those concerned with a particular action, they do not constitute a full overview of the fishery.

Without access to relevant information for conducting social impact analyses it is important to identify any foreseeable adverse effects on the human environment. With quantitative data often lacking, one can use qualitative data to provide a rough estimate of some impacts. In addition, when there is a body of empirical findings available from the social science literature, one should summarize and reference it in the analysis.

Summary of Social Impacts

Table 1b. Summary of social impacts.

ACTION	SOCIAL IMPACTS
ACTION 1: Add brown and pink shrimp to the management unit.	Adding brown and pink shrimp to the management unit will have few social impacts alone. The inclusion of brown and pink shrimp in the management unit will create the necessary conditions and regulatory framework to enforce compatible state and federal regulations. An overall benefit should be derived through the Council's ability to address problems within the fishery that have a direct or indirect effect upon other fisheries or other physical and social environments. Although adding these species to the management unit has few direct social impacts, one of the indirect impacts may be the perception by shrimp fishermen of increasing regulation and possible negative impacts. Fishermen understand that while adding a species to the management unit itself may not affect them, it is the actions that follow which will most likely have an impact.
Rejected Options	

No Action Option.	Currently, regulations to reduce shrimp trawl bycatch are in place in North Carolina and are proposed for the Florida east coast, South Carolina, and Georgia by the beginning of the 1996 fishing year. No action would preclude implementation of compatible federal regulations to reduce bycatch and would hinder enforceability of state regulations. The Council needs a regulatory framework which will allow the overall impacts of shrimp trawl bycatch to be assessed. Because there is finfish bycatch in the brown and pink shrimp fisheries, to exclude them from the management unit would be inconsistent with various federal and state regulations and mandates.
ACTIONS 2 & 3: Define overfishing for brown and pink shrimp. Define optimum yield for brown and pink shrimp.	Defining overfishing has few if any social impacts. The social impacts of an overfishing definition stem from the effect of regulations that are implemented once a stock has been defined as being overfished. Because the overfishing level chosen for brown shrimp has been reached only twice in the last 37 years and never for pink shrimp, it is unlikely that any negative social impacts would be realized from choosing this overfishing definition. The social impacts of an optimum yield definition are derived from the benefits to society from the harvest of a resource at such a level. Those benefits are difficult to measure without detailed information on the harvesting, intermediate, and consumer sectors that are affected. The definition for optimum yield chosen here as preferred assumes that harvest levels for the past 35 years have been at or near optimum yield. It is unlikely that choosing this definition for optimum yield will have any social impacts.
<u>Rejected Options</u>	
No Action Option.	With no definition for overfishing the Council would have difficulty establishing any regulatory regime if stocks were shown to be in a state of decline for reasons other than the earlier mentioned environmental fluctuations. Negative social impacts could result if stocks became overfished.
ACTIONS 4: Require the use of certified BRDs in all penaeid shrimp trawls in the EEZ.	The problem of shrimp trawl bycatch reduction can be separated into two distinct issues: 1) a short-term problem of forced technological change and its immediate impact; and 2) the longer-term recovery of finfish stocks and its subsequent impact. The first is assumed by the industry to be a negative impact, while the second is assumed to be a positive impact for society as a whole. There is another implicit assumption that the long-term impacts of finfish bycatch reduction outweigh the short-term impacts upon the industry and that those short-term impacts can be lessened. It seems that the uncertainty about the impacts regarding technology affect shrimp fishermen's perceptions and their attitude toward adoption. By providing as much detailed information as possible and incorporating fishermen into the process of decision making and development of gear technology, the Council may avoid much of the controversy which surrounded implementation of TEDs. Reducing uncertainty about the impacts of BRDs will most likely enhance implementation.
<u>Rejected Options</u>	

Rejected Option 1: **BRDs by season/area.**	Season and areal BRD use may have a beneficial impact by reducing bycatch but may also cause inconvenience for shrimp fishermen by forcing them to carry extra nets or equipment.
Rejected Option 2: **Area/season closures.**	Areal and season closures may have a beneficial impact by reducing bycatch but may also interfere with seasonal fishing rounds for shrimp fishermen.
No Action Option.	If no action is taken regarding bycatch reduction the Council will have inconsistent regulations with states in its jurisdictional area. State regulations promulgated to reduce bycatch in the shrimp trawl fishery will be compromised and possibly rendered unenforceable. At the same time, the long-term recovery for some finfish stocks may be jeopardized and net benefits to society would be reduced. The short-term negative impacts to the shrimp industry would be eliminated, however, any positive benefits to the industry that might be realized through implementation of BRDs would be forgone.
ACTION 5: Establish a BRD certification process and specify certification criteria for new or modified BRDs.	Adoption of certification process and criteria to be used in the BRD certification protocol should provide industry with the flexibility to design and use BRDs other than those prescribed in Action 4. By allowing for criteria and other modifications to be made through framework procedures, the Council may be able to respond quickly to either the needs of the stock or the fishermen.
Rejected Options	
No Action Option.	With no certification process or a framework to modify criteria, the Council's actions may seem too restrictive to the industry.

Social Impact Assessment Data Needs

Given the lack of sufficient data to conduct a complete social impact assessment, the following data needs are suggested to improve analysis of future actions addressing the South Atlantic shrimp fishery. The following categories include the types of data that need to be collected on the commercial harvesting sector:

Demographic information on commercial harvesters may include but not necessarily be limited to: Age, gender, ethnic/race, education, language, marital status, children (age & gender), residence, household size, household income (harvester/non harvester), household dependence upon income from commercial fishing, occupational skills, and association with vessels and firms (role & status).

Social structure information on commercial harvesters may include but not necessarily be limited to: Historical participation, description of work patterns, description of gear and materials needed for harvesting and their use, organization and affiliation, patterns of communication and cooperation, competition and conflict, and communication and integration.

Emic culture information may include but not necessarily be limited to:

Occupational motivation and satisfaction, attitudes and perceptions concerning management (especially the efficacy of BRDs), constituent views of their personal future of harvesting, and psycho-social well-being.

A general description of the shrimp fishery would aid in determining social impacts beyond the harvesting sector. Such a description might include the support industry associated with harvesting shrimp, costs associated with handling and marketing, channels for selling shrimp products and finally, social and economic information on the areas, regions, or communities where shrimp are harvested and marketed. A specific focus upon the impact of BRDs and the subsequent changes that occur with regard to the fishing operation, management of the household, and attitudes toward future participation in the fishery and management as a result, would be beneficial to future social impact analyses.

1.0 PURPOSE AND NEED

The shrimp fishery is the largest and most valuable commercial fishery in the region with approximately 1,400 large vessels and 1,000 small boats harvesting 30 million pounds with an exvessel value of $60 million annually. Penaeid shrimp including white (*Penaeus setiferus*), brown (*Penaeus aztecus*), and pink (*Penaeus duorarum*) constitute the majority of harvest occurring from coastal, near-shore, and estuarine waters off the states of North Carolina through southeast Florida.

Trawling in the South Atlantic occurs over thousands of trips, and millions of hours during which large amounts of finfish bycatch are discarded dead. Survey results indicate that on the average trawls towed for one hour will capture 1,214 organisms weighing approximately 64 pounds (NMFS 1995). Of this catch, commercially valuable shrimp accounts for 20% by weight and 29% by number of penaeid shrimp relative to total catch including discarded bycatch of finfish, invertebrates, and crustaceans (NMFS 1995). A recent recalculation of the shrimp to finfish bycatch ratio indicates that for every one pound of white, brown, and pink shrimp, shrimpers catch approximately 2.3 pounds of finfish bycatch. Also, for every one shrimp caught, 1.6 finfish are caught. Finfish catch by weight for the entire shrimp fishery is highest between May and August when the catch ratio is 2.5 pounds of finfish for every pound of shrimp. In number, the highest catch of individual finfish occurred in January through April with 4.8 finfish caught for each shrimp. Bycatch in the shrimp fishery consists of up to 40% (by weight) of small, juvenile finfish which includes species of commercial and/or recreational value (spot, croaker, Spanish mackerel, king mackerel, weakfish, etc.). If left to mature, these juvenile fish would produce significantly higher yield in weight compared to the discarded weight.

Impacts of bycatch on the marine ecosystem can include changing the trophic structure through predator's food sources being decreased and scavenger food sources being increased. Coastal pelagics (mackerels) could subsequently be sensitive to a significant decrease in prey availability. This reduction could translate into reduced survivorship of other commercial and/or recreationally important species. Additionally, researchers using energy flow models, indicate that reduction of discarded finfish biomass may stimulate production in the lower end of the food chain and increase the total quantity of biomass. An example of a significant impact on an individual species is the case of Atlantic croaker in the Gulf of Mexico where bycatch has contributed to a significant reduction in the average size and number of age classes in the stock (Browder 1992). Overall impacts of discards on the ecosystem and fisheries could include a significant biological loss, biological overfishing of target and bycatch species, economic losses imposed on target fisheries, modification of biological community structures in ecosystems, and impacts on severely depleted, threatened or endangered species (Alverson et al. 1994).

The recent draft coastwide weakfish stock assessment (Gibson 1995) and draft Amendment 3 to the FMP for weakfish (ASMFC 1996) indicate the stock is severely depleted and in a state of decline. All indications are that the species is overfished and undergoing recruitment failure (DOC 1995). Gibson (1995) indicated that mortality associated with shrimp bycatch was a significant source

of mortality for age 0 and possibly age 1 weakfish. Inclusion of shrimp bycatch loss affects fishing mortality (F) for age 0 weakfish. Fishing mortality on age 0 weakfish averaged about 0.8 including shrimp bycatch but was estimated to be generally less than 0.2 without discards. Over 20 million age 0 and two million age 1 weakfish were the estimated discards as bycatch in 1994. The poor condition of the weakfish resource resulted in a closure of the EEZ through Secretarial action (DOC 1995) on December 21, 1995. Subsequently, a Federal judge issued an order that overturned the moratorium on February 16, 1996. The Mid Atlantic Fishery Management Council has determined they will develop a Federal fishery management plan for weakfish. Also, draft Amendment 3 to the Atlantic States Marine Fisheries Commission's (ASMFC) Weakfish Fishery Management Plan (ASMFC 1996) requires the South Atlantic states to implement measures by the beginning of the 1996 shrimp season which reduce weakfish trawl bycatch by 40% in state waters.

Considering the weakfish population is severely depleted, the reduction in any fishery related mortality, including mortality attributable to bycatch, will aid in the stock's ability to recover. The mackerel stock assessment for 1996 incorporated estimates of bycatch in the shrimp fishery. The inclusion of bycatch into the assessment has, as anticipated, lowered the Acceptable Biological Catch (ABC) range and the Spawning Potential Ratio (SPR) values for Atlantic Group Spanish mackerel. The estimated 1996/97 SPR has decreased to 29%.

This amendment presents the most recent information on bycatch characterization and results of the cooperative bycatch research program to facilitate the Council's efforts to reduce bycatch in the South Atlantic penaeid shrimp fishery.

1.1 Issues/Problems

The following problem from the shrimp FMP is modified (original wording shown in Appendix A) and addressed by this amendment:

1. Shrimp trawls have a significant bycatch of nontarget finfish and invertebrates, most of which are discarded dead. This may reduce ecosystem diversity, adversely impact other fauna, and significantly reduce yield in other fisheries directed at these discard species. In addition, shrimp trawls have a bycatch of endangered, threatened, and/or protected species (e.g., leatherback turtles) that are too large to be excluded by TEDs. Repeat captures of endangered turtles by shrimp trawls in areas of high turtle and shrimping concentration may be contributing to increased sea turtle mortalities.

The following new problems are proposed to be addressed by this amendment:

2. Lack of consistent/compatible regulations addressing bycatch in federal waters may result in unenforceable state regulations and preclude effective reduction of weakfish and Spanish mackerel bycatch throughout the range of the species.

3. There will be a compliance problem with fishermen participating in a transboundary penaeid shrimp fishery if reduction strategies are not standardized.

1.2 Management Objectives for Amendment 2

The following objective as stated in the shrimp FMP is addressed by this amendment:

1. Reduce the bycatch of non-target finfish, invertebrates, and threatened, protected and endangered species.

This amendment addresses the following new objectives:

2. Coordinate development of measures reducing bycatch with South Atlantic states to enhance enforceability of both state and federal regulations.

3. Enhance compliance of trawl fishermen participating in a transboundary penaeid shrimp fishery through standardization of bycatch reduction strategies.

1.3 History of Management

1.3.1 Shrimp Fishery Management Plan and Amendment 1

The Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region (SAFMC 1993) was prepared by the South Atlantic Fishery Management Council primarily to provide South Atlantic states with the ability to request concurrent closure of the EEZ adjacent to their closed state waters following severe winter cold weather and eliminate fishing mortality on overwintering white shrimp following severe winter cold kills. The plan provides an exemption for royal red and rock shrimp fisheries from any closure of the EEZ to harvest of white shrimp. In addition it establishes a buffer zone extending seaward from shore 25 nautical miles, inside which no trawling is allowed with a net having less than 4 inch stretch mesh during an EEZ closure. Vessels trawling inside this buffer zone could not have a shrimp net aboard (i.e., a net with less than 4 inch stretch mesh) in the closed portion of the EEZ. Vessels may transit the closed EEZ with less than 4 inch stretch mesh aboard while in possession of *Penaeus* species provided that the nets are in an unfishable condition which is defined as stowed below deck. Providing for transit through the EEZ and limiting the buffer zone to 25 miles allow rock shrimp fishermen to fish with minimal disruption during a closure of federal waters for protection of white shrimp. Brown and pink shrimp, although acknowledged as being part of the South Atlantic shrimp fishery, were not included in the management unit because no regulations were being proposed for the species at that time.

Amendment 1 to the shrimp fishery management plan (SAFMC 1996) adds rock shrimp to the management unit, limits the impact of the rock shrimp fishery on essential bottom habitat, and implements measures to ensure adequate reporting and monitoring of the fishery. The notice of availability of Amendment 1 was published in the Federal Register on March 19, 1996. The amendment, when implemented by the Secretary of Commerce, will bring rock shrimp under federal management and reduce the impact of the fishery on essential bottom habitat.

1.3.2 Development of Amendment 2

The Council, in the development of the Shrimp FMP (SAFMC 1993), identified bycatch as a significant problem in the penaeid shrimp trawl fishery and indicated a desire to begin developing management measures to reduce finfish bycatch. However, the November 1990 Magnuson Act reauthorization specifically prohibited the Council from implementing regulations to reduce bycatch that would have an impact on the shrimp fishery until bycatch was characterized and gears were developed that reduced bycatch while minimizing shrimp loss. NMFS has worked closely with the shrimp industry through the Gulf and South Atlantic Fisheries Development Foundation cooperative bycatch research program to characterize bycatch and develop Bycatch Reduction Devices (BRDs).

Effective April 1, 1994, the prohibition of the federal management councils from addressing bycatch in the southern shrimp fisheries expired. During the October 27, 1994, Council meeting, Bycatch Program personnel presented results of bycatch reduction research conducted to date. The Council voted at the October 1994 meeting to recommend NMFS place the emphasis of bycatch research efforts on perfecting bycatch reduction devices (BRDs) to provide the Council and states with options to reduce finfish bycatch in the shrimp fishery. Both the Council and the states encouraged NMFS to rapidly compile this information to further refine options for implementation of BRDs under the federal shrimp plan and interjurisdictional fishery management plans.

With the sunset of the congressional prohibition, combined with the availability of new data and technology resulting from the cooperative bycatch research program, the Council began the Magnuson Act and National Environmental Policy Act scoping process in February 1995. Five scoping meetings on bycatch in the shrimp fishery were held between February 7 and June 19, 1995 (Section 9.0).

John Watson, Chief of the Branch of Harvesting Systems with NMFS Southeast Fisheries Science Center, presented an updated compilation of bycatch reduction research as completed through 1994, at the Council's April 1995 meeting in Savannah, Georgia. Watson's presentation detailed technological options available to address levels of bycatch identified. BRDs which had passed the operational testing phase and were tested under the industry evaluation phase of cooperative bycatch research program included fisheyes and large mesh extended funnels. A report of the three year NMFS Cooperative Research Program Addressing Finfish Bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries (NMFS 1995) was submitted to Congress in April 1995.

The Council, at the June 1995 meeting in Palm Beach Gardens, Florida approved a motion to develop specific bycatch reduction measures for all penaeid shrimp trawl fisheries in the South Atlantic EEZ. On August 1, 1995, the Council convened a joint Shrimp Plan Development Team, Shrimp Advisory Panel, and Shrimp Committee meeting in Charleston, South Carolina. The groups reviewed cooperative bycatch research program results for the South Atlantic region, a draft report on bycatch characterization, the development of state bycatch reduction measures, and measures to be included in a public hearing draft of Amendment 2. The Council, at the August and October 1995 meetings, approved measures for public hearing.

Public hearings were originally scheduled between November 27 and December 5, 1995, but were postponed due to the federal government shutdown.

Seven public hearings were rescheduled and held in January, 1996 (Section 9.0). The Council took final public comment on February 14, 1996, at the Ponce De Leon Conference Resort in St. Augustine, Florida.

One of the Council's mandates is to insure fishing gear does not adversely impact other non-target marine resources. The Council, at the February 1996 meeting in St. Augustine, Florida approved Amendment 2 which proposes bycatch reduction measures for all penaeid shrimp trawl fisheries in the South Atlantic EEZ. The Council is proposing regulations to address the mandate to minimize the impact of the penaeid shrimp fishery on other fishery resources under Council and state jurisdiction focusing on reducing the impact on Spanish mackerel and weakfish resources.

1.4 Proposed Measures

The Council is proposing to add brown and pink shrimp to the management unit; define overfishing for brown and pink shrimp; define optimum yield for brown and pink shrimp as the amount of harvest that can be taken by U.S. fishermen without annual landings falling below two standard deviations below mean landings 1957-1993; require the use of certified Bycatch Reduction Devices (BRDs) in all penaeid shrimp trawls in the EEZ; and establish a framework for BRD certification which specifies BRD certification criteria and testing protocol.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

National Environmental Policy Act (NEPA) regulations indicate that Section 2.0 should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public. The Council's documents must also conform to Magnuson Act and "Other Applicable Law" requirements. National Environmental Policy Act regulations are one of the "other applicable laws" referenced. The Council decided to blend Magnuson Act and "other applicable law" (including NEPA) requirements in one consolidated, non-duplicative, and non-repetitive document. The bulk of the evaluation of alternatives and discussion about the effects on the environment is in Section 4.0 Environmental Consequences. Section 2.0 Alternatives presents a summary of Section 4.0. The Council concluded this meets NEPA regulatory requirements.

Management measures (proposed actions) address the management objectives and issues discussed in Section 1. Each management measure has a number of alternatives that have been considered by the Council. The following table summarizes how the alternatives address the problems and issues identified by the Council. Management alternatives are in the rows and issues and problems are in the columns.

A complete listing of the proposed management actions is shown below:

ACTION 1. Add brown and pink shrimp to the management unit.

ACTION 2. Define overfishing for brown and pink shrimp. The South Atlantic brown shrimp and pink shrimp resources are overfished when annual landings fall below two standard deviations below mean landings 1957-1993 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp]. If annual landings fall below two standard deviations of the 1957-1993 mean landings for two consecutive years the Council shall convene the shrimp stock assessment panel, Shrimp Advisory Panel, and the Shrimp Committee to review the causes of such declines and recommend any appropriate Council action to address the problem.

ACTION 3. Define optimum yield for brown and pink shrimp. Optimum yield for the brown shrimp and pink shrimp fisheries are defined as the amount of harvest that can be taken by U.S. fisherman without annual landings falling below two standard deviations below mean landings 1957-1993 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp].

ACTION 4. Require the use of certified Bycatch Reduction Devices (BRDs) in all penaeid shrimp trawls in the EEZ. Upon implementation of Amendment 2, BRDs that have passed the operational testing phase of the NMFS cooperative bycatch research program (fisheyes and large mesh extended funnel BRDs) are certified for use in the EEZ. Other BRDs will be subsequently certified according to procedures and criteria specified in Action 5. All shrimp nets (any net with mesh less than 2 $^{1}/_{2}$ inches stretched mesh - middle to middle of knot) and all shrimp

nets greater than 16 feet in headrope length which are used as try (test) nets must use a certified BRD.

ACTION 5. Establish a BRD certification process and specify certification criteria for new or modified BRDs.

A) Approve framework for BRD Certification:

Certification of BRDs would be administered by NMFS with the Regional Director making the decision based on direct application to NMFS. BRDs reviewed and recommended by state agencies meeting the criteria and testing protocol specified by the Council may be used throughout the South Atlantic EEZ when certified by NMFS.

B) Certification criteria:

New or modified bycatch reduction devices must be certified or approved by NMFS for use in the South Atlantic penaeid shrimp fishery based on the following criteria:

The BRD must reduce the bycatch component of fishing mortality for Spanish mackerel and weakfish by 50%, or demonstrate a 40% reduction in number of fish.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES
(Effects of Alternatives on the Issues/Problems)

	ISSUES/PROBLEMS
Proposed Actions and Rejected Options	**Management Unit**
Proposed Action 1: Add brown and pink shrimp to the management unit.	Provides regulatory mechanism for management.
Rejected Option 1. No Action.	None.
Proposed Actions 2 & 3: **Define overfishing for brown and pink shrimp.** **Define optimum yield for brown and pink shrimp.**	Meets the requirements of MFCMA.
Rejected Option 1. No Action.	None.
	Bycatch
Proposed Action 4: **Require the use of certified Bycatch Reduction Devices (BRDs) in all penaeid shrimp trawls in the EEZ.**	Reduces impact of penaeid shrimp fishery on non-target species including finfish and invertebrates. Reduces bycatch component of fishing mortality for weakfish and Spanish mackerel. Coordinates development of measures reducing bycatch to enhance enforceability of both state and federal regulations with South Atlantic states. This action will also reduce the impact of the penaeid shrimp fishery on the marine ecosystem.
Rejected Option 1. **BRDs use by season and/or area.**	Not quantifiable and compromises enforceability and subsequently the conservation goals of proposed state and federal bycatch regulations.
Rejected Option 2. **Season/area closures.**	Not quantifiable and compromises enforceability and subsequently the conservation goals of proposed state and federal bycatch regulations.
Rejected Option 3. No Action.	Continued impact on non-target bycatch species.
	Bycatch
Proposed Action 5: **Establish a BRD certification process and specify certification criteria for new or modified BRDs.**	Establishment of a certification process and specifying certification criteria will insure BRDs reduce weakfish and Spanish mackerel bycatch as well as total bycatch. Will provide industry with ability to develop more efficient BRD's.
Rejected Option 1.	Continued impact on non-target bycatch species.

3.0 AFFECTED ENVIRONMENT

The affected environment including a description of the shrimp fisheries in the South Atlantic Region are presented in detail in the original FMP (SAFMC 1993) and the profile of the shrimp fishery in the South Atlantic (SAFMC 1981). A description of Council concerns and recommendations on protecting shrimp habitat are also included in the original FMP. The following excerpts (Sections 3.1 - 3.2) from the original FMP (SAFMC 1993) are included for reference on detailed biology and ecological relationships of the shrimp species harvested by the fishery proposed for management.

3.1 Description of the Species and their Distribution

3.1.1 Identity

Penaeid shrimp are distributed worldwide in tropical and temperate waters. In the southeastern United States, the shrimp industry is based almost entirely on three shallow-water species of the family Penaeidae: the white shrimp, *Penaeus setiferus*, the brown shrimp, *Penaeus aztecus*, and the pink shrimp, *Penaeus duorarum*. The rock shrimp, *Sicyonia brevirostris* (family Sicyoniidae), and the royal red shrimp, *Pleoticus robustus* (family Solenoceridae) occur in deeper water than the three species of *Penaeus* and are of lesser importance to the fishery. Other common names for the white shrimp include gray shrimp, lake shrimp, green shrimp, green-tailed shrimp, blue tailed shrimp, rainbow shrimp, Daytona shrimp, common shrimp, and southern shrimp. The brown shrimp is also known as brownie, green lake shrimp, red shrimp, redtail shrimp, golden shrimp, native shrimp, and also the summer shrimp in North Carolina. Other names for the pink shrimp include spotted shrimp, hopper, pink spotted shrimp, brown spotted shrimp, grooved shrimp, green shrimp, pink night shrimp, red shrimp, skipper, and pushed shrimp.

3.1.2 Morphology

All penaeid shrimp are similar in appearance. They are typically shrimp-like in appearance with a well developed and toothed rostrum which extends to, or beyond the distal edge of the eyes. There are ten periopods (walking legs) that are slender and relatively long. Five pairs of pleopods (swimming legs) are located on the ventral surface of the abdomen.

The three species can be divided into non-grooved (white shrimp) and grooved shrimp (brown and pink). The grooves occur on the dorsal surface of the carapace on either side of the postrostral carina and on the sixth tail segment. White shrimp can also be distinguished from the other species by its much longer antenna (2.5 to 3 times longer than body length), light gray body color, green coloration on the tail, and the yellow band on the uropods. Larger grooved shrimp can usually be distinguished by body pigmentation when fresh. Pink shrimp typically have a dark colored spot on each side between the third and fourth abdominal somites. The uropods of pink shrimp usually have a dark blue band while the brown shrimp's coloration on the same band is usually more variable, ranging from purple to reddish purple. Some green and/or red pigmentation is also common on brown shrimp tails.

3.1.3 Distribution

With the exception of pink shrimp, which is also found off Bermuda, the three *Penaeus* species are restricted to the Atlantic Coast of the U.S. and the Gulf of Mexico.

White shrimp range from Fire Island, New York to St. Lucie Inlet on the Atlantic Coast of Florida, and from the Ochlochonee River on the Gulf Coast of Florida to Ciudad, Campeche, Mexico. Along the Atlantic Coast of the U.S., the white shrimp has centers of abundance in South Carolina, Georgia, and northeast Florida. White shrimp are generally concentrated in waters of 27 m (89 ft) or less, although occasionally found much deeper (up to 270 ft).

Brown shrimp occur from Martha's Vineyard, Massachusetts to the Florida Keys and northward into the Gulf to the Sanibel grounds. The species reappears near Apalachicola Bay and occurs around the Gulf Coast to northwestern Yucatan. While it may occur seasonally along the Mid-Atlantic states, breeding populations apparently do not range north of North Carolina. The species may occur in commercial quantities in waters as deep as 110 m (361 ft), but they are most abundant in water less than 55 m (180 ft).

Pink shrimp occur from southern Chesapeake Bay to the Florida Keys, and around the coast of the Gulf of Mexico to Yucatan south of Cabo Catoche. Maximum abundance is reached off southwestern Florida and the southeastern Golfo de Campeche. Along the Atlantic Coast of the U.S., pink shrimp occurs in sufficient abundance to be of major commercial significance only in North Carolina. Pink shrimp are most abundant in waters of 11-37 m (36-121 ft) although in some areas they may be abundant as deep as 65 m (213 ft).

Rock shrimp are found in the Gulf of Mexico, Cuba, the Bahamas, and the Atlantic Coast of the U.S. up to Virginia. In the South Atlantic area, they are most abundant off northeast Florida. They live mainly on sand bottom from a few meters to 183 m (600 ft), occasionally deeper. The largest concentrations are found between 25 and 65 m (82 and 213 ft).

Royal red shrimp are found throughout the Gulf of Mexico and South Atlantic area from Cape Cod to French Guiana. In the South Atlantic they are found in large concentrations primarily off northeast Florida. They inhabit the upper regions of the continental slope from 180 m (590 ft) to about 730 m (2,395 ft), but concentrations are usually found at depths of between 250 m (820 ft) and 475 m (1,558 ft) over blue/black mud, sand, muddy sand, or white calcareous mud.

3.1.4 Biological Characteristics

3.1.4.1 Reproduction

Maturation

All three species of penaeid shrimp are dioecious (separate sexes) and sexually dimorphic in that beyond a total length (TL) of 100 mm (3.9 in), females are larger than males of the same age. White shrimp attain sexual maturity at

about 135-140 mm TL. Brown shrimp also reach sexual maturity at about 140 mm, whereas pink shrimp reach sexual maturity at about 85 mm.

Fecundity

All three species have ovaries that extend from the anterior end of the cephalothorax to the posterior end of the abdomen. Fecundity for all species is 500,000-1,000,000 ova. Eggs are demersal, measuring 0.28 mm, 0.26 mm, and 0.31-0.33 mm in diameter for white, brown, and pink shrimp respectively.

Mating

In white shrimp, copulation is believed to take place between hard shelled individuals. During copulation the male anchors the spermatophore to the female's thelycum by the petasma and other structures and a glutinous material. Brown and pink shrimp apparently have copulation between hard-shelled males and soft-shelled females. Fertilization is believed to take place as ova and spermatozoa are simultaneously expulsed from the female.

Spawning

In Georgia and northern Florida, some white shrimp spawning may occur inshore, although most spawning occurs more than 1.2 miles from the coastline. Off Florida, spawning occasionally takes place inshore, at or near inlets, but most occurs offshore in depths of 6.1-24.4 m (20-80 ft). In South Carolina most spawning occurs within about four miles of the coast. Some shrimp with spermatophores attached have been found inside Charleston harbor (Whitaker, SCWMRD, pers. comm. 1991).

Spawning is correlated with bottom water temperatures and has been reported to occur at bottom temperatures of between 17° and 29° C although spawning generally occurs between 22° and 29° C. White shrimp begin spawning in April in Florida and Georgia and late April or May in South Carolina. Spawning may continue into September or October.

Brown shrimp spawn in relatively deep water. In the Gulf of Mexico, it was concluded that brown shrimp did not spawn in water less than 13.7 m (45 ft) and the greatest percentage of ripe females were at 45.7 m (150 ft). Spawning season for brown shrimp is uncertain, although there is an influx of postlarvae into the estuaries during February and March. Mature males and females have been found off South Carolina during October and November.

Pink shrimp apparently spawn between 3.7 and 15.8 m (12 and 52 ft). Off eastern Florida, peak spawning activity seems to occur during summer. In North Carolina, roe-bearing females are found as early as May, and by June, most pink shrimp are sexually mature.

3.1.4.2 Larval and Postlarval Phases

All three species have eleven larval stages (5 nauplier, 3 protozoan, and 3 mysid) before developing into postlarvae. Duration of the larval period is dependent on temperature, food, and habitat. Records suggest larval periods of 10-12 days for white shrimp, 11-17 days for brown shrimp, and 15-25 days for

pink shrimp. Brown shrimp postlarvae appear to overwinter in offshore bottom sediments (Whitaker, SCWMRD, pers. comm. 1991)

Postlarval size ranges from approximately 2.9 to 12 mm (0.1-0.5 in) TL, with pink and white shrimp sizes overlapping and brown shrimp usually larger.

Movement of Postlarvae

The mechanism by which postlarvae are brought from distant spawning areas to inside estuaries is not well-known. Shoreward countercurrents north of Cape Canaveral have been suggested as the mechanism for transport of pink shrimp larvae from spawning areas to nursery areas along the northeast Florida coast. Movement of white shrimp postlarvae into the estuary is a result of nearshore tidal currents as white shrimp spawn relatively close to shore. There is some data on brown shrimp that suggest postlarvae may overwinter in offshore waters and migrate into estuaries the following spring. White and pink shrimp move into the estuary during late spring and early summer.

3.1.4.3 Juvenile and Adult Phases

After entering the estuaries, postlarval shrimp occupy nursery areas which offer abundant food, suitable substrate, and shelter from predators. In the South Atlantic these areas are generally dominated by the marsh grass *Spartina alterniflora*.

White and pink shrimp enter the estuaries at about the same time, usually beginning in April and early May in the southern part of their range and in June and July in North Carolina sounds, where white shrimp are uncommon. Large white shrimp begin emigrating out of the estuary to the commercial fishing areas in August and continue through December. Smaller white and pink shrimp may remain in the estuary during winter and are termed overwintering stocks.

In the South Atlantic, juvenile and adult brown shrimp are rarely affected by severe winter weather because most have been captured by fishermen or predators, and others have moved offshore prior to the onset of cold weather.

Pink shrimp bury deeply in the substrate with the onset of cold weather and thus are protected to some extent from winter mortalities. However, pink shrimp can be adversely affected by low temperatures as evidenced by the mass mortalities in North Carolina during the winters of 1976-77 and 1977-78.

Pink and white shrimp that survive the winter grow rapidly in late winter and early spring before migrating to the ocean. The migrating white shrimp, called roe shrimp, make up the spring fishery and also produce the summer and fall crops of shrimp. When a majority of white shrimp do not survive the winter, the North Carolina and South Carolina fisheries are believed to be dependent on a northward spring migration of white shrimp from more southerly areas to form the spawning stock. However, tagging data are inconclusive on the extent of this northward movement.

3.1.4.4 Growth Patterns

Rates of growth in penaeid shrimp are highly variable and depend on factors such as season, water temperature, shrimp density, salinity, size, and sex. Adolescent shrimp grow rapidly with estimates ranging from 1.0-2.3 mm per day

for white shrimp, 0.5-2.5 mm per day for brown shrimp, and 0.25-1.7 mm per day for pink shrimp. Larger white shrimp may grow more than an inch per month.

Salinity is also a factor determining growth rate in white shrimp. High salinities appear to inhibit growth. Density also affects growth of white shrimp. During years of low densities, the average size is generally larger.

Temperature also affects brown shrimp growth rates, with rates as high as 3.3 mm per day recorded when temperature exceeded 25° C but less than 1.0 mm per day when water temperature was below 20° C. Salinity also affects growth rates in brown shrimp. Salinities in excess of 10 ppt seems to enhance growth rate.

Pink shrimp in Florida Bay were found to grow 3.5 mm CL (carapace length) in winter and only 1.9 mm CL in spring. In North Carolina, maximum pink shrimp growth rates were recorded in summer.

3.1.4.5 Population Size, Distribution, and Movement Patterns

Shrimp of the genus *Penaeus* are an annual crop and as such have an ever changing size distribution. Once shrimp leave the nursery they migrate seaward with increasing size. They are almost always greater than 100 mm (3.9 in) when they emigrate, and continue to grow until they die.

After entering the estuary as postlarvae, growth is rapid. Prior to the onset of maturation, shrimp begin moving from the inshore habitat to higher salinity offshore waters.

White shrimp begin moving seaward through the summer and fall with a gradient of increasing size from fresh water to water of higher salinity. They begin entering the commercial catch in high salinity water at about 90 mm (3.5 in). In North Carolina, white shrimp begin entering the commercial fishery in July and continue to be caught through December. In Florida, white shrimp leave inshore waters at about 120 mm (4.7 in). Movement to offshore waters may be caused by cold, storms, high tides, and/or large influxes of fresh water, but size is the principal determinant. Peaks in movement offshore appear to be related to drops in water temperature.

Brown shrimp first enter the commercial fishery in North Carolina in June at about 100 mm. Movement of brown shrimp appears to take place primarily at night with peak movement at, or shortly after dusk.

Pink shrimp leave Florida estuaries two to six months after having arrived as postlarvae. In North Carolina, young pink shrimp enter the commercial catch in August. Shrimp that overwinter in estuaries migrate to sea in May and June, at which time spawning takes place. Recruitment to the area offshore of Cape Canaveral begins in April and May and again during October and November.

3.2 Ecological Relationships

3.2.1 Food

Juvenile and adult penaeids are omnivorous (eating both plants and animals) bottom feeders with most feeding activity occurring at night although daytime feeding may occur in turbid waters. Food items may consist of polychaetes, amphipods, nematodes, caridean shrimps, mysids, copepods,

isopods, amphipods, ostracods, mollusks, foraminiferans, chironomid larvae, and various types of organic debris.

3.2.2 Substrate

White shrimp appear to prefer muddy or peaty bottoms rich in organic matter and decaying vegetation when in inshore waters. Offshore they are most abundant on soft muddy bottoms. Brown shrimp appear to prefer a similar bottom type and as adults may also be found in areas where the bottom consists of mud, sand, and shell. Pink shrimp are found most commonly on hard sand and calcareous shell bottom. Both brown and pink shrimp generally bury in the substrate during daylight, being active at night. White shrimp do not bury with the regularity of pink or brown shrimp.

3.2.3 Predation

Shrimp are preyed on by a wide variety of species at virtually all stages in their life history. Predation on postlarvae has been observed by sheepshead minnows, water boatmen, and insect larvae. Grass shrimp, killifishes, and blue crabs prey on young penaeid shrimp, and a wide variety of finfish are known to prey heavily on juvenile and adult penaeid shrimp.

3.3 Abundance and Present Condition

3.3.1 Abundance

All three species of penaeid shrimp are essentially annual crops. Population size is regulated by environmental conditions, and while fishing certainly reduces the population size over the course of the season, fishing is not believed to have any impact on subsequent year class strength unless the spawning stock has been reduced below a minimum threshold level by environmental conditions. Estimates of population size are not available but since the fishery is considered to be fished at near maximum levels, annual landings are probably a good indication of relative abundance. Annual variations in catch are presumed to be due to a combination of prevailing environmental conditions and fishing effort. Annual landings of the three penaeid species vary considerably from year to year. The contribution of each species to total landings varies in a relatively consistent pattern among the four southeastern states. In North Carolina, brown shrimp is the principal species while white shrimp are a minor component of the overall catch. In some years, pink shrimp are an important component of the catch. In South Carolina and Georgia, there are virtually no pink shrimp in the landings which are dominated by white shrimp. The relative contribution of brown shrimp to the catch varies yearly, but rarely exceeds the catch of white shrimp. In northeast Florida, some pink shrimp enter the catch, primarily as a bycatch of the rock shrimp fishery, but as in Georgia and South Carolina, white shrimp predominate.

3.3.2 Present Condition

When looking at the penaeid shrimp fishery by state, the general patterns identified in the original management plan continue to hold. Detailed shrimp production by species, state, month, and year is shown in Appendix D. Pink shrimp mean catch for 1957-93 was 1.71 million lb (Figure 1). Brown shrimp

landings averaged 8.35 million pounds (Figure 2) and white shrimp landings averaged 12.68 million pounds for the same period (Figure 3).

Years following freeze years generally show reduced landings for white shrimp. However, environmental conditions have been favorable and preliminary 1995 state landing reports indicate the fall white shrimp harvest may be one of the highest on record.

3.4 Maximum Sustainable Yield

Because the three principal species of penaeid shrimp dealt with by this amendment are annual crops that fluctuate considerably from year to year depending primarily on environmental factors, maximum sustainable yield (MSY) is not a particularly useful concept. Although there is a good historical time series of catch data, the associated effort data are not considered adequate to calculate MSY. Nevertheless, mean total landings are considered to be a reasonable proxy for MSY. The harvest of shrimp in the region has fluctuated around a relatively flat plateau over a long time period during which time the fleet size and fishing power has increased tremendously. Thus, it appears that additional effort will not result in increased catch suggesting that the resource has been fully exploited for many years.

For management purposes, MSY is considered to be the mean total landings for the southeast region. In calculating total landings, an additional ten percent (an estimate made by state shrimp biologists) has been added to the commercial catch to account for recreational landings that are unreported. Since implementation of a shrimp baiting permit for recreational harvesting of white shrimp in South Carolina, recreational catch of white shrimp for this state can be accounted for, and it was unnecessary to add the ten percent. Using this methodology, MSY is estimated to be 14.5 million pounds for white shrimp, 9.2 million pounds for brown shrimp, and 1.8 million pounds for pink shrimp.

3.5 Probable Future Condition

Shrimp stocks in the South Atlantic at present are near normal levels. Annual variations in white and pink shrimp stocks caused by severe winter weather continue to occur. Future white and pink shrimp production will continue to fluctuate with climatic conditions.

Brown shrimp stocks appear to be stable despite considerable inter-annual variation in abundance. Nevertheless, there is no reason to anticipate any major change in abundance. Annual production appears to be most influenced by late winter and early spring environmental conditions as has been observed in the Gulf of Mexico.

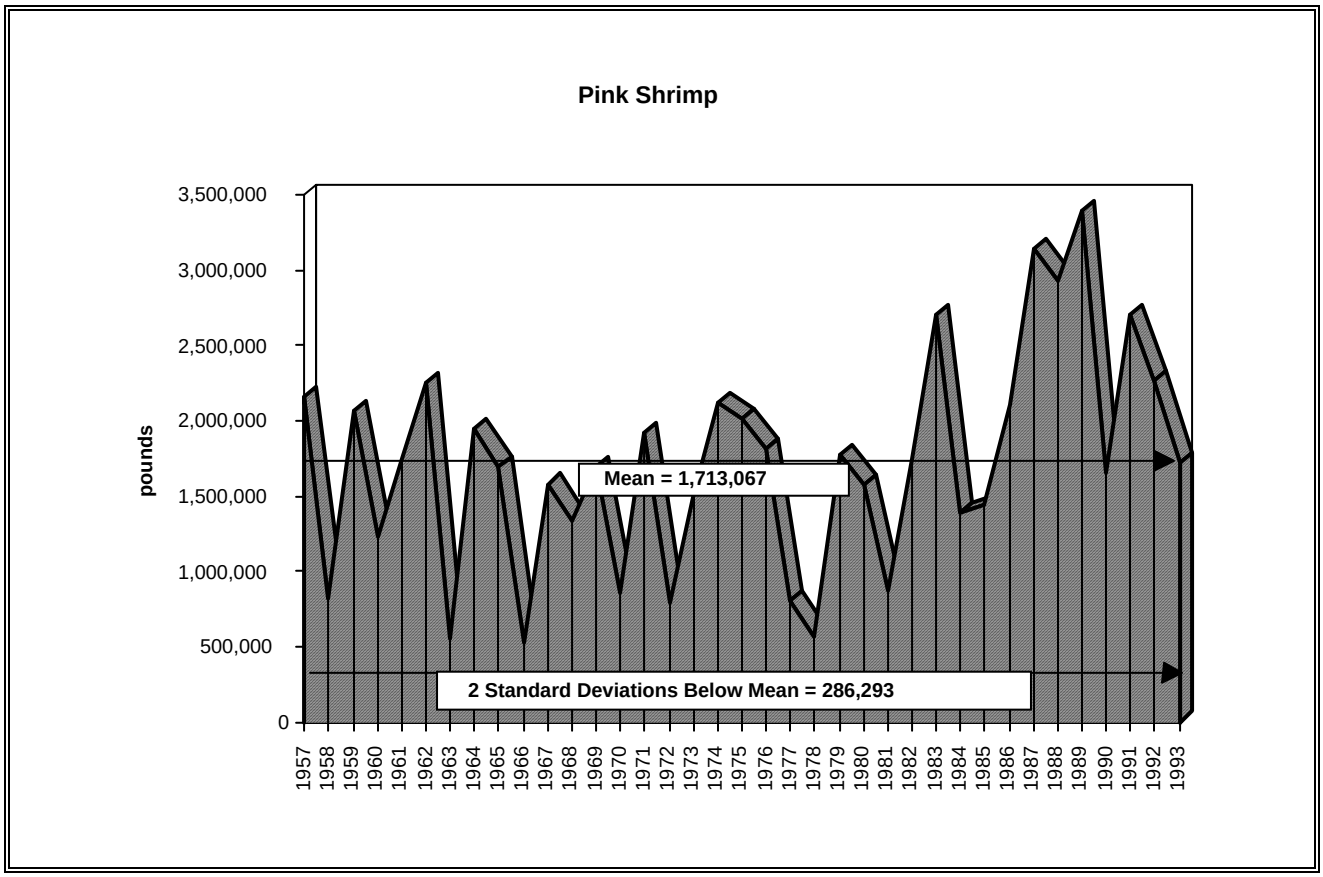


Figure 1. Commercial landings of pink shrimp (heads on) harvested in the South Atlantic region 1957-1993 (Data Source: NMFS & SA states 1995).

Because of high fecundity and migratory behavior, the three species are all capable of rebounding from a very low population size in one year to a large population size in the next, provided environmental conditions are favorable. Landings over the last thirty or forty years have remained stable while fishing pressure has increased dramatically. Fluctuations in abundance resulting from changes in environmental conditions will continue to occur. Perhaps the most serious potential threat to the stocks is loss of habitat due to pollution or physical alteration. Especially vulnerable and critical to shrimp production is the salt marsh (for white and brown shrimp) and inshore seagrass habitat (especially for pink shrimp) which comprise the nursery areas for juvenile shrimp.

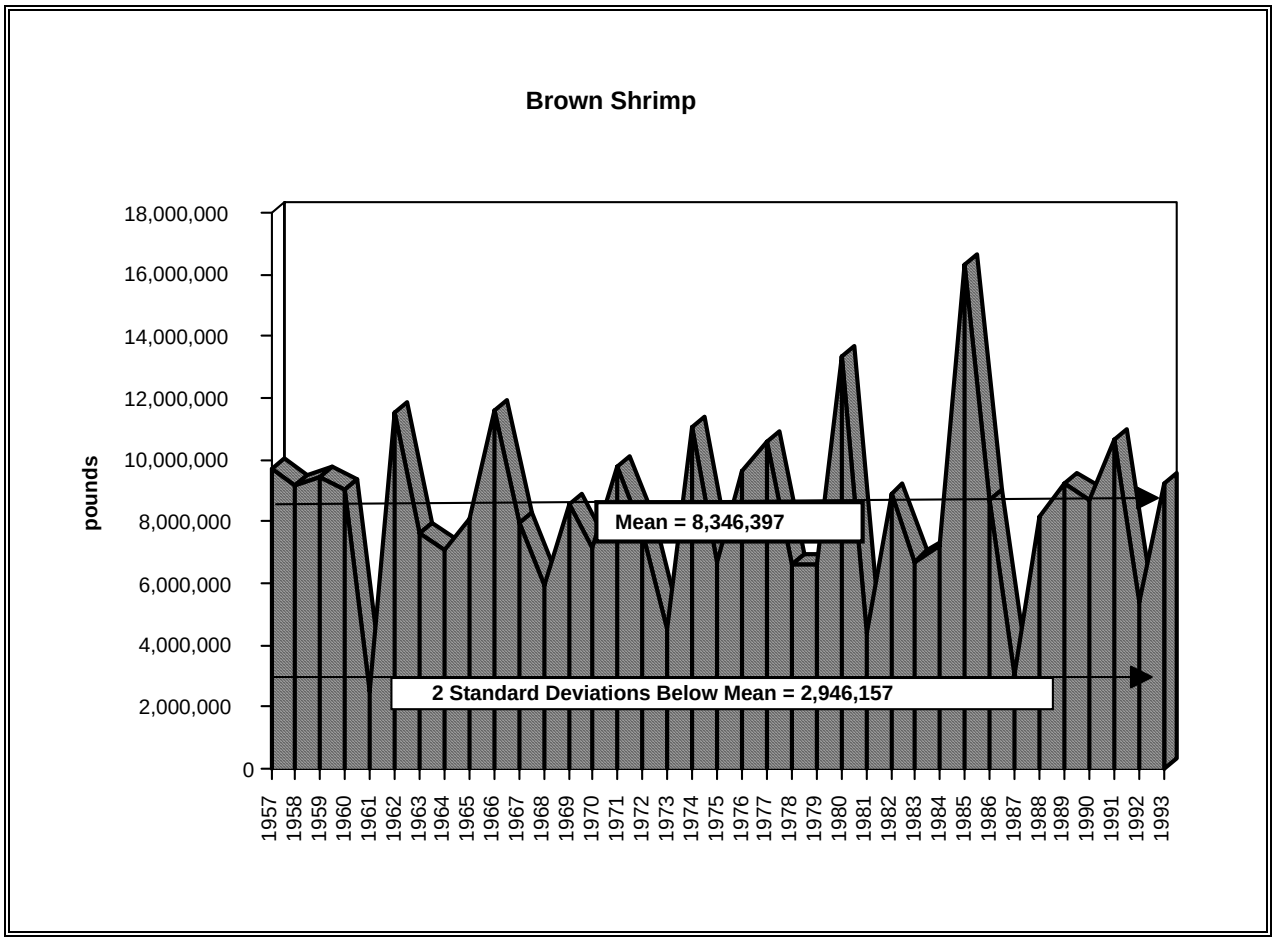


Figure 2. Commercial landings of brown shrimp (heads on) harvested in the South Atlantic region 1957-1993 (Data Source: NMFS & SA states 1995).

During years when inshore overwintering white shrimp stocks are greatly reduced because of severe winter weather, management action may accelerate recovery of the stocks and increase fall production. Under these circumstances, closure of federal waters off the South Atlantic would protect the few remaining spawners that survive a freeze. Also, elimination of winter and spring fishing mortality off southern Georgia and Florida may enable a greater quantity of potential spawners to move north, possibly resulting in larger regional white shrimp stocks the following fall. An offshore or deep estuarine water reserve of overwintering white shrimp may also contribute significantly to the spawning stock. In either case, while fishing does not by itself appear to be a factor in determining subsequent year class strength, in years when the overwintering adult population is significantly reduced due to severe winter weather, the additional mortality caused by fishing can result in a further reduction in subsequent fall production.

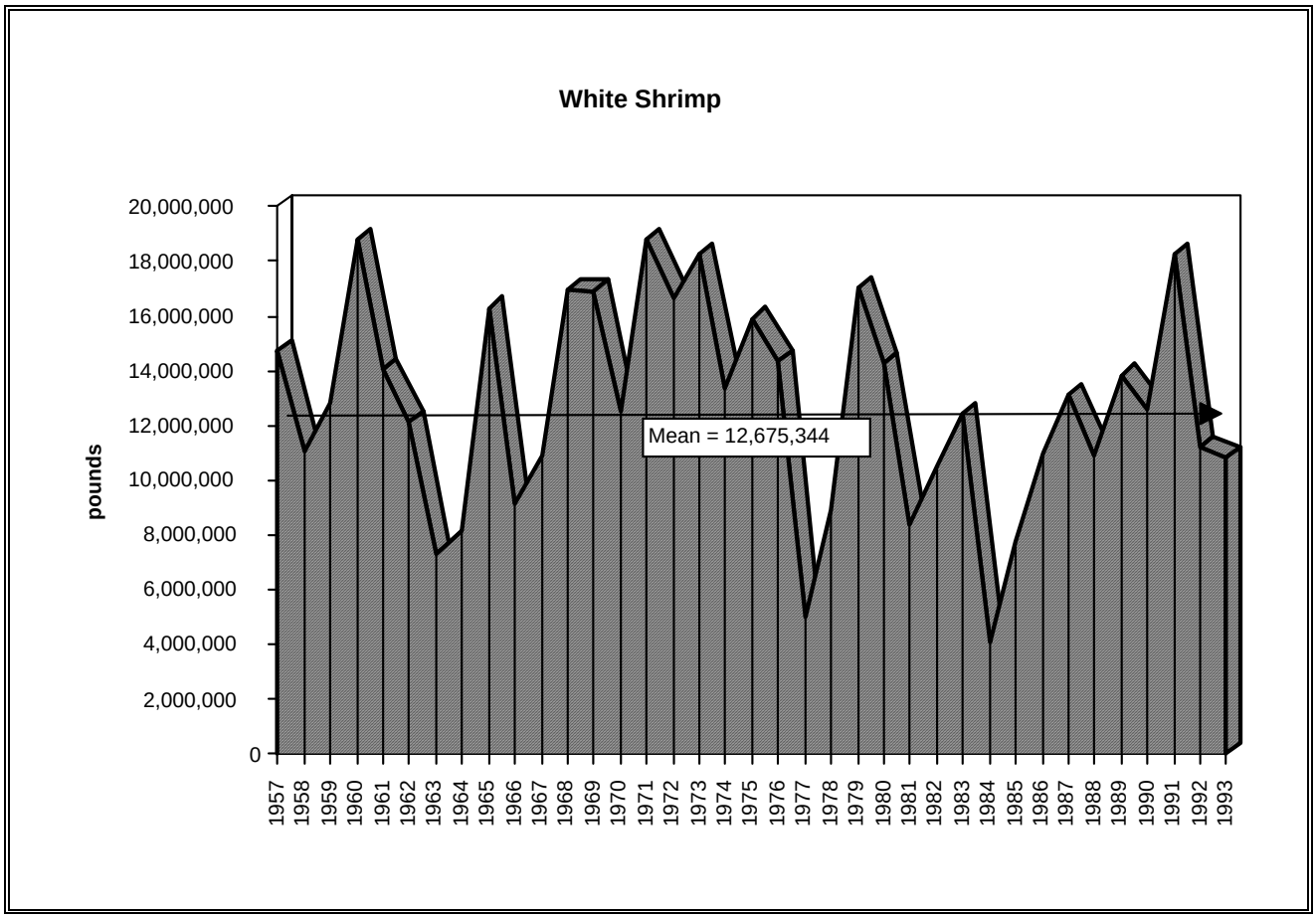


Figure 3. Commercial landings of white shrimp (heads on) harvested in the South Atlantic region 1957-1993 (Data Source: NMFS & SA states 1995).

3.6 Description of Fishing Activities

3.6.1 Commercial Fishery, Fishing Gear, and Operation

The South Atlantic commercial shrimp fishery harvests approximately 30 million pounds of penaeid shrimp annually (Figure 4). Over 95% of all shrimp landed in North Carolina are captured by trawls. The brown shrimp fishery is the most important fishery with on the average landings constituting 67% of total shrimp landings. The harvest of pink shrimp averages 25% of the annual harvest with white shrimp constituting only 8%. Vessels operate night and day in Pamlico Sound and at night in Core Sound and in the ocean off the central coast.

The summer to winter white shrimp fishery is the most important shrimp fishery for South Carolina vessels. The fishery often occurs in federal waters as also is the case with vessels fishing off Georgia and northeast Florida. Trawling occurs in the daylight hours in response to activity of the primary target species, white shrimp. In areas where white shrimp are the main target, trawls used in the fishery have been modified to increase the efficiency in the capture of white shrimp. The tongue trawl or high-rise trawl, was designed to fish higher in the water column making it more effective in catching white shrimp since they are more active than brown and pink shrimp. The Florida shrimp fishery occurring mainly in the northeast Atlantic coast, is characterized with brown shrimp dominating the summer fishery and white shrimp dominating the fall and winter

fisheries. Additional detailed state shrimp landing and fishery information is contained in Appendix B.

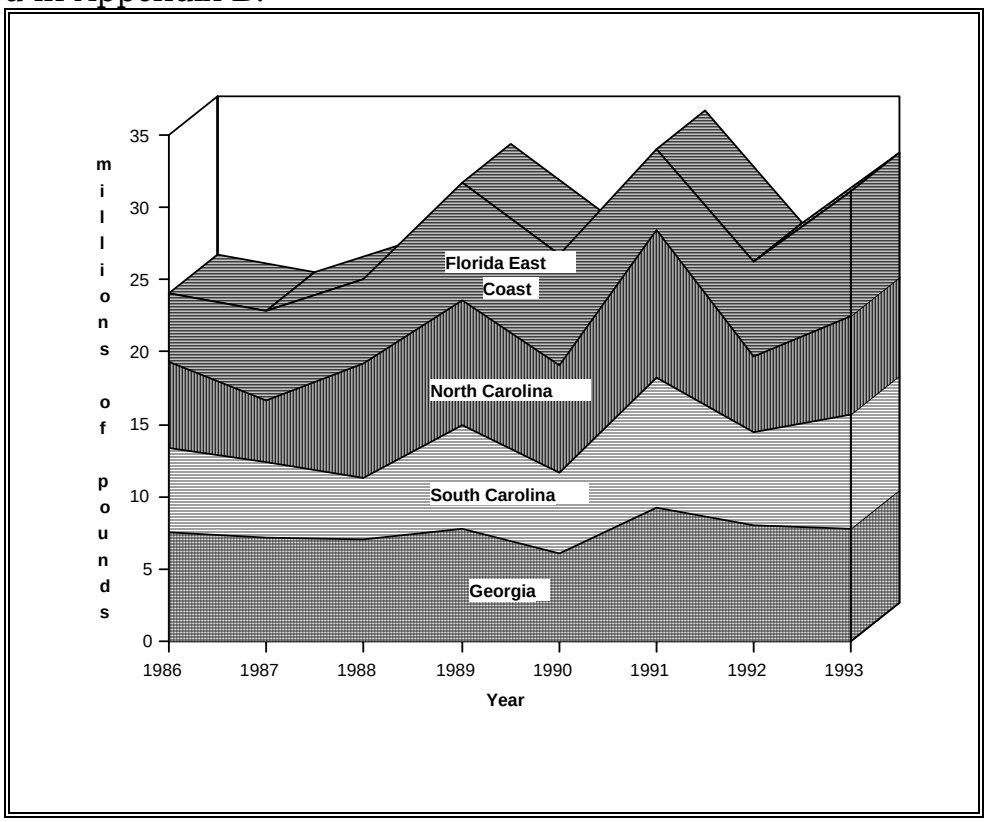
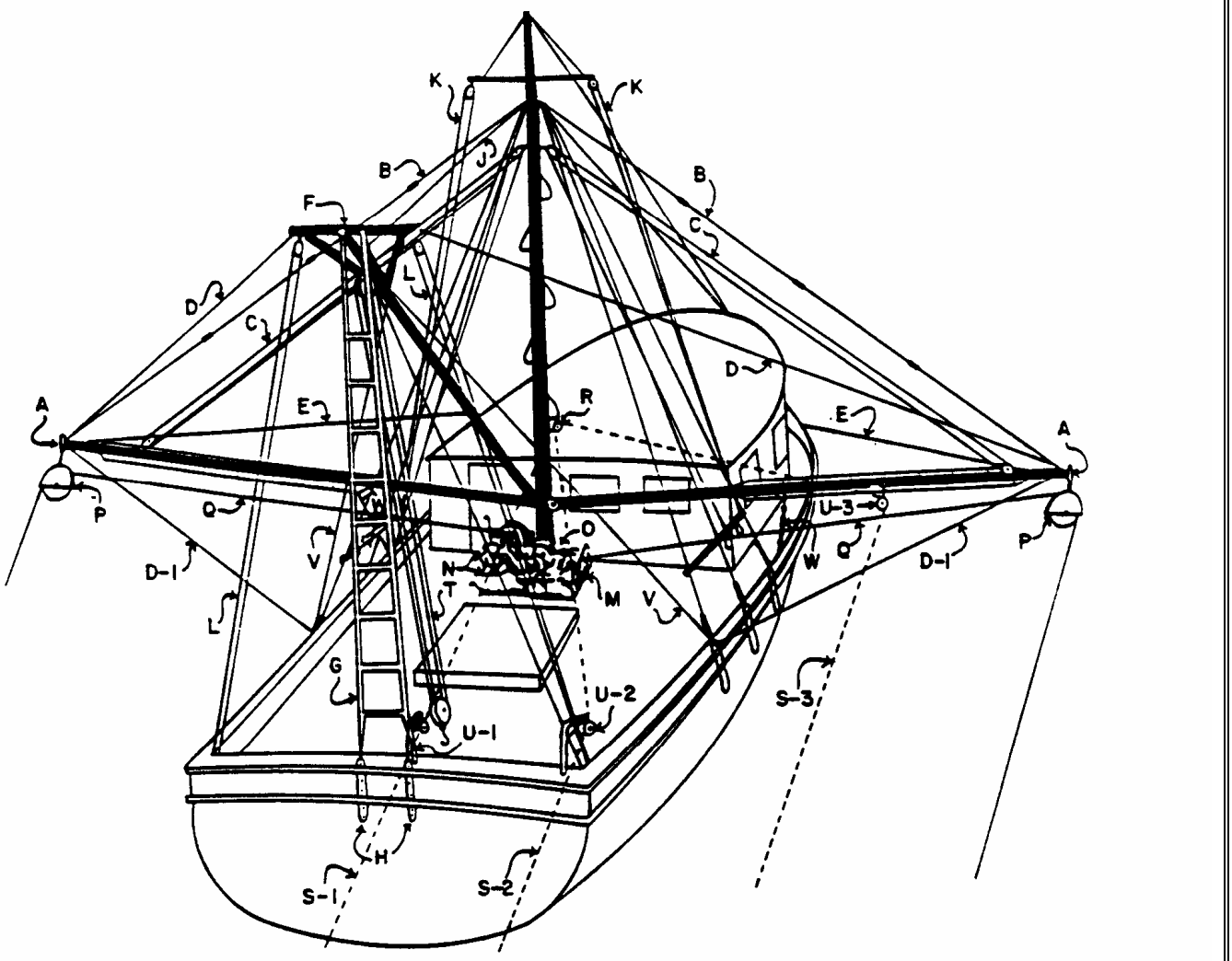


Figure 4. Commercial landings of all penaeid shrimp (heads on) harvested in the South Atlantic region 1986-1993 (Data Source: NMFS 1995).

The shrimp trawler (Figure 5) is used in the commercial shrimp fishery prosecuted in the EEZ. The shrimp trawl (Figure 6) consists of: (1) a cone-shaped bag in which the shrimp are gathered into the tail or cod end; (2) wings on each side of the net for herding shrimp into the bag; (3) trawl doors at the extreme end of each wing for holding the wings apart and holding the mouth of the net open; and (4) two lines attached to the trawl doors and fastened to the vessel. A ground line extends from door to door on the bottom of the wings and mouth of the net while a float line is similarly extended at the top of the wings and mouth of the net. A flat net is more often used when fishing for brown shrimp since they burrow into the bottom to escape the trawl. This net has a wider horizontal spread than other designs and is believed more effective for this species.



A- Towing boom or outrigger; B- towing boom topping stay; C- topping lift tackles; D- or D-1-towing boom outrigger back stay; E- towing boom outrigger bow stay; F- modified boom; G- boom back stays- ratline structure; H- boom back stay plate on transom; J- boom topping lift stay; K- single block tackle; L- single block tackle; M- trawl winch; N- heads, two on trawl winch; O- center drum for trynet warp; R- leading block for try net; S-1, S-2, S-3- trynet lead block; T- main fish tackle tail block; U-1, U-2, U-3- trynet lead block; any one may be used to accord with selection of S-1, S-2, or S-3; V- boom shrouds; W- chain stoppers for outriggers.

Figure 5. Rigged shrimp vessel used in the shrimp fishery (Source: SAFMC 1993).

Most newer trawl vessels are rigged for towing two to four nets simultaneously. The double-rigged shrimp trawler has two outrigger booms from

whose ends, through a block, the cable from the winch drum is run to the two nets (Figure 7). Some vessels use twin trawls, which are essentially two trawls on a single set of doors, joined together at the head and foot ropes to a neutral door connected to a third bridle leg. Thus, instead of towing two 70 foot nets the vessel tows four 40 foot nets (Figure 7). This rig has some advantages in ease of handling and increased efficiency. Some vessels in recent years have towed up to four nets on a side (David Whitaker, SCDNR pers. comm. 1995).

The length of tows varies depending on many factors including the concentration of shrimp. Large boats fishing offshore waters make much longer drags lasting several hours.

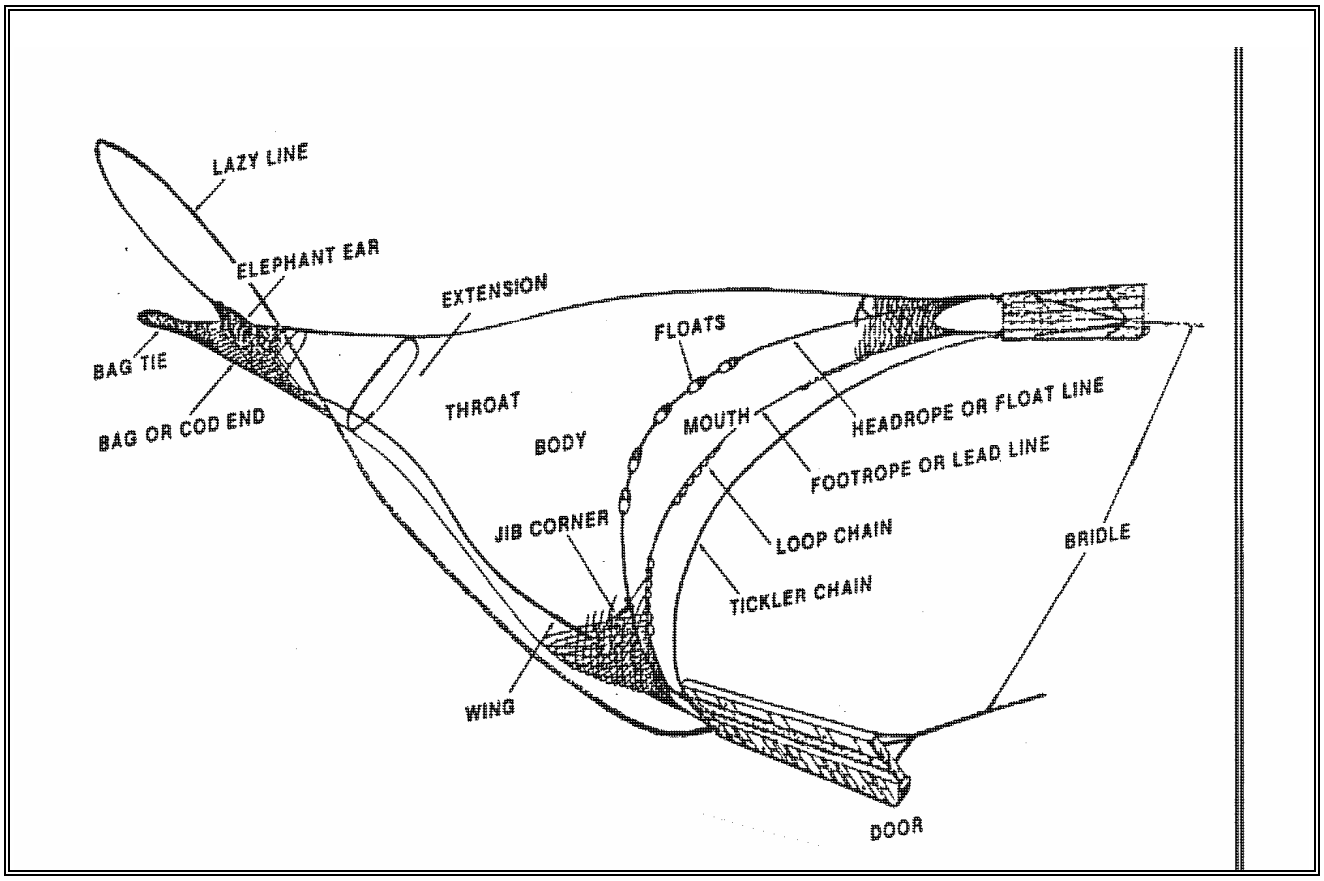


Figure 6. General shrimp trawl configuration (NMFS 1992b).

3.6.2 Shrimp Harvest Areas and Seasons

The summer brown shrimp fishery is principally from June through September in North Carolina. September represents the transition month to the fall pink and white shrimp fisheries (Figure 8). The summer shrimp fishery generally occurs between June through August with June being a transition month dominated by white shrimp landings (Figures 8-9). In Georgia, the food shrimp trawl season extends from June through December (Figure 9). If no winter freeze occurs the season is extended through January or February. The South Carolina shrimp trawl fishery (Figure 10) opens May 15 and closes December 31

through state statute. These dates can be modified if such action is in the best interest of the state.

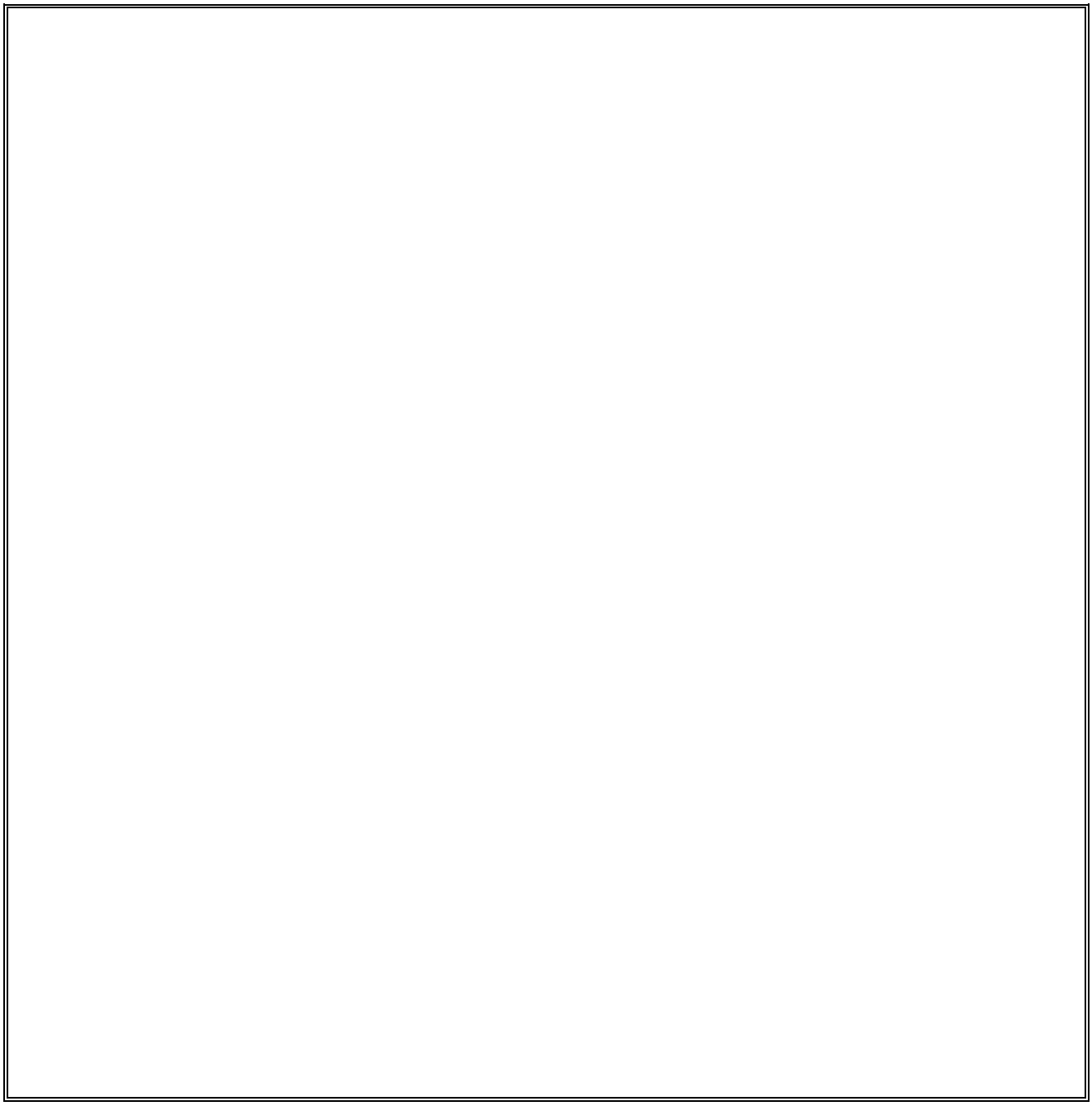


Figure 7. Net configurations typically used in shrimp trawl fisheries: (A) single conical net, (B) double net, and (C) twin net (SEAMAP 1995).

Effort data contained in the NMFS detailed shrimp database measured in total numbers of trips taken by distance from shore is presented in Figures 11-12. Both vessel (a documented craft of five net tons or greater that has its name and official number listed in Merchant Vessels of the United States) trips and boat (any

craft that isn't a vessel) trips were included in the compilation of effort by species information presented in Figures 11-12. On average, the majority of fishing effort for penaeid shrimp occurs in state waters. However, effort by distance from shore information is somewhat misleading with a large portion of trips taken occurring in both state and federal waters. Frequently, the last area fished is what is recorded on the landings report. In addition, many of the trips identified as unknown in Georgia since 1984 (Figures 11a) are trips where fishing occurred in the EEZ. North Carolina effort data (Figure 12a) is probably representative because the great majority of catch occurs in state waters for brown and pink shrimp.

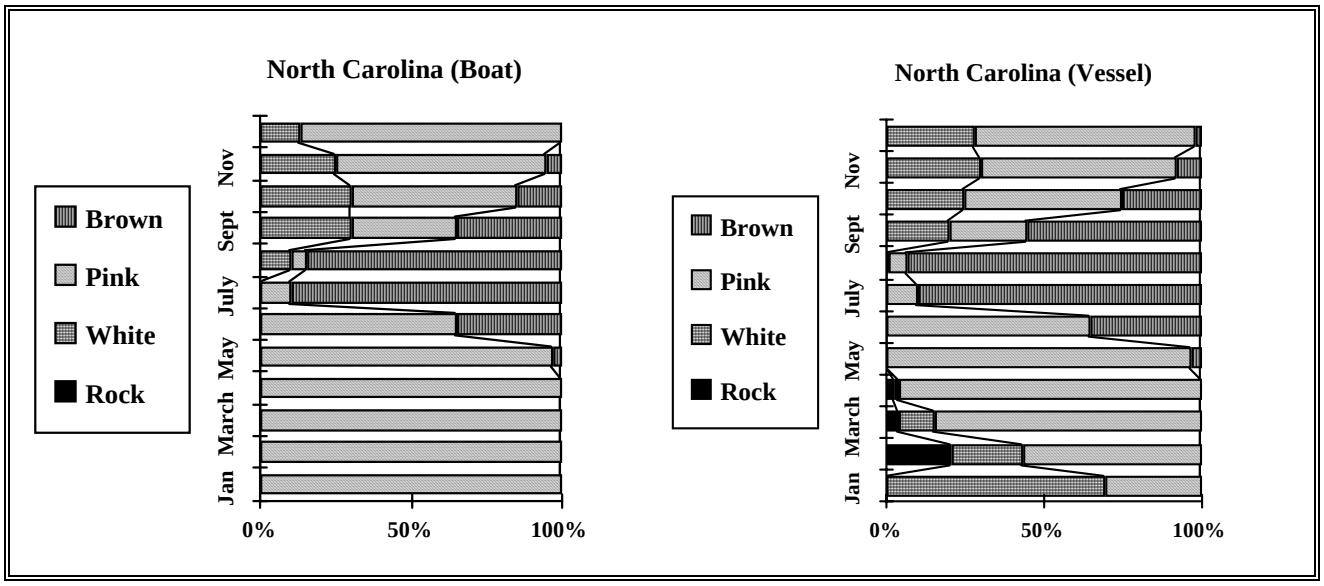


Figure 8. Monthly percent landings by species for North Carolina (Data Source: SEAMAP 1995).

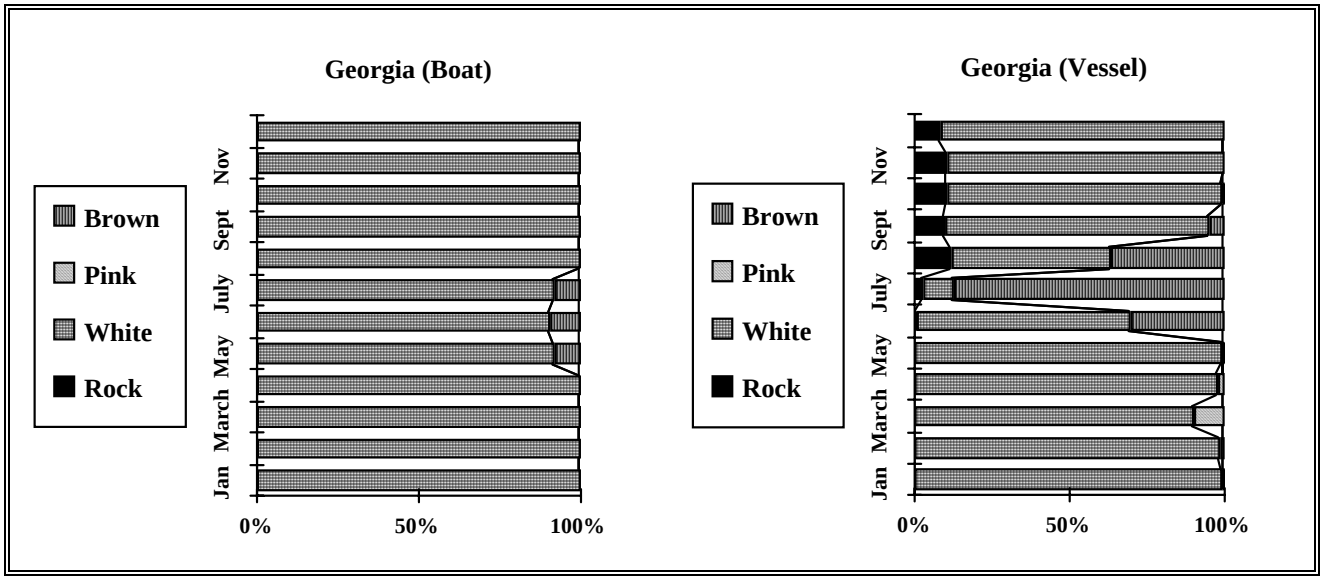


Figure 9. Monthly percent landings by species for Georgia (Data Source: SEAMAP 1995).

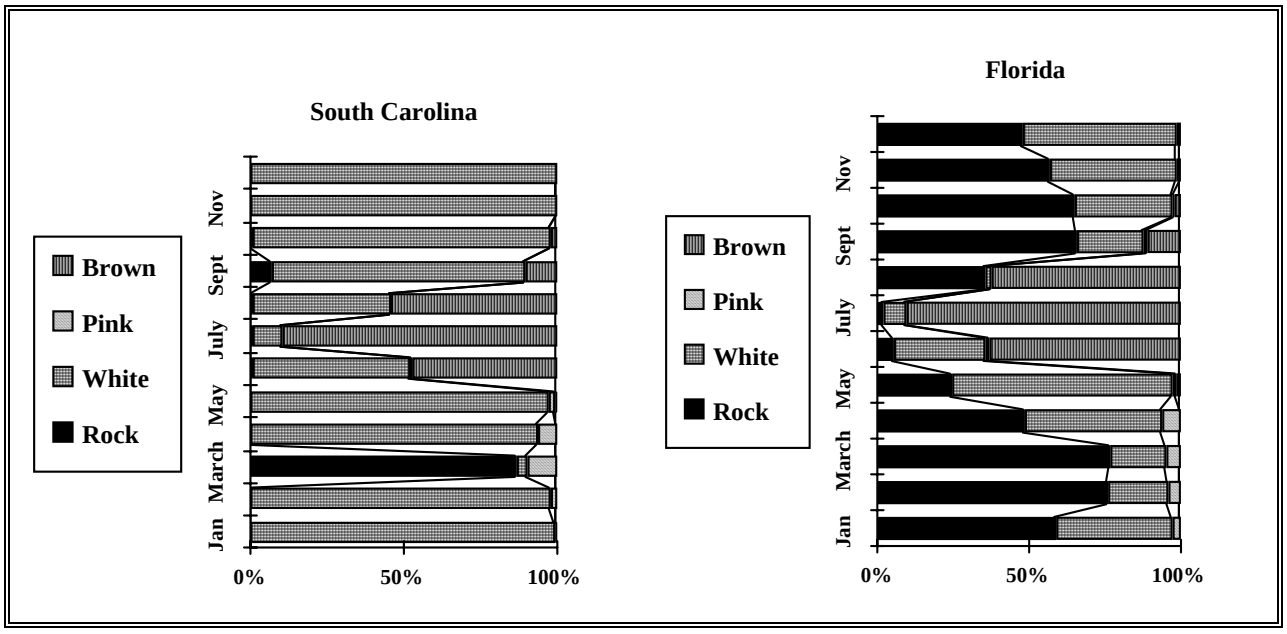


Figure 10. Monthly percent landings by species for South Carolina and Florida east coast(Source: SEAMAP 1995).

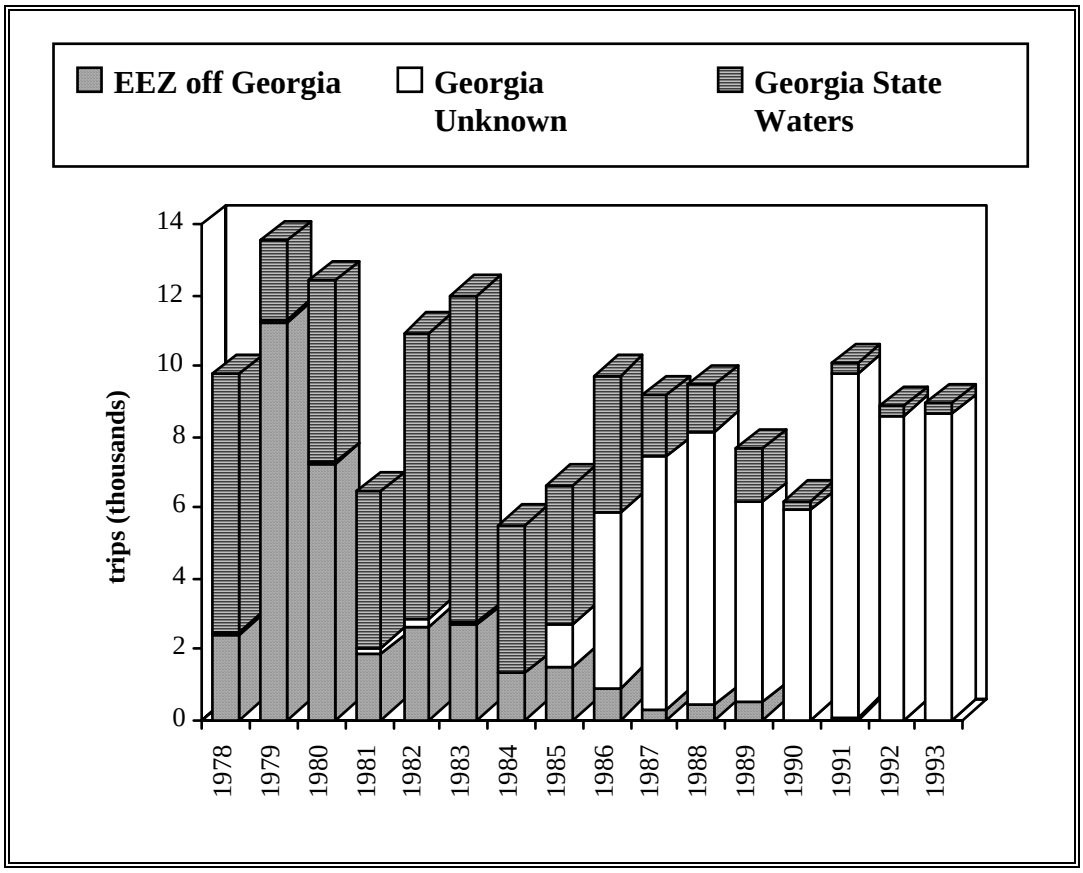


Figure 11a. Annual vessel shrimp trips by distance from shore for Georgia (Source: Data in SEAMAP 1995).

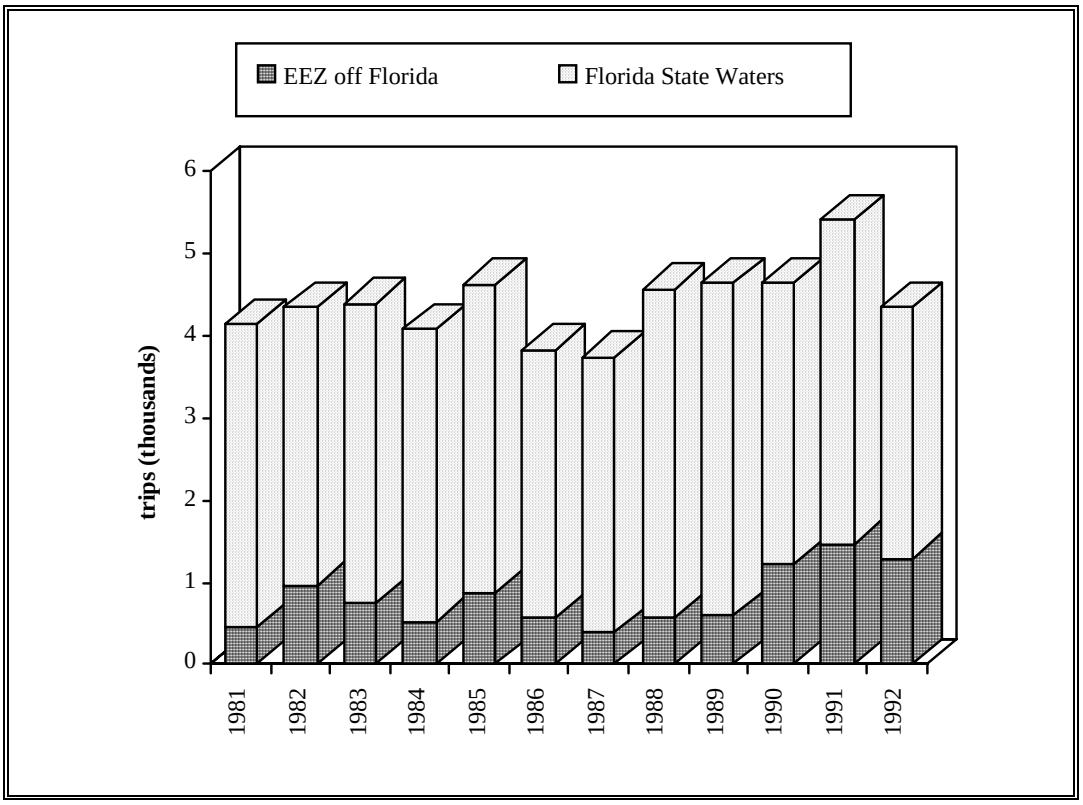


Figure 11b. Annual vessel shrimp trips by distance from shore for Florida east coast (Source: Data in SEAMAP 1995).

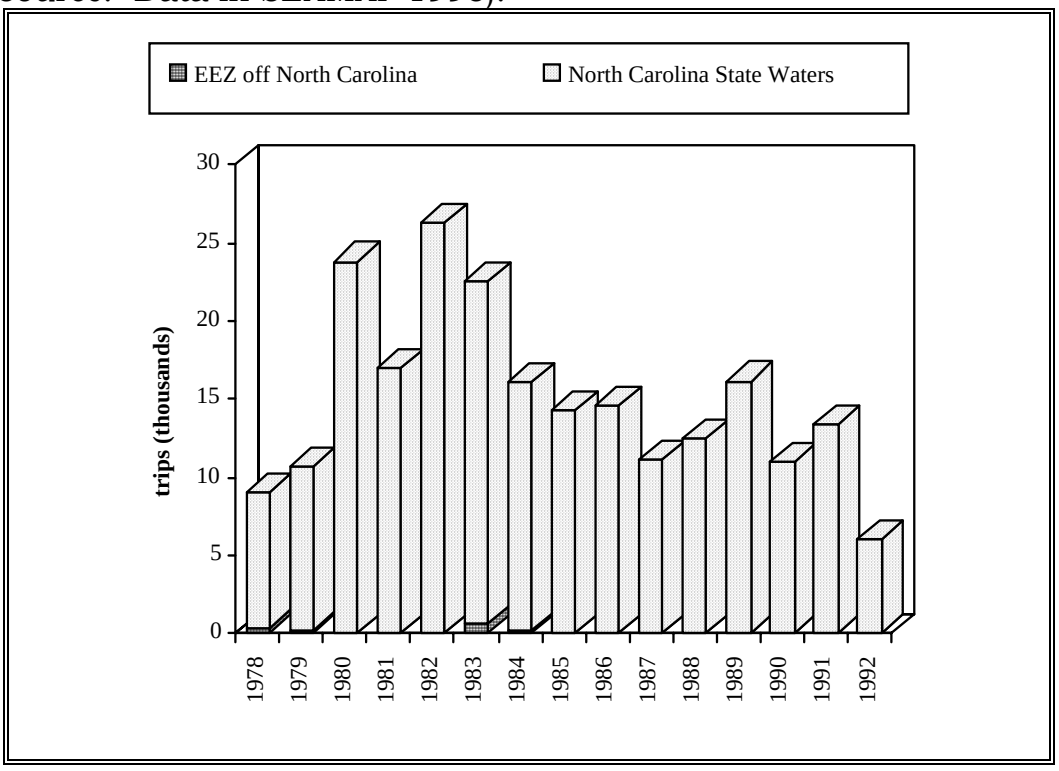


Figure 12a. Annual vessel shrimp trips by distance from shore for North Carolina (Source: Data in SEAMAP 1995).

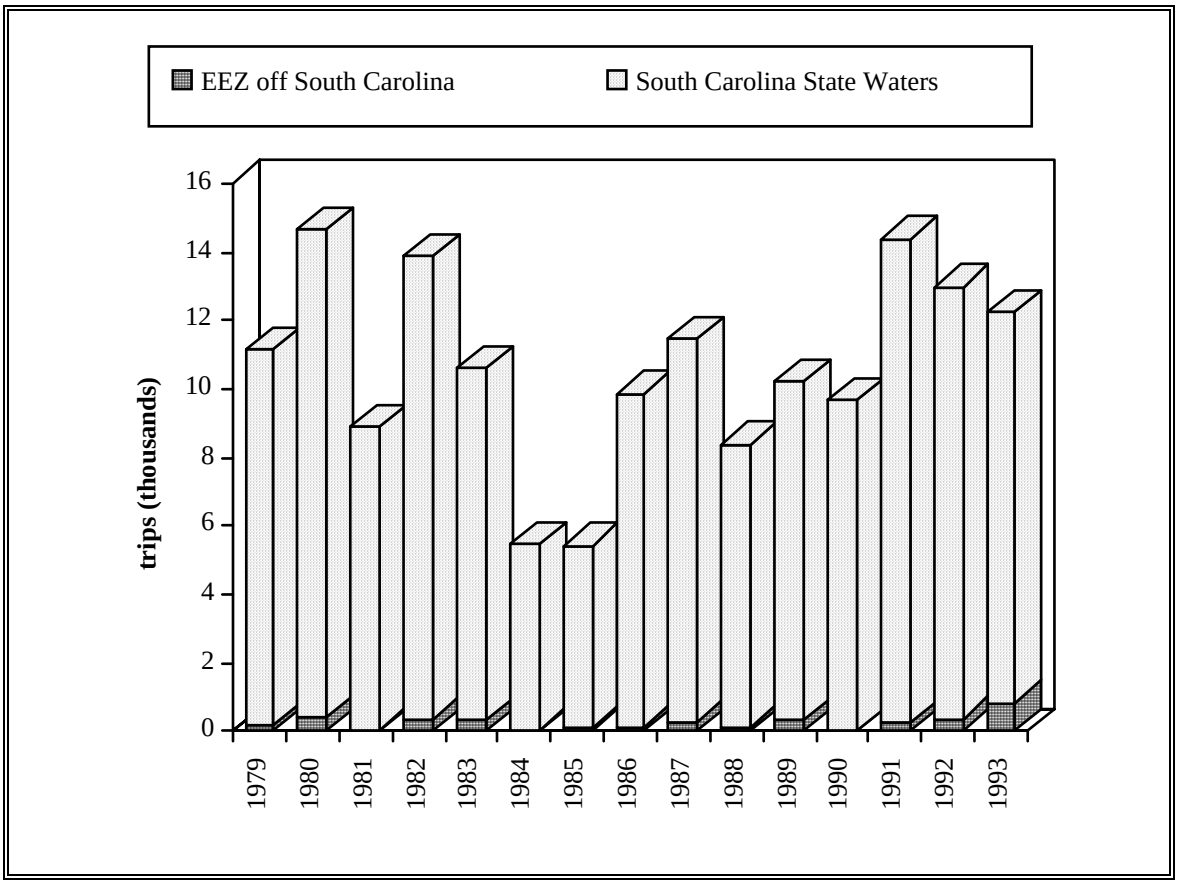


Figure 12b. Annual vessel shrimp trips by distance from shore for South Carolina (Data Source: SEAMAP 1995).

For state regulations affecting penaeid shrimp fisheries, refer to the matrix contained in Appendix C.

3.6.3 Impact of the Shrimp Fishery on other Fishery Resources

3.6.3.1 Turtle Interactions and TEDS

While the proposed regulations for the shrimp fishery contained in this amendment will not have any impact on threatened or endangered species, the southeastern shrimp fishery itself does have a significant interaction with sea turtles, all species of which are listed as either threatened or endangered under the ESA of 1973, 16 U.S.C., 1531 et seq. (Appendix F, Amendment 1, SAFMC 1996). Incidental capture by trawlers fishing for white, brown, and pink shrimp has been documented for loggerhead, Kemp's ridley, green, leatherback, and hawksbill turtles in coastal waters of the southeastern United States and Gulf of Mexico.

Regulations promulgated by NMFS, under authority of the Endangered Species Act, required shrimp trawlers in federal or state waters off the southeastern Atlantic coastal states to comply with federal sea turtle conservation requirements. The final rule as published in the Federal Register is presented in Appendix VIII of the original FMP (SAFMC 1993).

NMFS estimated that prior to 1987, commercial shrimp trawlers killed more than 11,000 sea turtles annually in waters off the South Atlantic and Gulf of Mexico states. A more recent review and analysis of existing information by the National Academy of Sciences in 1990, found that the NMFS estimates were conservative, and that the number of turtles killed by shrimp trawlers could be as high as 44,000 each year which makes this the largest human-caused source of turtle mortality in U.S. waters (National Academy of Sciences 1990).

A biological opinion on the implementation of the 1987 Sea Turtle Conservation Regulations (52 FR 24244, June 29, 1987) was submitted on September 30, 1987. The 1987 opinion addressed the potential adverse effects to listed species of implementation of the rule, and concluded the regulations would have a positive impact on sea turtles by substantially reducing mortalities.

NMFS issued regulations under the ESA on June 29, 1987 [52 FR 24244] to reduce the incidental capture of sea turtles by shrimp trawlers. Trawlers 25 feet or longer were required to use TEDs in offshore waters and were required to limit tow times to 90 minutes or use TEDs in inshore waters (landward of the COLREGS line). Trawlers less than 25 feet in length were required to use 90 minute tow times or TEDs in inshore and offshore waters. These conservation measures were required in the waters off the southeastern Atlantic United States (North Carolina through Florida) from May 1 through August 31, except for the Canaveral area where the regulations were in place year round. Because of extensive strandings of turtles during periods when TEDs were not required, NMFS issued regulations on September 4, 1991 [56 FR 43713] extending the sea turtle conservation regulations from September 1, 1991, through April 30, 1992 in the Atlantic area. On April 9, 1992, Endangered Species Act (ESA) Section 7 consultation was initiated by the South Atlantic Fishery Management Council. This consultation was to address the potential adverse effects to listed species of both the proposed management action (adoption of a Shrimp Fishery Management Plan for the South Atlantic) and the shrimp fishery itself.

A Biological Opinion regarding implementation of the Shrimp Fishery Management Plan for the South Atlantic Region and Amendment 6 to the Gulf of Mexico Shrimp Fishery Management Plan was issued on August 19, 1992 (contained in Appendix IX of the original FMP; SAFMC 1993). NMFS concluded shrimp trawling in the southeastern United States was in compliance with the 1992 Revised Sea Turtle Conservation Regulations, and the proposed management actions under the South Atlantic shrimp FMP were not likely to jeopardize the continued existence of threatened or endangered species under NMFS jurisdiction.

On September 8, 1992 (57 FR 40861) NMFS issued a final rule effective September 1, 1992 that extended the sea turtle regulations in the Atlantic area to year-round rather than May 1 through August 31. Effective November 1, 1992 in all areas where tow times were used in place of TEDs, tow times were reduced from 90 to 75 minutes. The interim rules also eliminated the exemption for the rock shrimp fishery in the Atlantic and provided for exemptions for vertical barred beam trawls, roller trawls, wing nets, skimmer trawls, pusher-head trawls, and bait shrimpers.

As of December 1, 1992 shrimp trawlers were required to comply with sea turtle conservation measures throughout the year in all areas. Effective January 1, 1993 shrimp trawlers under 25 feet in offshore waters could no longer use

limited tow times as an alternative to using TEDs. Also effective January 1, 1993, was the requirement that shrimp trawlers in inshore waters must use TEDs unless they are equipped with a single net with a headrope length less than 35 feet and a footrope length less than 44 feet; if using such a single net, then they could use limited tow times until December 1, 1994. Final ESA regulations for the shrimp fishery were published on December 4, 1992 (FR Doc. 92-29370).

A Section 7 consultation was reinitiated on November 14, 1994 and a Biological Opinion regarding the present prosecution of the southeast shrimp trawl fishery was issued on November 14, 1994 (Appendix F, Amendment 1; SAFMC 1996). This opinion found the fishery as presently prosecuted, is likely to jeopardize the continued existence of threatened or endangered species under NMFS jurisdiction. Subsequently, the opinion directed NMFS to implement permits in the entire shrimp fishery within four months and detailed specific tasks to increase enforcement of existing regulations, and to accomplish research needed to identify and implement management measures to eliminate the jeopardy situation.

An Emergency Response Plan (Appendix E), developed in response to the 1994 biological opinion, was issued by NMFS and specifies monitoring and regulatory action required if allowable take levels of threatened and endangered sea turtles are exceeded. The 1995 activities under the Emergency Response Plan are summarized in Appendix F. NMFS has reinitiated a Section 7 consultation for the Gulf of Mexico and South Atlantic shrimp fisheries.

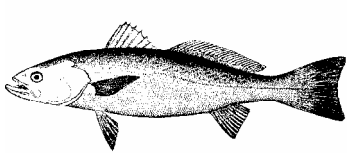
3.6.3.2 Finfish and crustacean bycatch and discards

The discarded bycatch of fish and crustaceans in the shrimp trawl fishery is highly variable by season and area. Directed research has been conducted documenting bycatch in the penaeid shrimp fishery.

The estimates of bycatch of sub-adult and juvenile finfish in the South Atlantic shrimp fishery have only recently been refined into a form which can be incorporated into species specific stock assessments. Most previous stock assessments have either not incorporated estimates of bycatch or used proxies. In addition, the total bycatch of finfish, invertebrates, and other crustaceans may have a combined and unquantifiable effect on the productivity or species composition of the ecosystem.

The known information on status of finfish stocks which are of concern to the Council and states, or are major bycatch of the shrimp fishery, are summarized in the following section. Weakfish managed under the interjurisdictional fishery management plan is the only species which has used specific information on bycatch in stock assessments. Once these estimates for other species such as Spanish mackerel, which is planned for April 1996, are refined, they will replace proxies presently used in estimating the impact of bycatch on the South Atlantic stock.

3.6.3.3 Status of weakfish and Spanish mackerel stocks caught as bycatch in the South Atlantic shrimp fishery

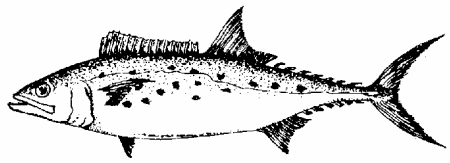


Weakfish

A draft revised coastwide weakfish stock assessment was prepared in September 1995 (Gibson 1995). The stock remains juvenescent, where young and juvenile are the dominant age classes in the stock. Previous assessments indicated a deterioration in the stock with increasing fishing mortality. Additional analyses were conducted to compare various virtual population analysis techniques used in estimating fishing mortality and spawning stock biomass. The most recent estimate of fishing mortality on the adult stock is between $F_{1994} = 1.58$ and 1.89. The ASMFC Weakfish Management Board adopted $F_{1994} = 1.89$ for age 2 and older weakfish as the best estimate of terminal F. Estimates of spawning stock biomass in 1994 range between 9,785 and 11,085 metric tons depending on the assessment technique used (Rob O'Reilly, VMRC pers. comm., 1995). The ASMFC Weakfish Board maintains the best estimate of $F_{20\%}$ is 0.35. All estimates show high fishing mortality on the adult stock with low spawning stock biomass levels in 1994.

The highest mortality, next to natural mortality, on age 0 and age 1 weakfish is from shrimp trawl bycatch. Mortality on age 0 weakfish was estimated to be 0.8 when bycatch is included and 0.2 when bycatch is not included (Gibson 1995).

Other indications of the steady decline in the stock include the drop in citation size weakfish reported by recreational anglers. In 1980, 3,575 weakfish of citation size in North Carolina (> 6 lb), Delaware (10 lb to 1987 and>11 lb after), Virginia (>12 lb), and Maryland (>10 lb) were reported. In 1994 only 6 fish were reported in all four states. Also, the age composition of the catch has been compressed with over 91% of the recreational fish measured through the MRFSS program being age 2 or less (Gibson 1995).



Spanish Mackerel

A full stock assessment for Atlantic group Spanish mackerel was conducted in 1994. These analyses included virtual population analyses of estimated numbers at age. The expected yield from Atlantic group Spanish mackerel for the 1993/1994 fishing year (FY 93/94) was 6.2 million pounds. Results of the 1994 assessment of Atlantic group Spanish mackerel indicate current fishing mortality rate on fully recruited year classes (2+) is 0.18, which is less than the $F_{30\%}$ SPR fishing rate of 0.71. The 93/94 median SPR is 42%; however, the SPR may be overestimated due to low bycatch estimates. The 1994/95 allowable biological catch (ABC) range is 4.1 to 9.2 million pounds, with a 50% risk of exceeding the ABC at the upper level. Atlantic group Spanish mackerel were considered not

overfished for the 1994/95 fishing year. Cooperative state/federal management has achieved a successful stock recovery.

The 94/95 median SPR was 49%; however, and the SPR again was overestimated due to low bycatch estimates. The 1995/96 allowable biological catch (ABC) range was 4.9 to 14.7 million pounds, with a 50% risk of exceeding the ABC at the upper level. Atlantic group Spanish mackerel were considered not overfished for the 1995/96 fishing year and the Council set the TAC at 9.4 million pounds..

The draft 1996 mackerel stock assessment panel report estimates the 1996/97 ABC range for Atlantic group Spanish mackerel to be 5 - 7 million pounds. With the incorporation of bycatch estimates into the assessment, the transitional SPR at the beginning of 1996/97 is estimated to be 29%.

3.6.3.4 NMFS Directive for Initiating a Cooperative Bycatch Research Program

The Council considered the issue of finfish bycatch being included in the shrimp management as the best approach to addressing bycatch when the federal plan was first being developed. However, the November 1990 reauthorization of the Magnuson Act specifically prohibited the Councils from taking any action on finfish bycatch in the shrimp fishery until 1994. Instead, an amendment to the Act required the following:

1. Within 9 months after the date of enactment of the Fishery Conservation Amendments of 1990, the Secretary shall, after consultation with the Gulf of Mexico Fishery Management Council and South Atlantic Fishery Management Council, establish by regulation a 3-year program to assess the impact on fishery resources of incidental harvest by the shrimp trawl fishery within the authority of such Councils.

2. The program established pursuant to paragraph (1) shall provide for the identification of stocks of fish which are subject to significant harvest in the course of normal shrimp trawl fishing activity.

3. For stocks of fish identified pursuant to paragraph (2), with priority given to stocks which (based upon the best available scientific information) are considered to be overfished, the Secretary shall conduct --
   (a) a program to collect and evaluate data on the nature and extent (including the spatial and temporal distribution) of incidental mortality of such stocks as a direct result of shrimp trawl fishing activities;
   (b) an assessment of the status and condition of such stocks, including collection of information which would allow the estimation of life history parameters with sufficient accuracy and precision to support sound scientific evaluation of the effects of various management alternatives on the status of such stocks; and
   (c) a program of data collection and evaluation for such stocks on the magnitude and distribution of fishing mortality and fishing effort by sources of fishing mortality other than shrimp trawl fishing activity.

4. The Secretary shall, in cooperation with affected interests, commence a program to design, and evaluate the efficacy of, technological devices and other changes in fishing technology for the reduction of incidental mortality of nontarget fishery resources in the course of shrimp trawl fishing activity. Such program shall take into account local conditions and include evaluation of any reduction in incidental mortality, as well as any reduction or increase in the retention of shrimp in the course of normal fishing activity.

5. The Secretary shall, upon completion of the programs required by this subsection, submit a detailed report of the results of such programs to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Merchant Marine and Fisheries of the House of Representatives.

6. (a) Except as provided in this paragraph, the Secretary may not implement any measures under this Act to reduce incidental mortality of nontarget fishery resources in the course of shrimp trawl fishing which would restrict the period during which shrimp are harvested or would require the use of any technological device or other change in fishing technology.
(b) The prohibition contained in subparagraph (a) shall cease on January 1, 1994.
(c) This paragraph does not apply to any law or regulation in effect on the date of enactment of this paragraph, nor does it limit in any way the Secretary's authority to take action, including any limitation on entry permitted by this Act, for the conservation and management of the shrimp fishery resource.

3.6.3.5 Results of Cooperative Bycatch Research Program

To accomplish the mandate established in the reauthorization of the Magnuson Act, NMFS funded the Gulf and South Atlantic Fishery Development Foundation to develop and coordinate a bycatch research plan. This plan was developed in cooperation with NMFS, commercial and recreational fishing industries, universities, state and federal fishery management agencies, and environmental organizations through a 30-member finfish bycatch steering committee (NMFS 1991).

The National Marine Fisheries Service has conducted this research and development program in cooperation with the Councils, coastal states, commercial and recreational fishing industries, and the conservation and academic communities. February 1995 marked the third year of the program. Pursuant to the mandate, a report on the Cooperative Research Program Addressing Finfish Bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries was submitted to Congress in April 1995 (NMFS 1995). These results have been incorporated into this amendment.

3.6.3.6 Shrimp Trawl Bycatch Characterization

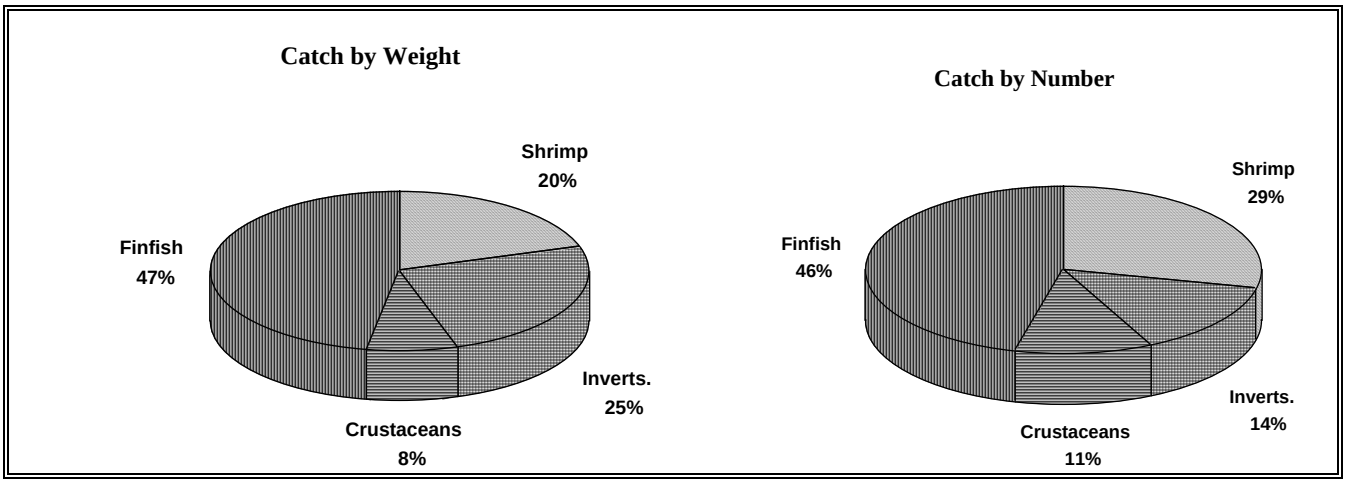
Previous estimates of the nature and level of bycatch associated with commercial shrimp trawling in the South Atlantic region were suspect and a survey based on direct observer coverage during normal fishing operations was

essential. In order to insure the integrity and validity of the estimates, the following research actions were conducted:

1. A voluntary observer program using trained NMFS and non-NMFS observers was under taken. The program included vessel insurance and compensation for cooperating vessels.
2. Using a stratified sampling approach indexed to shrimping effort, NMFS deployed observers throughout the fleet to document bycatch during normal fishing operations using standard data collection protocols.
3. All data was entered into a common database managed by NMFS Southeast Fisheries Science Center's Galveston Laboratory.
4. Characterization data were analyzed, and these data and analyses were made available to other program researchers and fishery managers.

A total of 2,549 sea days, 215 trips, and 3,296 tows were completed between February 1992 and September 1994. Of these, 393 sea days (15%), 63 trips (29%), and 679 tows (20%) were completed in the South Atlantic region. Considering this program was to characterize the entire southeast shrimp fishery prosecuted in both the Gulf and South Atlantic region and the fact that the Atlantic fishery accounts for 10% of the total U.S. production of shrimp, this sampling level was deemed sufficient by NMFS to characterize the fishery.

Survey results, when presented for the entire South Atlantic shrimp fishery, indicate that on the average a trawl towed for one hour will capture 1,214 organisms weighing approximately 64 pounds. Of this catch, commercially valuable shrimp accounts for 29% by number and 20% by weight (Figure 13). In addition, total finfish accounts for 46% by number and 47% by weight (Figure 13). Off South Carolina and Georgia, total finfish bycatch accounts for 44% by weight, and brown, white, and other shrimp account for 20% by weight (Figure 14). Spot, croaker, and other bycatch accounts for 54%, crab account for 20%, and mainly brown and pink shrimp account for 26% of catch by weight in North Carolina shrimp trawls (Figure 15).



*based on 679 commercial tows/ 150 taxa 1992-1994

Figure 13. South Atlantic shrimp trawl estimated catch by weight and number 1992-1994 (Data Source: NMFS 1995).

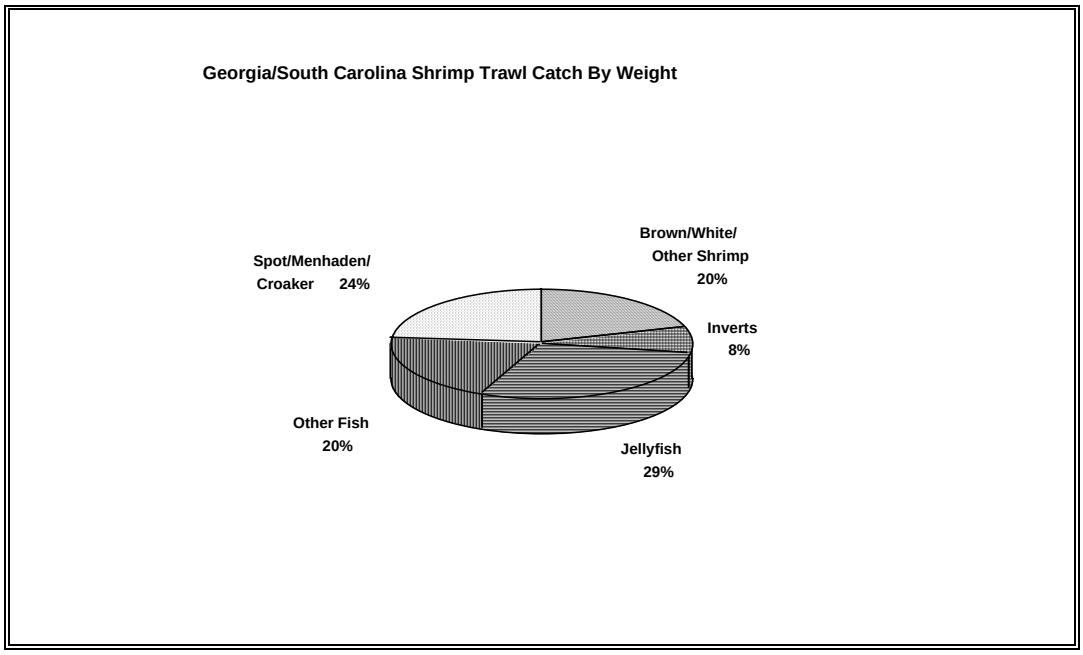


Figure 14. Georgia and South Carolina shrimp trawl estimated catch by weight 1992-1994 (Data Source: NMFS 1995).

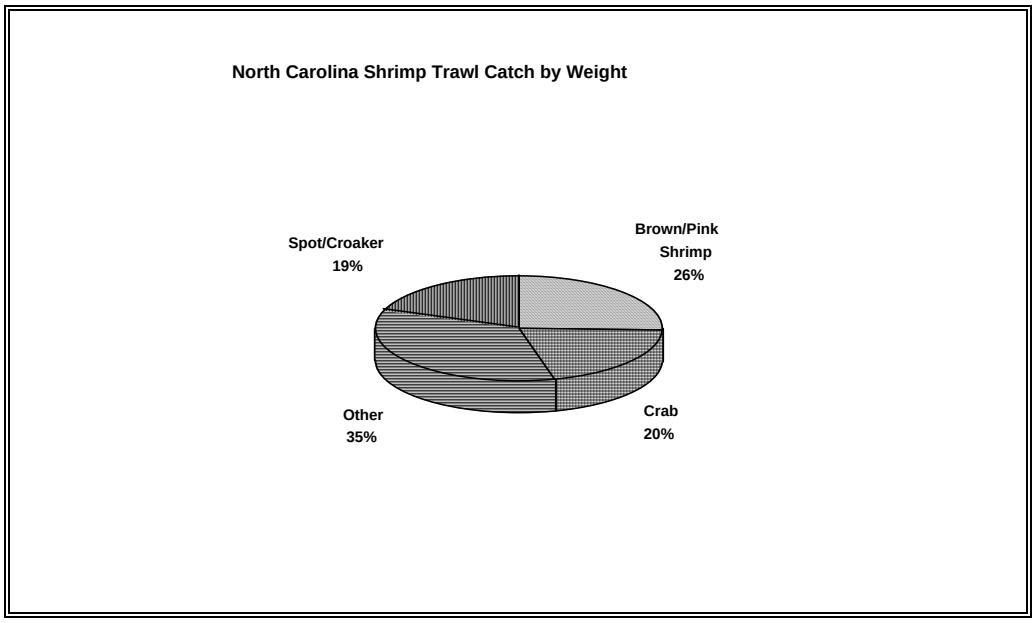


Figure 15. North Carolina shrimp trawl estimated catch by weight 1992-1994 (Data Source: NMFS 1995).

Overall, the shrimp to finfish ratio for the combined shrimp fishery in the South Atlantic region is 2.3 to 1 by weight and 1.6 to 1 by number (NMFS 1995).

Finfish catch by weight for the entire shrimp fishery is highest between May and August with a finfish ratio of 2.5 pounds of finfish caught for every pound of shrimp caught (Table 2). In number, the highest catch of individual finfish occurred in January through April when 4.8 finfish are caught for each shrimp.

When looking at catch by depth across all shrimp fisheries, the highest bycatch of finfish comes from vessels fishing in 60 feet or greater with 56% of the catch being finfish and 18% shrimp or a ratio of 3.1 finfish caught for each shrimp caught (Table 3).

Table 2. Average hourly shrimp trawl catch by season in the South Atlantic (Data Source: NMFS 1995).

CATCH	WEIGHT			NUMBER		
	Jan-April	May-Aug	Sept-Dec	Jan-April	May-Aug	Sept-Dec
FINFISH	50%	60%	36%	62%	54%	28%
SHRIMP	27%	24%	18%	13%	32%	22%
CRUSTACEANS	16%	7%	7%	21%	12%	10%
INVERTEBRATES	6%	9%	39%	4%	2%	40%
TOTAL CATCH	31 lb	51 lb	88 lb	850	1100	1700
FINFISH:SHRIMP RATIO	1.9 to 1	2.5 to 1	2 to 1	4.8 to 1	1.7 to 1	1.3 to 1

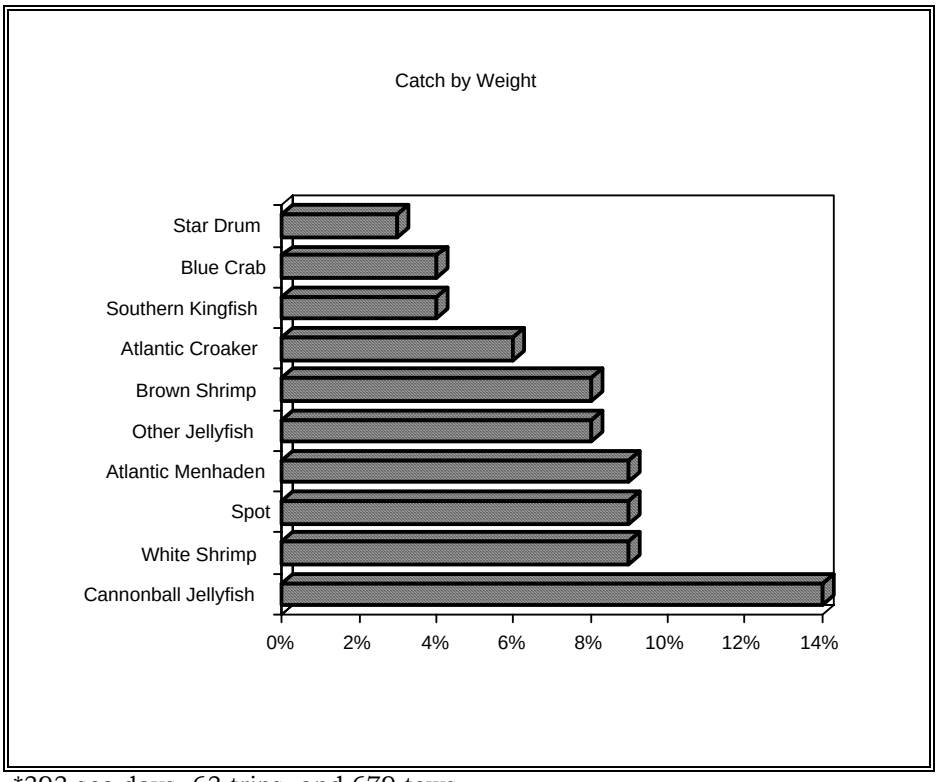
* 393 sea days, 63 trips, and 679 tows

Table 3. Percent average hourly shrimp trawl catch by area and depth (Data Source: NMFS 1995).

AREA	Finfish	Shrimp	Crustaceans	Invertebrates	Total Catch (number)	Finfish to Shrimp
SOUTH ATLANTIC						
< 60 feet	46%	29%	11%	14%	1229	1.6 to 1
= 60 feet	56%	18%	21%	5%	726	3.1 to 1
FLORIDA						
< 60 feet	37%	30%	27%	6%	1207	1.2 to 1
= 60 feet	43%	29%	23%	4%	802	1.5 to 1

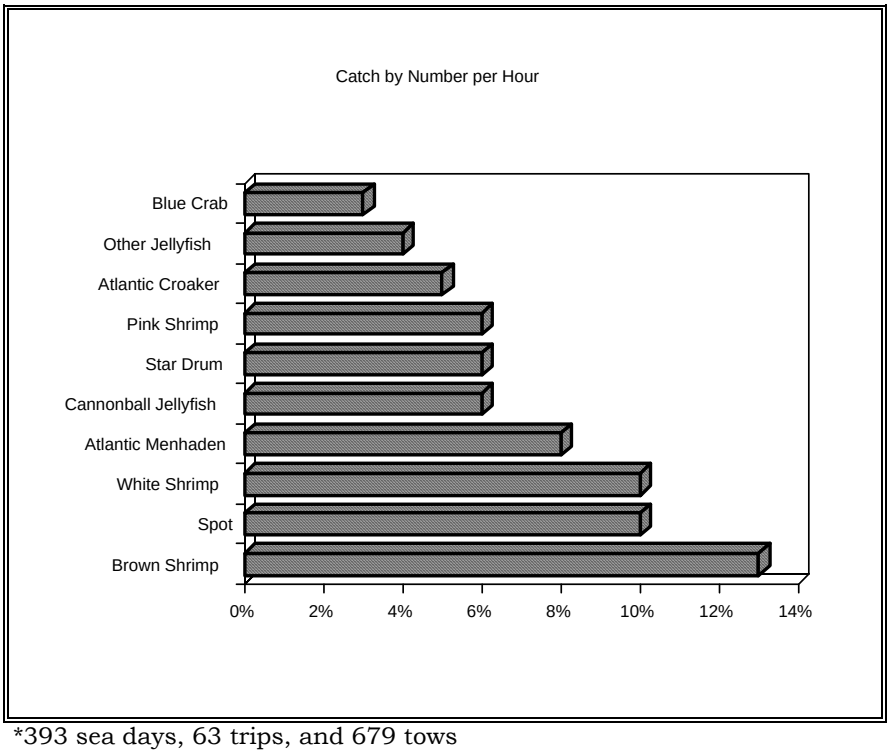
* 393 sea days, 63 trips, and 679 tows

When summarizing catch of the South Atlantic shrimp fleet by species, cannonball jellyfish constitutes 14% catch by weight (Figure 16) and brown shrimp constitutes 13% by number (Figures 17). White shrimp constitute 9% in catch by weight and 10% in catch by number. Brown shrimp constitute 8% in catch by weight and 13% in catch by number. The highest catch of an individual finfish species is spot which accounts for 9% by weight and 10% by number.



*393 sea days, 63 trips, and 679 tows

Figure 16. Top ten species caught in South Atlantic shrimp trawls by weight (Data Source: NMFS 1995).



*393 sea days, 63 trips, and 679 tows

Figure 17. Top ten species caught in South Atlantic shrimp trawls by number per hour (Source: NMFS 1995).

3.6.3.7 Bycatch Estimates for Stock Assessment

The South Atlantic SEAMAP Committee appointed a bycatch work group to help NMFS in bycatch data identification, review, and analysis. A draft report (SEAMAP 1995) was developed and presented estimates of finfish bycatch in the South Atlantic shrimp fishery for specific geographic regions and periods of time based on available data (catch and effort data for 1992 and 1993 and characterization and BRD data from 1992-1994). The document, currently undergoing an American Fisheries Society review, presents the best available information on bycatch. The bycatch information combines information from the cooperative bycatch research program with shrimp effort information derived from NMFS detailed shrimp database and the Florida trip ticket data. Data were summarized into three geographic areas and four seasons per year. The geographic areas include: 1) North Carolina inshore, 2) South Carolina, Georgia, and northeast Florida (between 30° N. latitude and 34° N. latitude), and 3) Florida south of 30° N. latitude. The four seasons include: 1) winter (December, January, and February), 2) spring (March, April, May, and June), 3) summer (July and August), and 4) fall (September, October, and November).

Figures 18-21 present catch per trip by area, season, and year for Spanish mackerel and weakfish. In South Carolina, Georgia, and northeast Florida spot and croaker dominated bycatch estimates by weight and number over most of the time. Bycatch data summarized for North Carolina data (limited to inshore), showed Atlantic croaker and spot to also be the dominant species during most of the seasons and years observed. However, weakfish were abundant in catches by weight in North Carolina during the summer and fall of 1993. The average weight per trip for any of the selected species in North Carolina was far below those calculated for the two other geographic areas. Totals of individual bycatch species by weight and number were not calculated for the entire South Atlantic fishery but were calculated for an individual geographic area by year and season because available effort information was limited. The data generated were developed to be used by stock assessment scientists to calculate total bycatch for an individual species and the mortality associated with that bycatch.

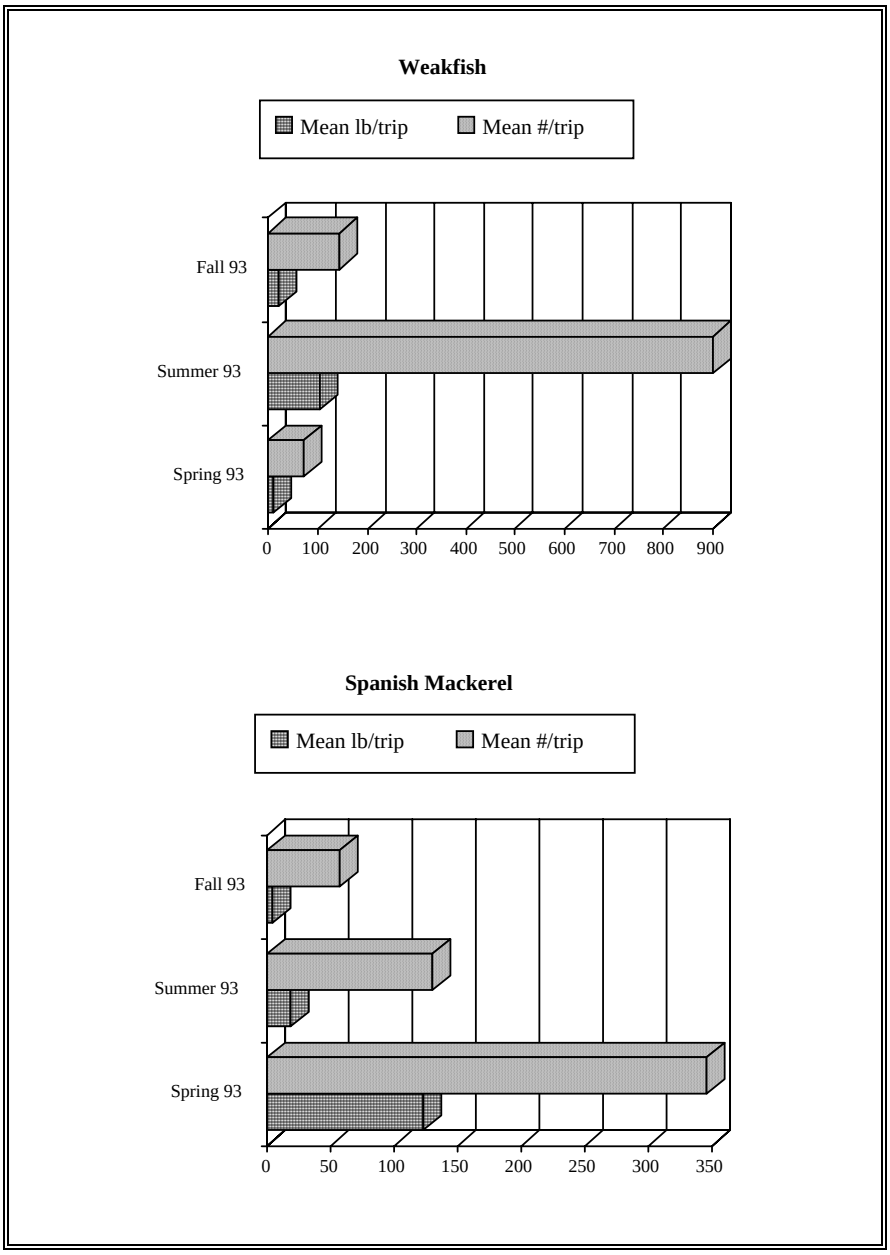


Figure 18. Bycatch rates for weakfish and Spanish mackerel in pounds and number per trip estimated for trips taken in SC, GA, and Florida east coast north of 30° for the 1993/1994 season (Data Source: SEAMAP 1995).

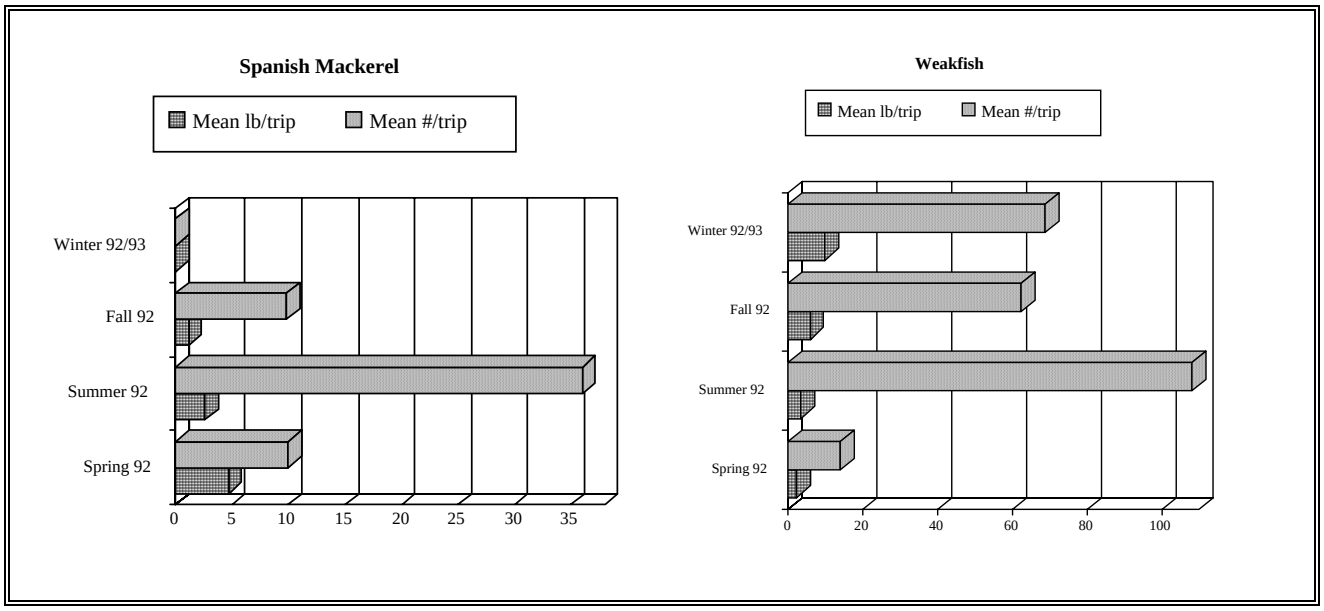


Figure 19. Bycatch rates of weakfish and Spanish mackerel in pounds and number per trip estimated for trips taken in SC, GA, and Florida east coast north of 30° N. latitude for the 1992/1993 season (Data Source: SEAMAP 1995).

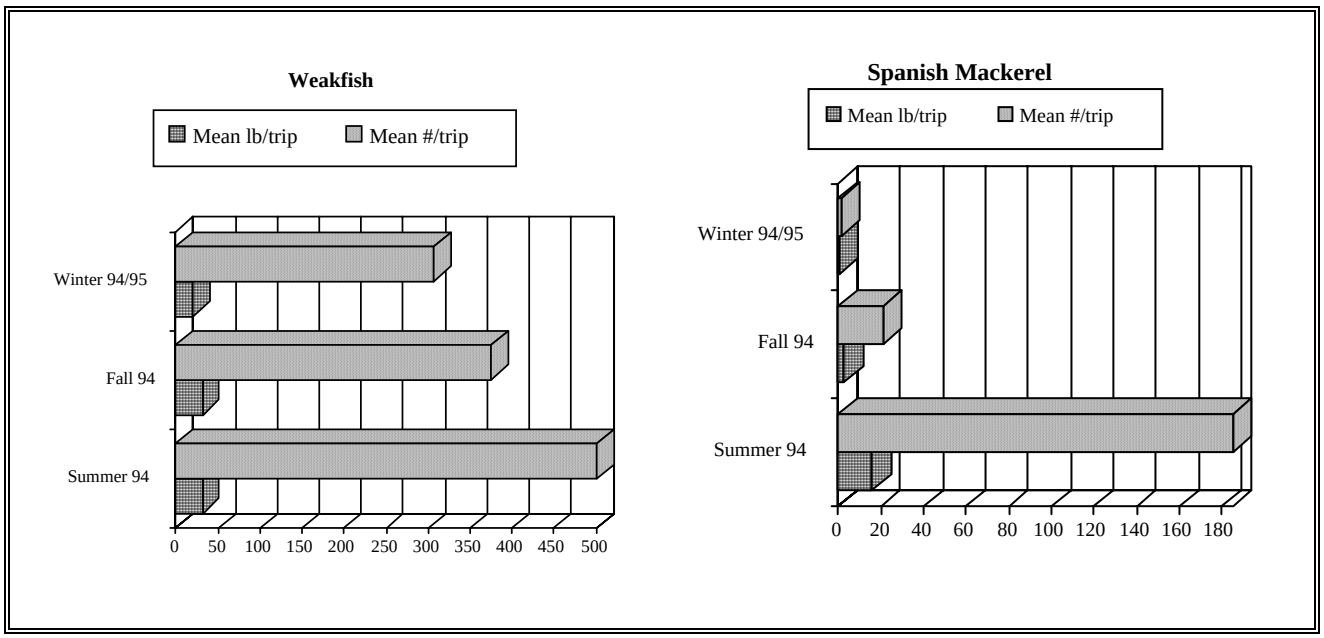


Figure 20. Bycatch rates of weakfish and Spanish mackerel in pounds and number per trip estimated for trips taken in SC, GA, and Florida east coast north of 30° N. latitude for the 1994/1995 season (Data Source: SEAMAP 1995).

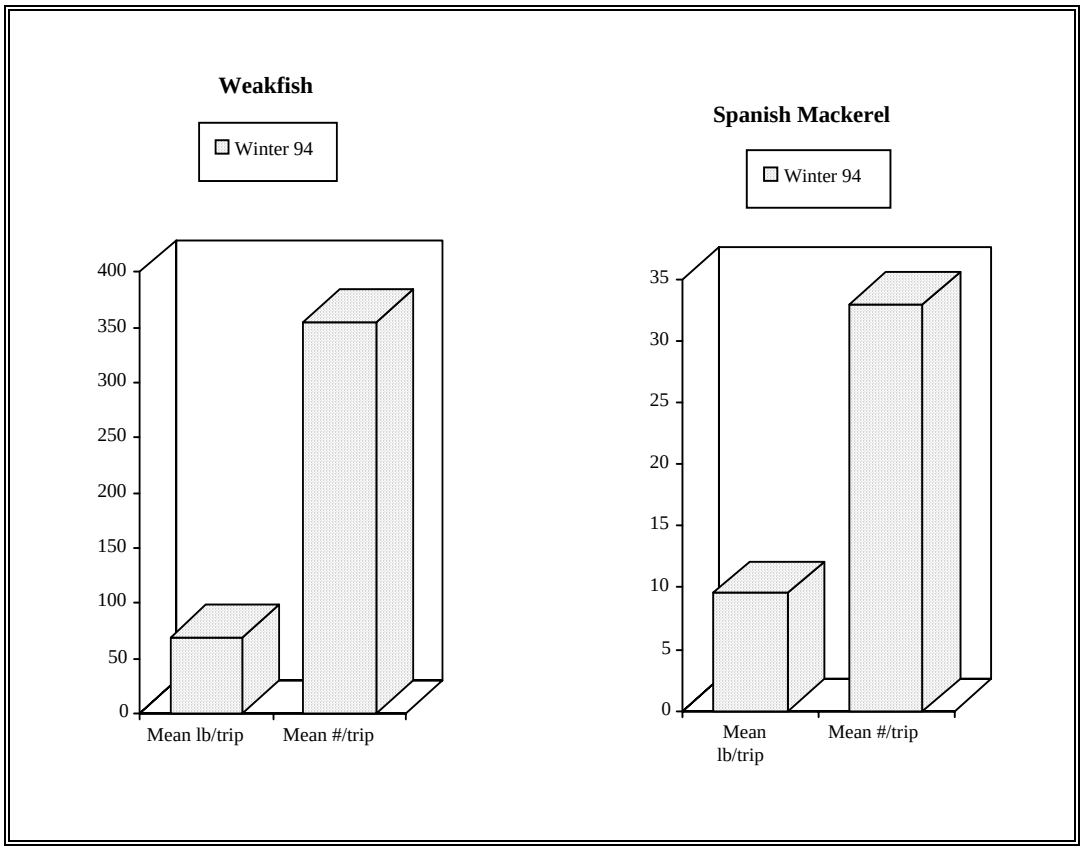


Figure 21. Bycatch rates of Spanish mackerel and weakfish in pounds and number per trip estimated for trips taken in Florida east coast south of 30° N. latitude during winter 1994 (Data Source: SEAMAP 1995).

3.6.3.8 Bycatch at age and size

In order to assess the impact of bycatch on the associated stocks, information on size and age at capture is necessary. Estimates of the bycatch component of fishing mortality can only be calculated if catch at size information is available. An analysis of discreet size and subsequently age classes will more clearly indicate the benefit of reducing bycatch. Fish taken in shrimp trawls are generally small and represent early ages of most species. Atlantic croaker taken in shrimp trawls ranged in size from 115 mm (4.53 in) to 160 mm (6.30 in) total length in the fall and winter. Spot caught in inshore North Carolina trawls ranged in size from 90 mm (3.54 in) to 160 mm (6.30 in) mean total length. Spanish mackerel measured between 150 mm (5.91 in) and 270 mm (10.63 in) mean fork length in South Carolina, Georgia, and northern Florida and between 90 mm (3.54 in) and 330 mm (12.30 in) in North Carolina inshore waters. Weakfish measured between 120 mm (4.72 in) and 190 mm (7.48 in) total fork length in South Carolina, Georgia, and northeast Florida and 140 mm (5.51 in) in North Carolina inshore waters (SEAMAP 1995).

Weakfish bycatch estimates presented in the SEAMAP analyses were used to expand to total catch by year and age class in the 1995 stock assessment. The draft assessment report (Gibson 1995) presented estimates of the bycatch component of fishing mortality for weakfish for age 0 and age 1 mortality attributable to shrimp trawl discards. In 1994, it was estimated that

more than 20 million age 0 weakfish were discarded by the South Atlantic shrimp fishery (Figure 22). This represented a major source of mortality on not only age 0 weakfish but also age 1 fish which were also captured in trawls. Over 2 million age 1 weakfish were estimated to be discarded from penaeid shrimp trawls (Figure 23). The estimates are however preliminary and a revised stock assessment using a new methodology is being completed. The estimates of weakfish only incorporate weakfish identified in bycatch characterization and as the SEAMAP (1995) report indicates, "Trout species values (those that could not be identified to the species level because of their small size) were not expanded since only the genus was known for this group. Thus, weakfish are probably under-estimated since unknown quantities of this species were likely contained within the trout species group."

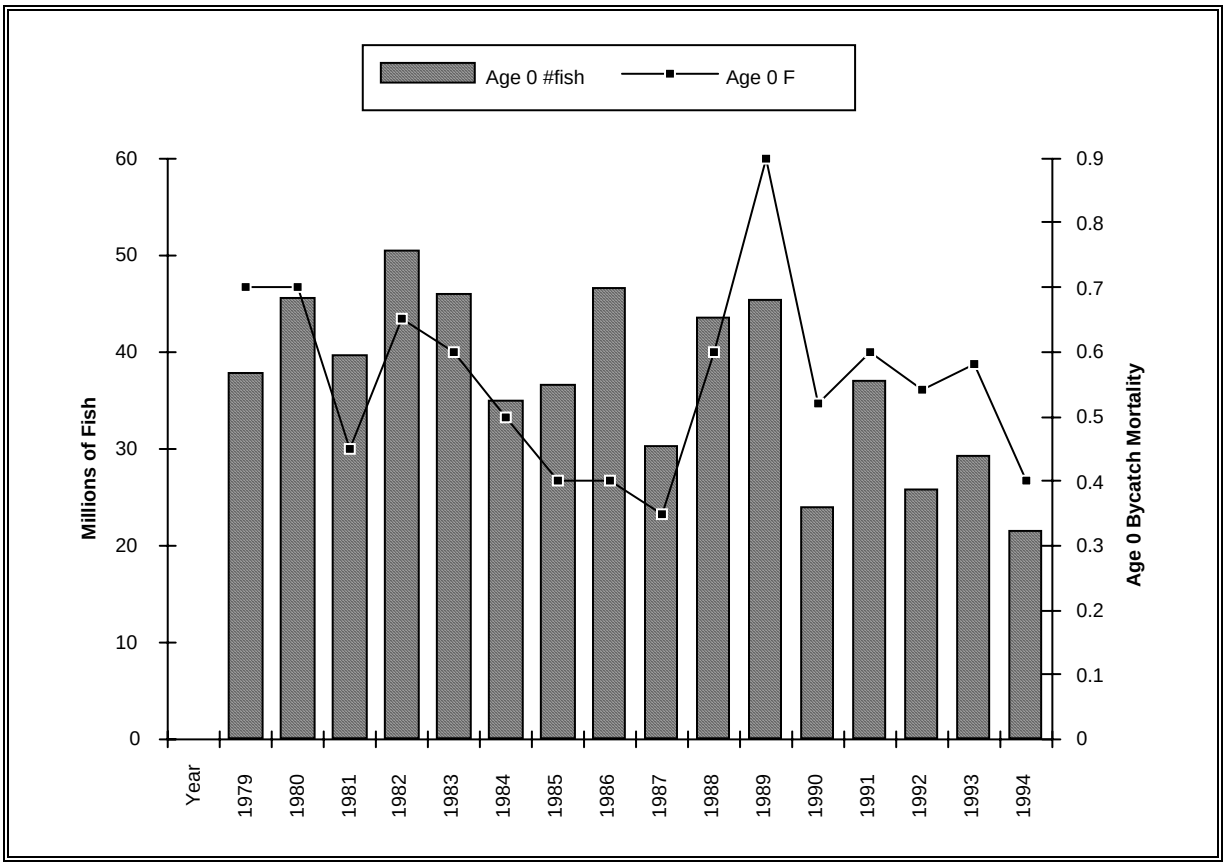


Figure 22. Preliminary estimated numbers of age 0 weakfish discarded in the South Atlantic penaeid shrimp fishery 1979-1994 and bycatch mortality attributable to these discards (Data Source: Gibson 1995).

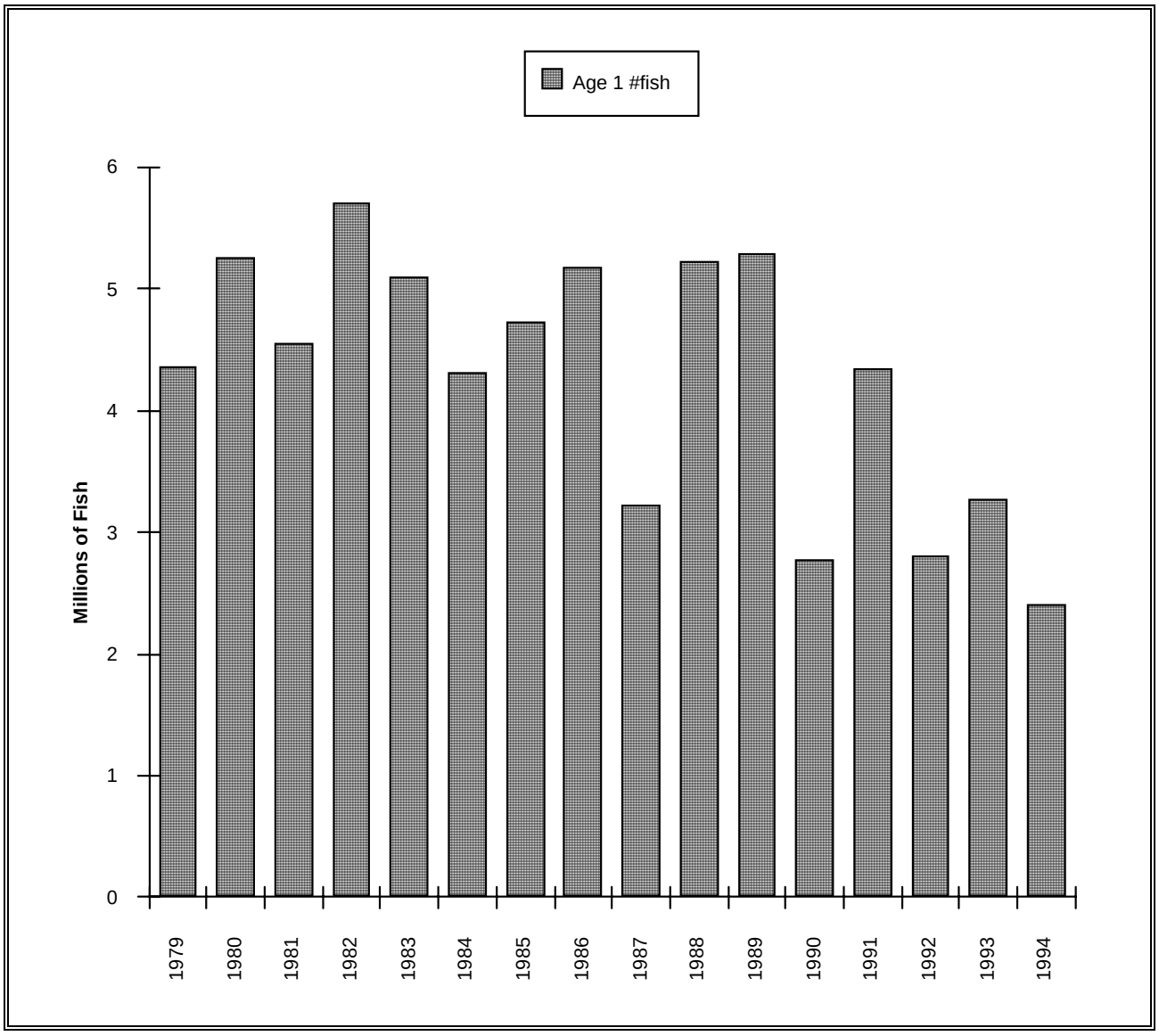


Figure 23. Preliminary estimates of numbers of age 1 weakfish discarded in the South Atlantic penaeid shrimp fishery 1979-1994 (Data Source: Gibson 1995).

The similarity in size of shrimp and small weakfish makes separation a difficult engineering problem (SCDNR 1995). Figure 24 shows the length frequencies of all weakfish caught during fish excluder testing (including those caught in control nets) does not differ greatly with the length frequencies of weakfish captured with a BRD.

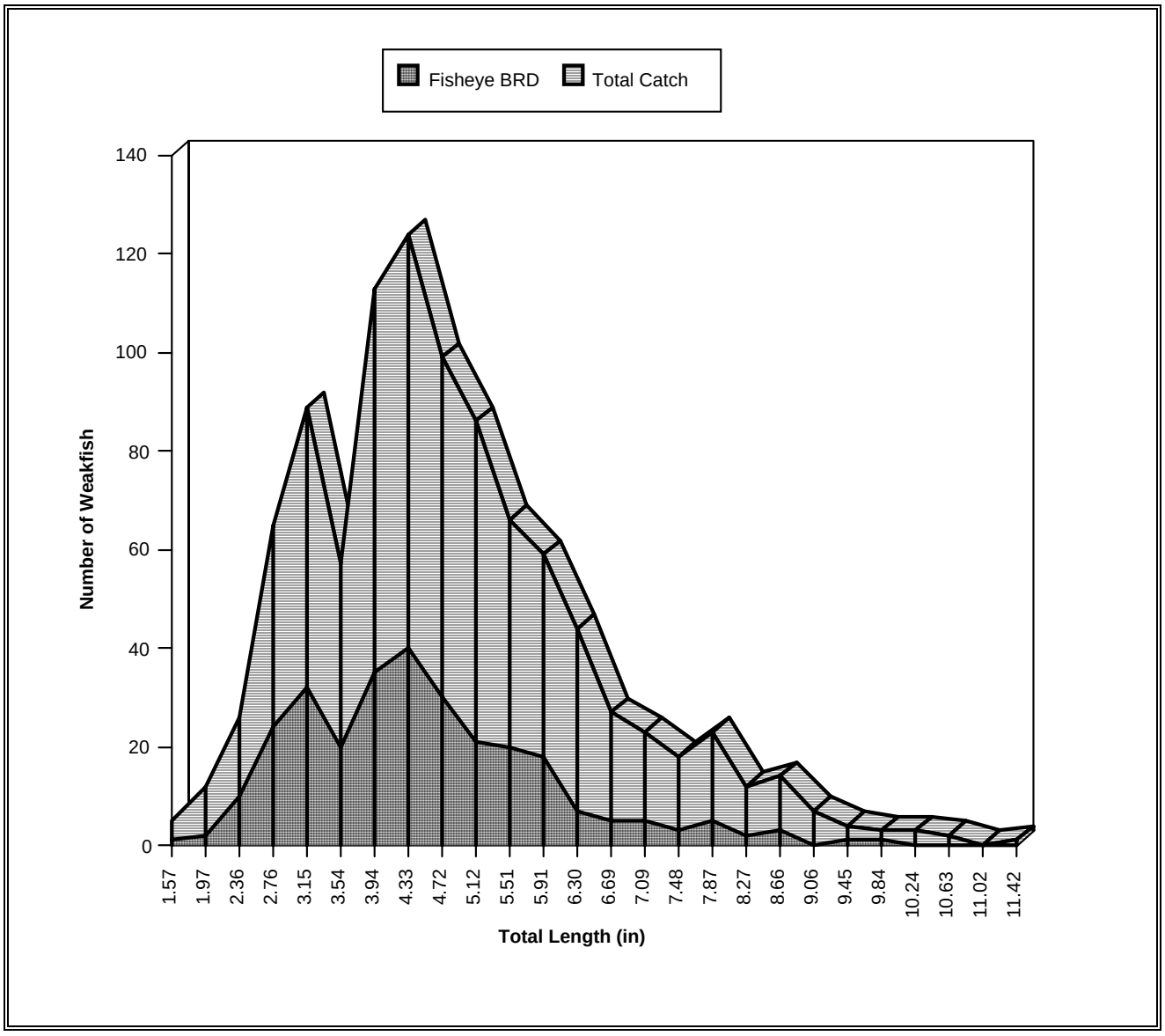


Figure 24. Weakfish length distribution in BRD test trials off South Carolina using a 6" x 6" fisheye (Data Source: SCDNR 1995).

3.6.3.9 Development and Evaluation of Bycatch Reduction Devices (BRDs)

Under the federally mandated research study, trawl gear modification was targeted as the most cost effective and least disruptive way to minimize finfish bycatch in the shrimp fishery. A process was therefore implemented under the cooperative program to develop, evaluate, and transfer gear technology to the shrimp industry. The specific actions undertaken included:

1. Develop a suitable BRD development and testing protocol that is both sufficiently rigorous from a scientific perspective and acceptable to the shrimp industry.

2. Organize and use a gear development panel to cooperatively identify and evaluate BRD concepts and designs.
3. Evaluate BRDs and alternative gear using standardized testing criteria, procedures, and data collection protocols.

The National Marine Fisheries Service Harvesting System Division evaluated 82 BRD designs in 1990 and 1994 of which 24 were recommended for proof of concept testing (Figure 25).

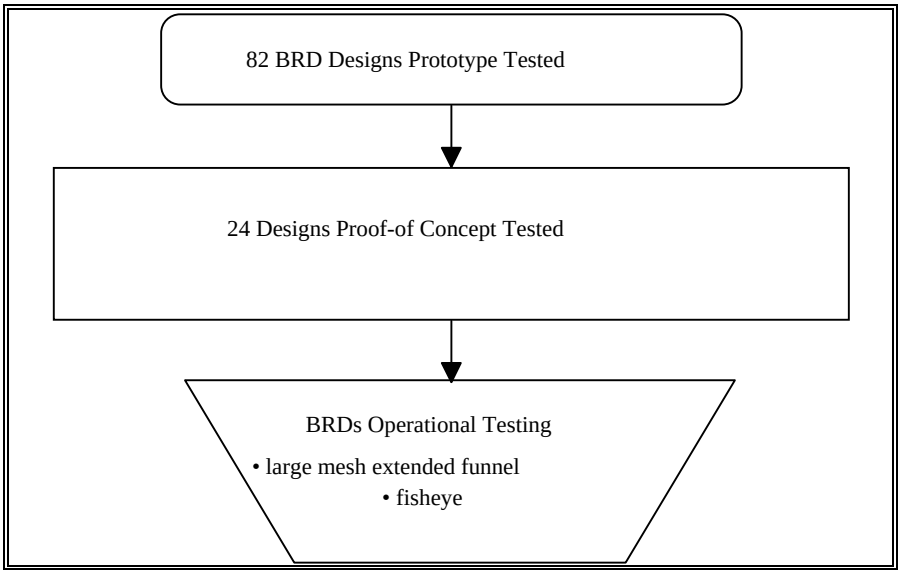


Figure 25. BRDs testing program results (Source: NMFS 1995).

The designs analyzed included modified trawls, modified TEDs, fisheyes, funnels, and fish stimulators (Watson et al. 1993). The top position fisheye, the large mesh funnel design, and the extended funnel were approved by the gear review panel for operational evaluation based on their ability to reduce finfish bycatch while minimizing shrimp loss. Operational testing of these designs was conducted in the South Atlantic on commercial shrimp vessels by the Gulf and South Atlantic Fisheries Development Foundation (GSAFDF) and the North Carolina Department of Marine Fisheries (NCDMF). BRDs that advanced to the industry evaluation phase of testing included the fisheye and the large mesh extended funnel BRD. Watson (1995) indicated that in the South Atlantic, the fisheye and the large mesh extended funnel BRDs effectively reduce weakfish within the specified parameters of BRD size and placement. These installation specifications are presented in Appendix D.

Twenty-two selected species (Table 4) were processed for each subsample taken during bycatch reduction device evaluation trips.

3.6.3.10 Fish Behavior and Bycatch Reduction

An essential component in the development of effective gear for reducing finfish bycatch is an understanding of fish behavior (Watson 1992). NMFS in the development and testing of bycatch reduction devices utilized scuba, video

cameras, and remote operated vehicles to observe shrimp and fish behavior as it related to BRDs being tested. Most fish show an optomotor response which is an unconditioned response to visual stimuli where they orient themselves parallel to a part of the trawl gear and attempt to keep pace with it (Watson et al. 1993).

Table 4. Selected Finfish Species for Bycatch Reduction Device Evaluation Protocol (Source: NMFS 1995).

hardhead catfish	*Arius felis*
sharks (all species)	
Atlantic bumper	*Chloroscombrus chrysurus*
trout species	*Cynoscion sp.*
spot	*Leiostomus xanthrus*
snapper (other)	*Lutjanus sp.*
red snapper	*Lutjanus campechanus*
lane snapper	*Lutjanus synagris*
whiting	*Menticirrhus sp.*
Altantic croaker	*Micropogonias undulatus*
southern flounder	*Paralichthys lethostigma*
butterfish	*Peprilus tricantus* or *Peprilus burti*
black drum	*Pogonias cromis*
cobia	*Rachycentron canadum*
vermilion snapper	*Rhomboplites aurorubens*
red drum	*Sciaenops ocellatus*
king mackerel	*Scomberomorus cavalla*
Spanish mackerel	*Scomberomorus maculatus*
longspine porgy	*Stenotomus caprinus*
cutlassfish	*Trichiurus lepturus*
spotted seatrout	*Cynoscion nebulous*
weakfish	*Cynoscion regalis*

When the fish cannot maintain a swimming speed required to keep pace with the trawl they are captured in the net. Finfish, through the use of the lateral line system detect water flow boundaries and areas of turbulent flow. Altering the water flow characteristics in a trawl to create areas of turbulent flow and areas of decreased flow in the net is what occurs with the placement of a BRD in a shrimp trawl. The fish react by orienting themselves to the reduced flow areas which provide escapement through the strategically placed opening in the trawl (Watson 1992). Watson et al. (1993) indicated that changes in flow velocity appeared to modify the optomotor reaction of juvenile fish. Fish were observed to exit through a BRD escape opening when the water flow rate through the escape opening was between 0.2 and 0.5 meters per second. Juvenile finfish did not escape if the flow-rate was less than 0.2 or greater than 0.5 meters per second.

3.6.3.11 Bycatch Reduction with BRDs

The cooperative research program identified two BRD types which are effective at reducing bycatch. A summary of reduction by weight attributed to BRD designs tested in the South Atlantic during 1993 and 1994 is presented in

Tables 5, 6a, 6b, and 6c. A summary of reductions attributed to BRD designs tested in the South Atlantic during 1993 and 1994 showing reductions in individuals by species per hour is shown in Table 6. Spanish mackerel catch rate was reduced by 34% and weakfish by 40% for the fisheye placed 30 meshes from the front fished with a hard TED. Spanish mackerel catch rate was reduced 34%-83% and weakfish catch rate was reduced 6%-56% (Tables 6a, 6b and 6c). The State of North Carolina has conducted testing on BRDs and Table 6b presents the summary of the observed reduction rates for BRDs proposed for use in federal waters.

Table 5. Summary of reductions in kilograms per hour attributed to BRD designs tested in the South Atlantic during 1993 and 1994 (Sources: Watson, NMFS, pers. comm. 1995 and Branstetter, GSAFDF pers. comm. 1996).

	Fish-eye 4"Hx7"W 30 meshes from front	Fish-eye 5"Hx 12"W 30 meshes from front	Fish-eye 5"Hx 12"W 45 meshes from front	Large mesh extended funnel
Total Biomass(kg/hr)	-4(27)	-9*(66)	-9(117)	-12(156)
Crustaceans(kg/hr)	+6(27)	-13*(66)	-14*(80)	-13*(156)
Other Inverts.(kg/hr)	-2(27)	-7(66)	-4(111)	-9*(156)
Total finfish(kg/hr)	-16(27)	-16*(66)	-12*(117)	-22*(156)
Comm. Shrimp(kg/hr)	-3(27)	-1(66)	-1(116)	+2(156)
Misc. fish spp.(kg/hr)	-15(26)	-6(66)	-14(122)	-22*(156)

* statistical difference from zero where H_0 = CPUE of control net - CPUE of the BRD net = 0.

** all *Cynoscion* combined

numbers in ( ) represent sample size

Table 6a. Reduction rates (kg per hour) for weakfish, trout, and Spanish mackerel for the large mesh extended funnel BRD (1995 GSAFDF data) (Data Source: Watson, NMFS, pers. comm. 1995).

Large Mesh Extended Funnel	Reduction Rate (kg/hr)	Number	95% Conf.
Weakfish	-37%	63	35%-39%
Spanish Mackerel	-44%	26	39%-48%
Shrimp	+2%	63	

Table 6b. Reduction rates (kg per hour) for weakfish and Spanish mackerel for Florida fisheye, and large mesh extended funnel BRDs (NCDMF 1992-1994 data)(Data Source: Watson, NMFS, pers. comm. 1995).

Florida Fisheye	Reduction Rate (kg/hr)	Number = 213
Weakfish	-58%	

Spanish Mackerel	-34%
Shrimp	-8%

Large Mesh Extended Funnel	Reduction Rate (kg/hr)	Number = 36
Weakfish	-56%	
Spanish Mackerel	-83%	
Shrimp	-2%	

Table 6c. Reduction rates (kg per hour) for weakfish, trout, and Spanish mackerel for large mesh extended funnel, and midsize fisheyes (1993-1994 NMFS and GSAFDF data) (Data Source: Watson, NMFS, pers. comm. 1995).

Large Mesh Extended Funnel	Reduction Rate (kg/hr)	Number	95% Conf.
Weakfish	-6%	39	
Spanish Mackerel	-38%	67	16%-59%
Trout	-27%	148	15%-39%
Shrimp	+3%	186	

Midsize Fisheye w/hard TEDs 30m position	Reduction Rate (kg/hr)	Number	95% Conf.
Weakfish	-40%	58	29%-52%
Spanish Mackerel	-34%	47	24%-44%
Trout	-29%	174	21%-37%
Shrimp	+3%	268	3%-10%

Midsize Fisheye, w/soft TEDs 30m position	Reduction Rate (kg/hr)	Number	95% Conf.
Weakfish	-7%	26	-
Spanish Mackerel	-0%	20	-
Trout	-20%	32	-
Shrimp	-2%	112	-

Midsize Fisheye, 45m position	Reduction Rate (kg/hr)	Number	95% Conf.
Weakfish	-16%	95	
Spanish Mackerel	-0%	30	
Trout	-81%	4	
Shrimp	+3%	160	

The Florida fish eye tested by NCDMF, showed a reduction of weakfish by over 55% with high reductions for other species including spot and croaker which were reduced by more than 50% (Figure 26).

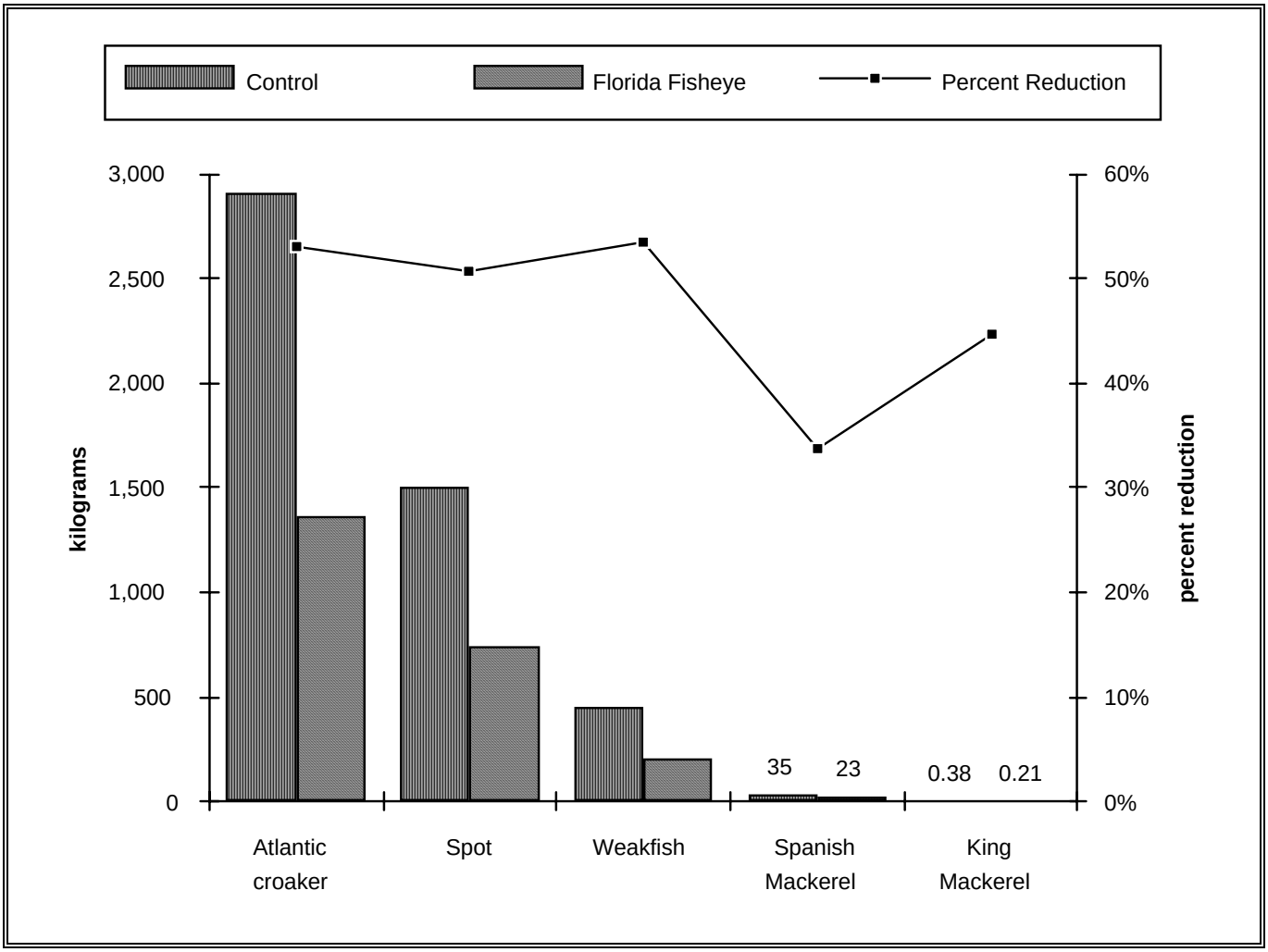


Figure 26. Reduction rates (kg) for selected species and groups for Florida fish eye BRD tested aboard commercial trawlers in NC in 1992 and 1994 (Data Source: NCDMF 1995).

The NCDMF tests also showed that the fisheye also reduced total finfish by 48% and total biomass by 28% (Figure 27).

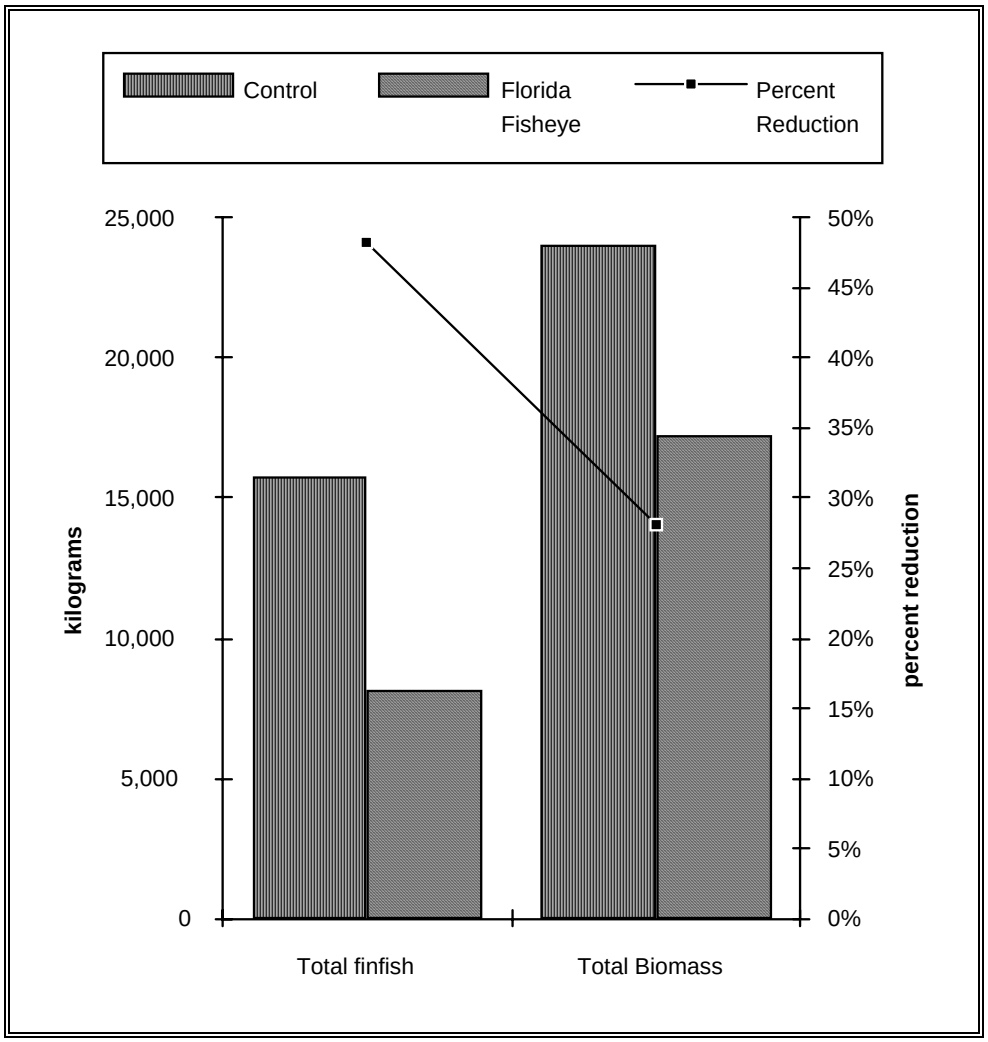


Figure 27. Reduction rates (kg) for total finfish and total biomass, for Florida Fish Eye BRD tested aboard commercial trawlers in NC in 1992 and 1994 (Data Source: NCDMF 1995).

A comparison of reduction rates attributable to various Florida fisheye configurations tested aboard commercial trawlers in North Carolina between 1992 and 1994 is shown in Figure 28. The 9" by 9" fisheye reduced total biomass by over 60% and the 5.5" by 6.5" fisheye showed the greatest finfish reduction of about 60%. The 9" by 9" fisheye reduced Spanish mackerel by close to 50% with the 5.5" by 6.5" fisheye reducing weakfish by over 70% (Figure 28).

Tests of large mesh extended funnel BRDs were conducted by NCDMF and showed reduction rates presented in Figure 29.

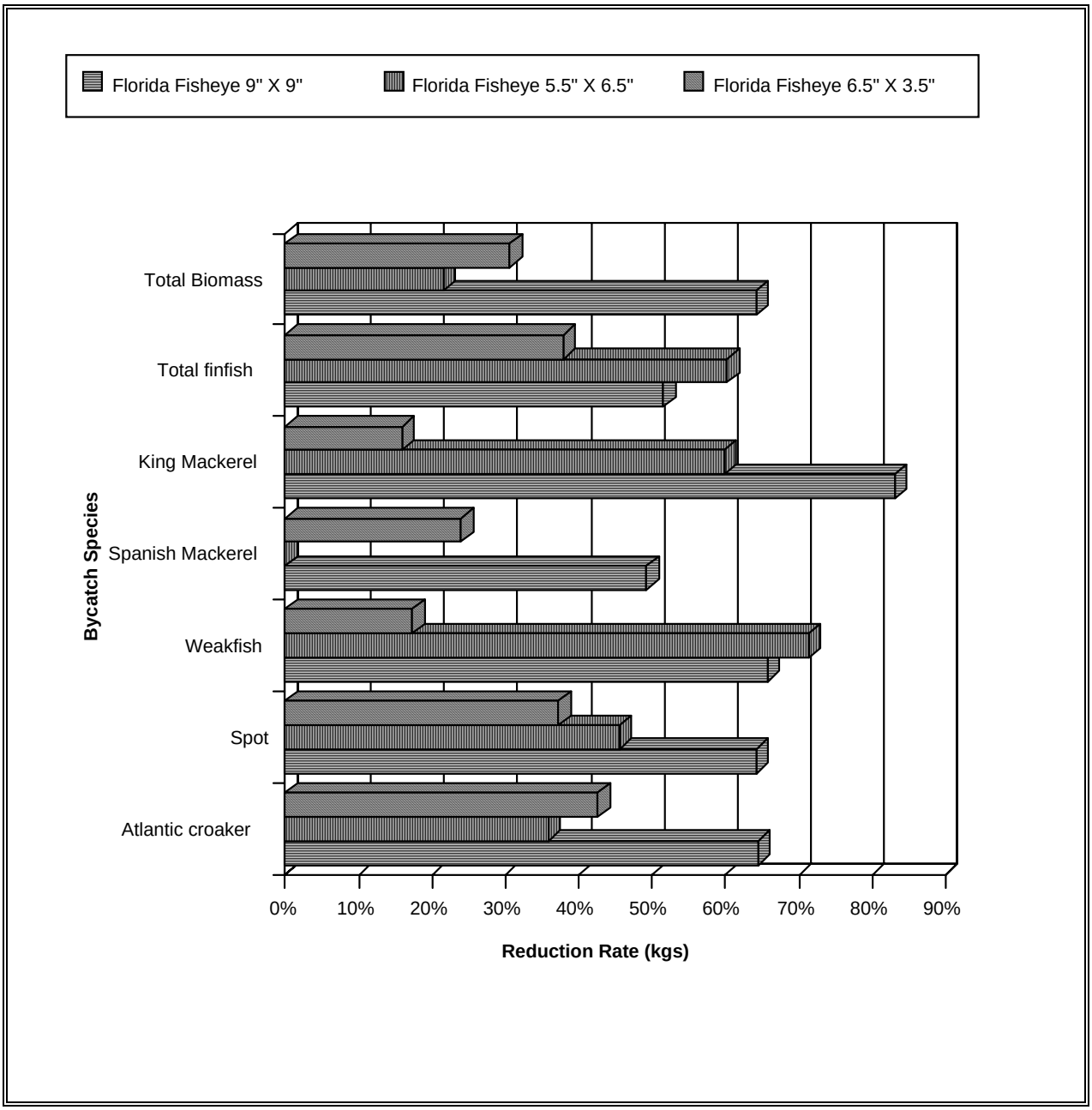
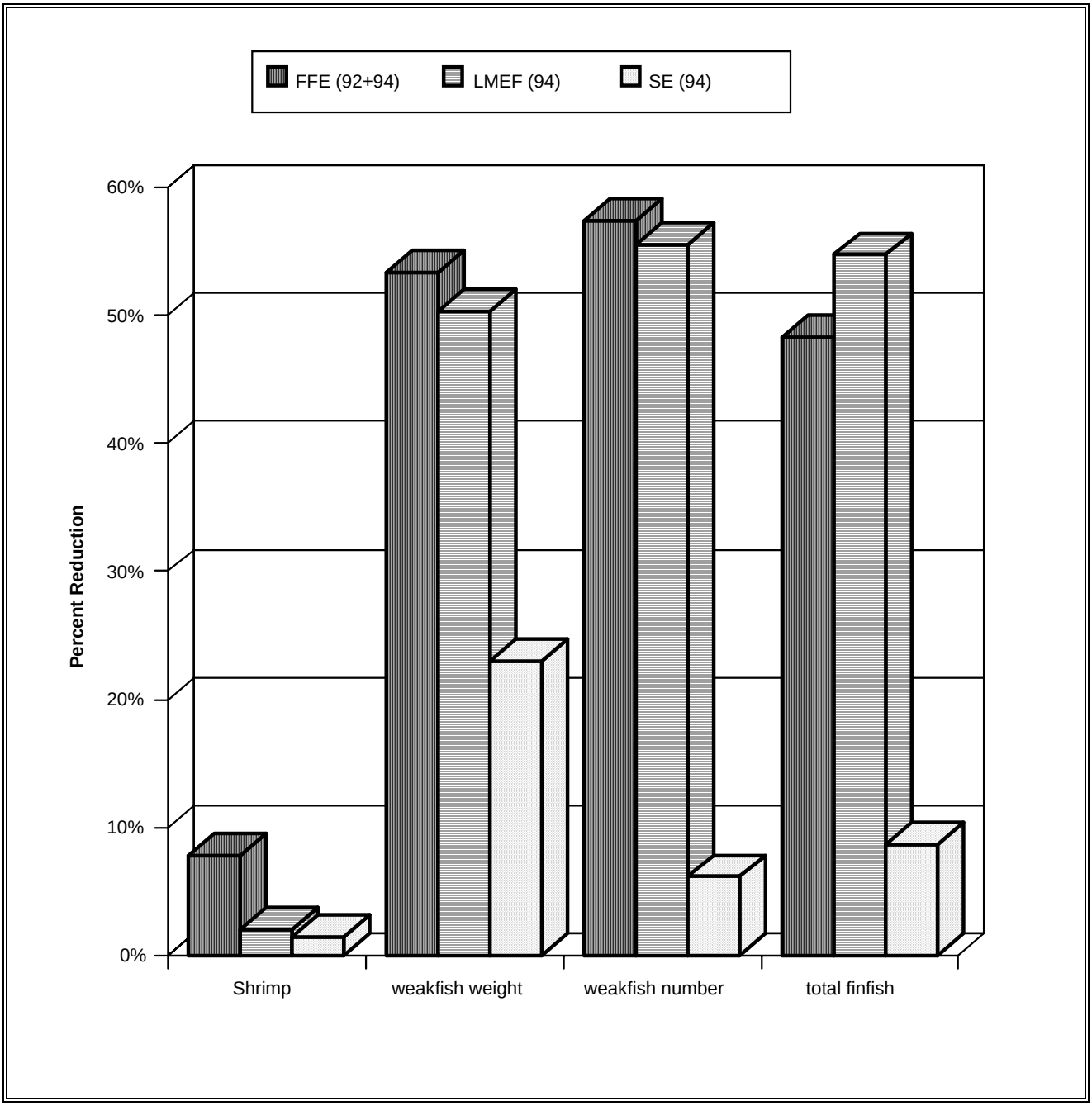


Figure 28. A comparison of reduction rates (kg) for selected species and groups for various Florida Fisheye BRDs tested aboard commercial trawlers in NC in 1992 and 1994 (Data Source: NCDMF 1995).



[FFE - Florida Fish Eye LMEF - Large Mesh Extended Funnel SE - Snake Eye]

Figure 29. A comparison of reduction rates for three basic BRD designs tested aboard commercial trawlers in NC in 1992 and 1994 (Data Source: NCDMF 1995).

Weakfish caught as bycatch in shrimp trawls are age 0 and age 1 fish and measure mainly between 60 mm (2.36 in) and 179 mm (7.03 in) total fork length (Figure 30). The draft assessment report (Gibson 1995) presents bycatch estimates for age 0 and age 1 weakfish attributable to shrimp trawl discards.

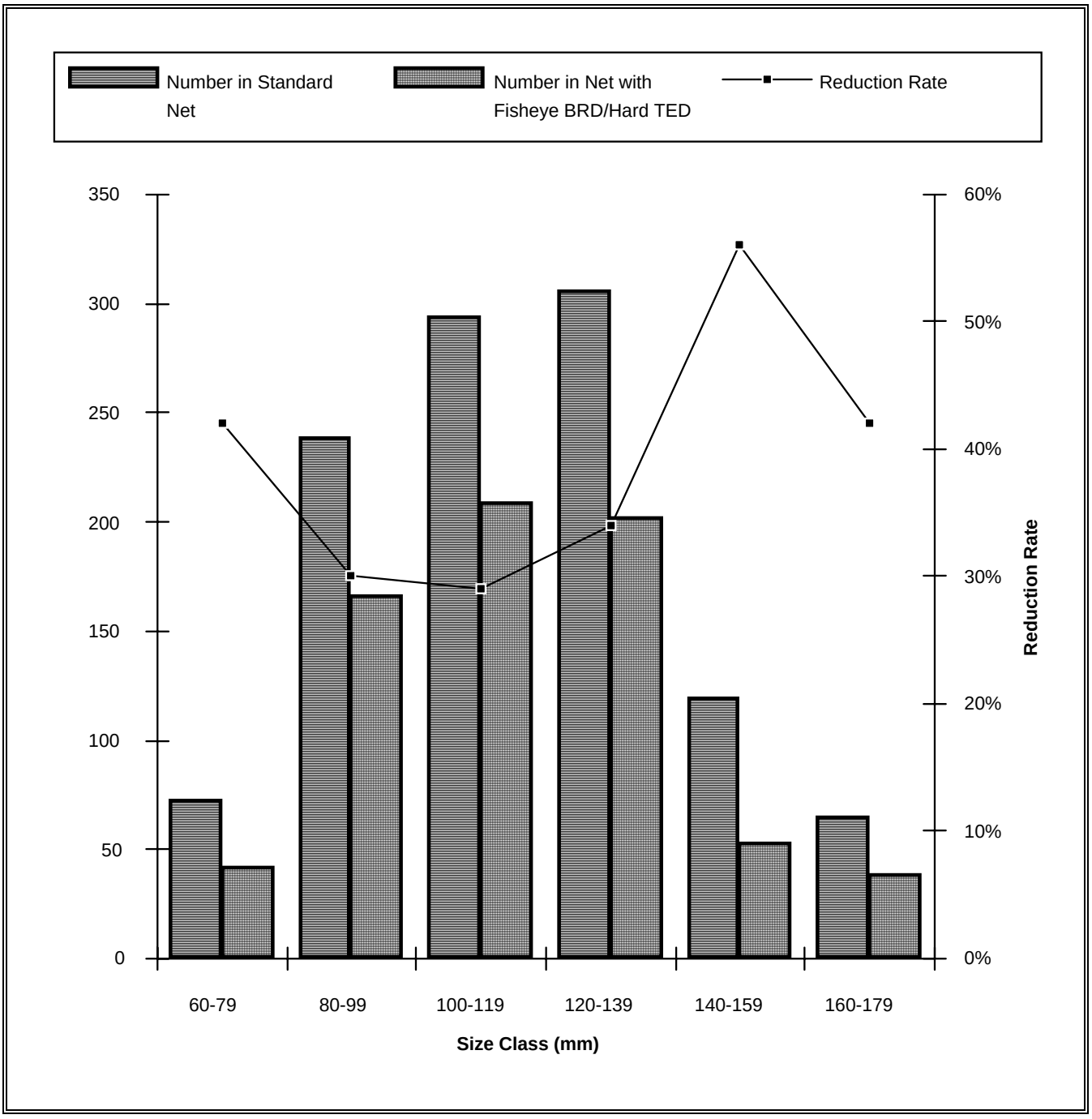


Figure 30. Reduction rates for weakfish by size class for fisheye BRDs placed in 30 mesh position with hard TEDs (Data Source: Watson, NMFS, pers. comm. 1995).

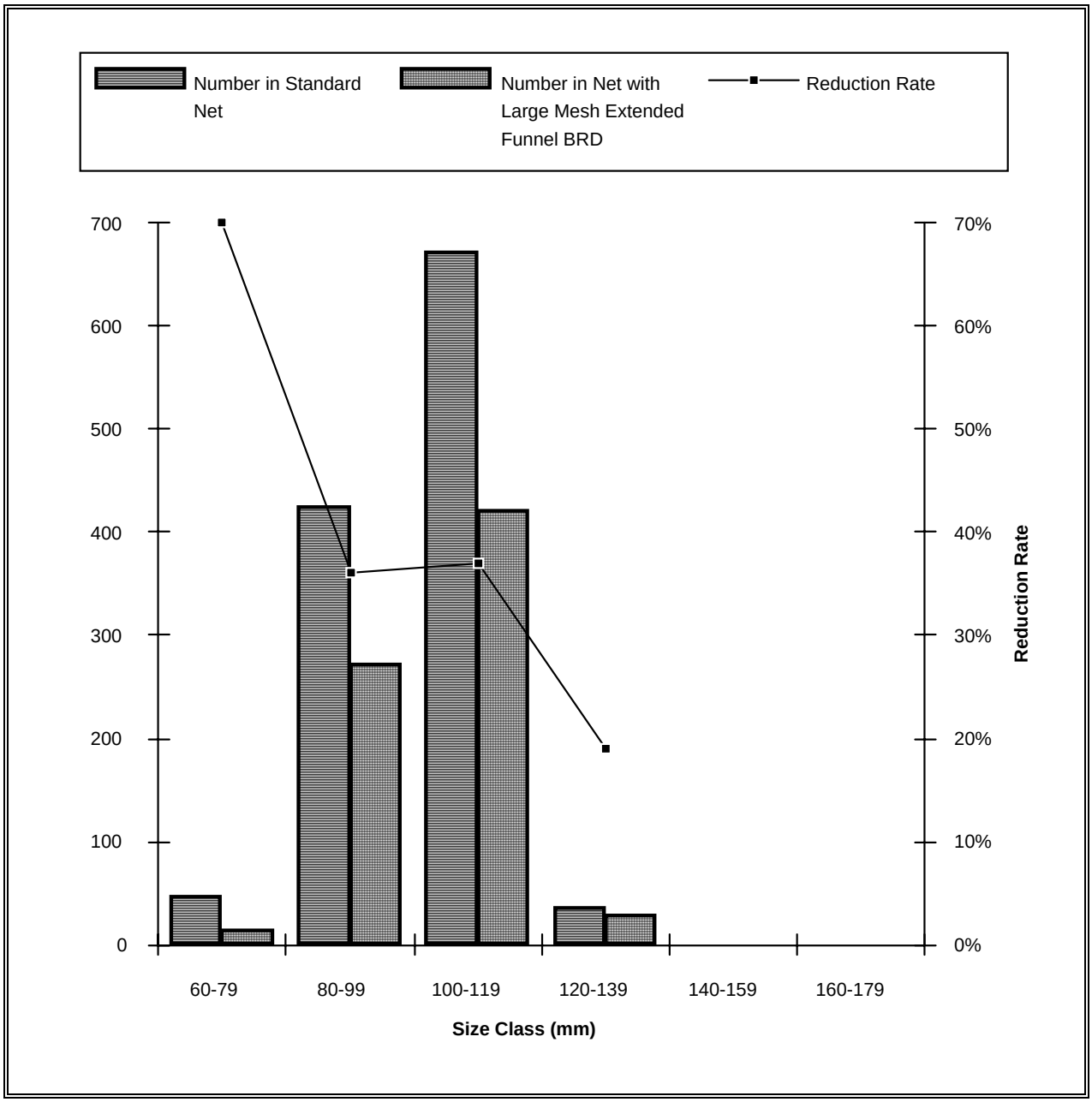


Figure 31. Reduction rates for weakfish by size class for fisheye BRDs placed in 30 mesh position with hard TEDs (Data Source: Watson, NMFS, pers. comm. 1995).

3.6.4 Recreational Fishery

Recreational shrimp harvest in the South Atlantic occurs almost exclusively in state waters. However, for certain species such as white shrimp, landings may account for a significant portion of the total annual catch. Recreational shrimpers using cast nets are only licensed in South Carolina, where a license is required to fish for shrimp over bait during a 90 day annual season. Thus, it is very difficult to estimate the total number of recreational shrimp fishermen throughout the region.

In South Carolina a license to cast net for shrimp over bait during a regulated recreational season has been required since 1988. Permit sales have continued to increase from 5,509 permits issued in 1988 to 13,366 permits issued in 1994 (Table 8). It is estimated that the recreational catch accounted for 1.91 million pounds or 34% of the total 1994 fall white shrimp harvest in South Carolina (Table 7). In 1995 close to 14,000 permits were issued. The estimated catch does not reflect recreational brown or white shrimp catch outside of the permitted season in South Carolina.

Two studies conducted in South Carolina showed in 540 casts for shrimp, only 57 fish were caught, indicating shrimping over bait produces relatively little finfish bycatch (Whitaker 1992).

In Georgia, a telephone and access intercept survey conducted in 1989 estimated that 47,723 individuals participated in the recreational cast net shrimp fishery in summer and 23,298 in fall. These cast netters were estimated to have taken 184,887 total trips and caught 576,000 pounds of shrimp, most of which were white shrimp. This accounted for 7.7% of all penaeid shrimp landed in Georgia in 1989. Also, certain estuarine zones are opened for recreational live bait shrimping with single 10 foot trawl nets. Catch limits are restrictive, limits that allow a sport baiter to retain only four quarts of live shrimp per person or eight quarts per boat. However, the number of recreational sport bait licenses (GDNR, unpublished statistics) has declined by 50% decline since 1978.

Gear used by recreational shrimp fishery in Florida consists of dip, drop, and bridge nets, seines and cast nets. Cast nets and seines can be used by recreational fishermen in specified inside waters with no size restrictions.

Table 7. Season comparisons of participants, effort, and catch parameters for South Carolina's recreational shrimp bait fishery (Data Source: Joe Moran, SCDNR, pers. comm. 1995).

	1987	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**
Permits	NA	5,509	6,644	9,703	12,005	11,571	12,984	13,366
Active permits (%)	NA	92%	82%	94%	89%	87%	91%	86%
Assistants/ permit holder	NA	2.50	2.14	2.79	2.24	2.15	2.43	2.32
Participants	21,735	17,749	17,171	34,662	34,821	31,812	40,620	38,081
Trips/permit	NA	7.0	5.7	7.8	6.6	6.1	6.8	6.0
Total trips	40,101	35,609	31,624	71,153	71,034	62,459	80,709	70,429
Quarts/trip (whole)	28.5	22.1	26.5	25.6	21.3	25.4	23.5	18.5
Total catch (million lb)	1.80	1.16	1.25	2.75	2.14	2.35	2.72	1.91
Pounds/ participant	83	65	73	79	62	74	67	50
% of fall landings	29	32	24	46	29	39	44	34

* 99.99% white shrimp

3.7 Threats to shrimp habitat

The shrimp plan (SAFMC 1993) indicated that brown shrimp were 12.5 times more numerous and white shrimp were 2.5 times more numerous in natural areas over altered areas. Subsequently, the continued loss and degradation of coastal estuarine systems may directly reduce the quality and the amount of productive shrimp habitat. Human threats to the estuarine zone and shrimp habitat include, but are not limited to, dredge and fill for land use development, impoundment of wetlands, phosphate mining, saltwater intrusion, prop dredging of seagrass, and non-point source discharge of contaminants.

The Council has adopted a general habitat policy and developed policy statements to address concerns and present recommendations on dredging and dredge disposal, plastic pollution, oil and gas exploration, development and transportation, and submerged aquatic vegetation. The text of the policy statements on dredging and dredge disposal, submerged aquatic vegetation are included in Appendix G and Appendix H respectively. Appendix I presents an updated policy statement for the exploration, production, and transportation of oil and gas.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1. Introduction

This section presents management measures and alternatives considered by the Council and the environmental consequences of management. The final supplemental environmental impact statement (FSEIS), regulatory impact review (RIR), and social impact assessment (SIA) are incorporated into the discussion under each of the proposed action items.

Each action is followed by four sub-headings: Biological Impacts, Economic Impacts, Social Impacts, and Conclusion. These are self explanatory with the first three presenting the impacts of each measure considered. The Council's rationale for taking or rejecting the actions are presented under the heading "Conclusion". The Council's preferred action is listed below the Action number and options considered by the Council are indicated under the heading "Rejected Options".

4.2. Management Options

4.2.1 ACTION 1. Add brown and pink shrimp to the fishery management unit.

The description of the management unit contained in the existing management plan will be modified to read as follows:

Management Unit. The management unit includes the populations of white, brown, pink, and rock shrimp along the U.S. Atlantic coast from the east coast of Florida, including the Atlantic side of the Keys, to the North Carolina/Virginia border. Royal red shrimp are included in the fishery but not in the management unit because regulations in this plan only address white, brown, pink, and rock shrimp at this time. Although three species of penaeid shrimp and rock shrimp are also harvested in the Gulf of Mexico, it is believed that the Atlantic and Gulf populations are essentially isolated from one another.

Biological Impacts

Brown and pink shrimp are included in the management unit to establish an all inclusive federal regulatory framework for penaeid shrimp. As this action relates to other actions in this amendment, it establishes a mechanism for reducing bycatch in the penaeid shrimp fishery and for enhancing the South Atlantic state's efforts to reduce bycatch in state waters by providing compatible regulations throughout the range of penaeid shrimp.

Economic Impacts

No direct economic impact is expected to individual vessels or to the industry by adding brown and pink shrimp to the management unit. However, it allows the Council to propose and implement management measures for the two species together with white and rock shrimp already in the management unit and to take timely actions when necessary. Successful implementation of management measures would likely result in increased net benefit to society in the long-term. In terms of reducing bycatch from the shrimp fishery, a reduction in total bycatch mortality would likely result in higher sustainable yields of those bycatch species in the long-term if those species are effectively managed.

Social Impacts

Adding brown and pink shrimp to the management unit will have few social impacts. The management framework established will provide managers, industry, and other interested parties with a mechanism to address concerns that develop regarding all aspects of the penaeid shrimp fishery. Inclusion of brown and pink shrimp in the management unit will also create the necessary conditions and regulatory framework to enforce compatible state and federal regulations. Compatible state/federal regulations will enhance enforcement. An overall benefit should be derived through the Council's ability to address problems within the fishery that have a direct or indirect effect upon other fisheries or other physical and social environments.

Although adding these species to the management unit has few direct social impacts, one of the indirect impacts may be the perception by shrimp fishermen of increasing regulation and possible negative impacts. Shrimp fishermen have had few regulations, other than areal and seasonal closures, to abide by prior to implementation of Turtle Excluder Devices (TEDs). Because of the controversial nature of TEDs and the continuing problems with sea turtle mortality, the perception of increased regulation by adding brown and pink shrimp to the management unit may be minor in comparison. However, fishermen understand that while adding a species to the management unit itself may not impact them, it is the actions that follow which will most likely have an impact.

Conclusion

The shrimp management unit currently consists of white shrimp and will include rock shrimp once Amendment 1 is implemented. However, both brown and pink shrimp are considered an integral part of the South Atlantic penaeid shrimp fishery along with white shrimp. Both species are harvested by the same fishermen using the same vessels, fishing essentially in the same areas. They may at times be harvested as part of a mixed shrimp species catch along with white shrimp. In order to effectively manage the penaeid shrimp resource, brown and pink shrimp must be included in the management unit.

Including brown and pink shrimp in the management unit is a necessary first step in creating a regulatory structure to manage the penaeid shrimp fishery. This action will therefore provide the Council with the ability to implement management measures necessary to minimize the impact of the fishery on the environment by reducing bycatch of non-target marine organisms.

Rejected Option for Action 1:

Rejected Option 1. No Action.

Biological Impacts

The Council is mandated to insure gear utilized in one fishery does not adversely impact other fishery resources under its jurisdiction. Taking no action relative to including brown and pink shrimp in the management unit at this time would compromise the Council's ability to meet this mandate. No action would jeopardize the long-term sustainability of other species under federal and interstate management.

Economic Impacts

Presently, there are no regulations under the MFCMA for managing the brown or pink shrimp fishery in the South Atlantic EEZ. However, regulations requiring shrimpers to use TEDs were approved pursuant to the Endangered Species Act. Although there are no direct economic impacts of "no action", not including both species in the management unit could result in continued bycatch mortality of other species. This would result in reduced net benefit to society on a sustained basis.

Social Impacts

No action would preclude implementation of compatible federal regulations and would hinder enforceability of state regulations. The Council needs a regulatory framework which will allow overall management of the shrimp trawl fishery.

Conclusion

The Council concluded no action would compromise the Council's ability to manage the penaeid shrimp trawl fishery, would result in continued bycatch, would reduce the effectiveness of state regulations, and would likely result in reduced net benefits to society an a sustained basis, therefore, the Council rejected taking no action.

4.2.2 ACTION 2. Define overfishing for brown and pink shrimp.

The South Atlantic brown shrimp and pink shrimp resources are overfished when annual landings fall below two standard deviations below mean landings 1957-1993 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp]. If annual landings fall below two standard deviations of the 1957-1993 mean landings for two consecutive years the Council shall convene the Shrimp Stock Assessment Panel, Shrimp Advisory Panel, and Shrimp Committee to review the causes of such declines and recommend any appropriate Council action to address the problem.

Biological Impacts

Both species are short lived and produce annual crops, thus as long as sufficient spawners survive there is no benefit from leaving an excess of the present year's crop for the next season. Therefore, in practice establishing an overfishing definition, even though mandated by the Magnuson Act, is not a very useful tool in managing annual stocks like penaeid shrimp. However, fishing effort should be at a level that will allow enough shrimp to spawn and provide for adequate recruitment for the next season's crop. The above overfishing definition would provide a mechanism that should alert the Council before a stock is overfished and annual landings fall below a certain threshold for three consecutive years.

Economic Impacts

No direct impact, however, this option should preserve the biological integrity of the stocks and could result in increased net economic benefit in the long-term.

Social Impacts

Defining overfishing has few if any social impacts. The social impacts of an overfishing definition stem from the effect of regulations that are implemented once a stock has been defined as being overfished. In addition, when the biological level of overfishing is unknown, important social impacts can follow if that level is set too high or too low with respect to the actual level where overfishing may occur. Because the level of two standard deviations below the mean harvest level from 1957-1993 chosen for brown shrimp has been reached only twice in the last 37 years and never for pink shrimp, it is unlikely that any negative social impacts would be realized. Shrimp are an annual crop and stocks have rebounded many times the year following a particularly poor harvest. Choosing this overfishing definition makes it unlikely that the Council would be required to implement a rebuilding program strictly based upon an environmental fluctuation in stock status.

Conclusion

The Council selected this option because even though the shrimp stocks fluctuate annually based mainly on prevailing environmental conditions, such a sustained decline may indicate a problem in the fishery. The Council is mandated by the Magnuson Act and associated guidelines and regulations to include a measurable definition of overfishing based on the best scientific information available. The Council concluded this definition offers biological protection and considers the social and economic impacts and therefore fulfills that mandate. Incorporating a definition for overfishing provides a mechanism to address unusual circumstances. By adopting an overfishing definition, the Council establishes a system to monitor the fishery with the input of the shrimp stock assessment panel, Shrimp Advisory Panel, and Shrimp Committee review the causes of such declines and recommend any appropriate Council action to address the problem.

Rejected Options for Action 2:

Rejected Option 1. No Action.

Biological Impacts

This option would not provide a measure whether or not pink shrimp are overfished.

Economic Impacts

Not defining overfishing could result in dissipation of economic benefits and possible overcapitalization in the fisheries.

Social Impacts

With no definition for overfishing the Council would have difficulty establishing any regulatory regime if stocks were shown to be in a state of decline for reasons other than the earlier mentioned environmental fluctuations. Negative social impacts could result if stocks became overfished.

Conclusion

The Council rejected this option because it would not meet the requirements of the Magnuson Act.

Rejected Option 2. Other Definitions Considered.

1. The South Atlantic brown shrimp and pink shrimp resource is overfished when annual landings fall below two standard deviations below mean landings 1957-1991 (2,953,549 pounds (heads on) for brown shrimp and 241,662 pounds (heads on) for pink shrimp).

2. The South Atlantic brown shrimp and pink shrimp resources are overfished when the annual landings exceed two standard deviations above mean landings 1957-1991 [13,858,423 pounds (heads on) for brown shrimp and 3,153,065 pounds (heads on) for pink shrimp].

3. Overfishing is indicated when the overwintering pink shrimp population within a state's waters declines by 80 percent or more following severe winter weather resulting in prolonged cold water temperatures.

The same discussion under Action 2 holds for biological, economic and social impacts. These definitions either were not based on the best scientific information available or were not measurable. The options based on a shorter time period do not include the most recent and comprehensive state landings data. Detailed shrimp landings are available for 1994 and 1995 in South Carolina, Georgia, and Florida. However, recent North Carolina detailed statistics are not available due to the back log of data input since the trip ticket system went into place in 1994. These options do not require landings to fall below a threshold level for three consecutive years before management measures are instituted to protect the biological integrity of the resources. One problem with this is that action could be instituted prematurely particularly when the decrease in landings could have been the result of natural cyclical fluctuations.

Temperature related mortality can be attributed to pink shrimp similar to white shrimp. However, no action could be taken in the EEZ that would benefit the stock considering pink shrimp are primarily a state fishery. This option would depend on determining if the population was impacted by a winter kill through state pink shrimp sampling programs that do not exist. Subsequently, this would not be a measurable definition.

The Advisory Panel and Plan Development Team recommended that if an overfishing definition is selected then it should be selected based on a biological minimum below which a level which would ensure good production.

As discussed under the social impacts for Action 2 an overfishing definition for shrimp must account for environmental fluctuations in stock abundance. Defining overfishing based upon an annual harvest as in definitions 1 and 2 may initiate unnecessary regulatory action which could impact harvesters and other sectors of the industry. Definition 3 would provide protection for pink shrimp after a severe reduction in stock with the implementation of an effective rebuilding program. Such a definition may not provide sufficient protection for brown shrimp because any rebuilding program would be tied to the status of pink shrimp only. Such a definition may also be too narrow in its focus to address other signs of overfishing that are attributable to aspects separate from severe winter weather.

Negative social impacts could result if either species did become overfished and no provisions for rebuilding were put in place. However, it should be restated that defining overfishing for any species which is an annual crop like shrimp is difficult and that the environmental fluctuations affecting abundance can contribute greatly to stock status.

The Council rejected these options because they were either not measurable definitions of overfishing or were not based on the best scientific information available. The Council concluded selecting a definition based on the a high level of catch was more likely to reflect good environmental condition and good shrimp production rather than a problem in the stock.

4.2.3 ACTION 3. Define optimum yield (OY) for brown and pink shrimp.

Optimum yield for the brown shrimp and pink shrimp fisheries in the South Atlantic EEZ are defined as the amount of harvest that can be taken by U.S. fisherman without annual landings falling two standard deviations below mean landings 1957-1993 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp].

Biological Impacts

Both species are short lived and produce annual crops, thus as long as sufficient spawners survive there is no benefit from leaving an excess of the present year's crop for the next season. Therefore, in practice establishing an optimum yield, even though mandated by the Magnuson Act, is not a very useful tool in managing annual stocks like penaeid shrimp.

Economic Impacts

This definition should create a stable fishery and sustained economic benefits in the long-term.

Social Impacts

The term optimum yield is used in the first national standard of the Magnuson Act to achieve the greatest overall benefit to society through the harvest of any species. It refers to the maximum harvest that can be allowed safely as modified by social, economic, and ecological factors. The difficulty in determining optimum yield comes from the limited information available within the social, economic, and ecological realms.

The social impacts of an optimum yield definition are derived from the benefits to society from the harvest of a resource at such a level. Those benefits are difficult to measure without detailed information on the harvesting, intermediate, and consumer sectors that are affected. The definition for optimum yield chosen here as the preferred option assumes that harvest levels for the past 37 years have been at or near optimum yield.

It is unlikely that choosing this definition for optimum yield will have any social impacts. The available data do not allow a more precise specification of optimum yield.

Conclusion

The Council concluded the most recent complete data set should be used to define optimum yield and that this definition meets the mandates of the Magnuson Act.

Rejected Options for Action 3:

Rejected Option 1. No Action.

Biological Impacts

The biological impacts are discussed under the proposed Actions 4 and 5.

Economic Impacts

Not defining optimum yield could lead to dissipation of economic benefits from the fishery if overfishing occurs.

Social Impacts

There would be few if any social impacts of no action.

Conclusion

The Council rejected this option because defining optimum yield is necessary to regulate the fishery. Also, defining optimum yield is a required part of a fishery management plan.

Rejected Option 2. Other Definitions Considered.

1. Optimum yield for the brown shrimp and pink shrimp fisheries in the South Atlantic EEZ are defined as the amount of harvest that can be taken by U.S. fisherman without annual landings falling below two standard deviations below mean landings 1957-1991 [2,953,549 pounds (heads on) for brown shrimp and 241,662 pounds (heads on) for pink shrimp].

2. Optimum yield for the brown shrimp and pink shrimp fisheries in the South Atlantic EEZ is defined as the amount of harvest that can be taken by U.S. fisherman without annual landings exceeding two standard deviations above mean landings 1957-1991 [13,858,423 pounds (heads on) for brown shrimp and 3,153,065 pounds (heads on) for pink shrimp].

3. Optimum yield for the brown and pink shrimp fisheries in the South Atlantic EEZ is defined as the amount of harvest that can be taken by U.S. fisherman without reducing the spawning stock below the level necessary to ensure adequate reproduction.

The Council considered a full range of alternatives for defining optimum yield. The time series 1957-1991 is not the most recent or complete data available. The Council initially desired to use the time series through 1994 but detailed shrimp data are not available for North Carolina due to back log in data processing since the implementation of the state trip ticket system. The Council

determined that landings should remain below the specified level for three consecutive years to insure that the decline was not due to either short-term environmental conditions, or a shift in effort to other fisheries.

The Council considered specifying optimum yield based on a calculation of spawning stock biomass and determined at present there was not enough information to derive estimates for either brown or pink shrimp.

The social impacts of defining optimum yield as two standard deviations below or above the mean landings for 1957-1991 would likely have few social impacts. In addition, it is unlikely that there would be any social impacts from defining optimum yield as the amount of harvest which could be taken without reducing the spawning stock below the level necessary for adequate reproduction.

The Council concluded at present there was not enough information to calculate spawning stock biomass for either brown or pink shrimp. Therefore, a definition based on this would not meet the requirements under MFCMA. The Council also concluded that the most recent complete time series (1957-1993) represents the best available data on which to base a definition of overfishing. The Council, based this decision in part on input from the Shrimp Advisory Panel and the Shrimp Plan Development Team who indicated defining optimum yield based on a drastic decline in stock abundance was more appropriate. Both groups desired the definition be based on a decline and some low level that may jeopardize the stock.

4.2.4 ACTION 4. Require the use of certified Bycatch Reduction Devices (BRDs) in all penaeid shrimp trawls in the EEZ.

Upon implementation of Amendment 2, BRDs that have passed the operational testing phase of the NMFS cooperative bycatch research program (fisheyes and large mesh extended funnel BRDs) are certified for use in the EEZ. Other BRDs will be subsequently certified according to procedures and criteria specified in Action 5. All shrimp nets (any net with mesh less than 2 $^{1}/_{2}$ inches stretched mesh - middle to middle of knot) and all shrimp nets greater than 16 feet in headrope length which are used as try (test) nets must use a certified BRD.

The Council is requiring all vessels fishing for penaeid shrimp (white, brown, and pink shrimp) in the South Atlantic EEZ use BRDs in their trawls. Fish eyes and large mesh extended funnels are approved for use in the EEZ. Configurations are specified in Appendix D.

Extensive testing by NMFS and its contractors has been conducted on 82 BRDs under a research program designed to develop BRDs that reduce finfish bycatch without incurring a significant shrimp loss. The testing protocol used during the research program is presented in Appendix J. The large mesh extended funnel (LMEF) BRD (Figure 32) consists of a funnel of small mesh netting within a cylinder of large mesh netting, held open by at least one semi-rigid hoop, and is installed in the trawl behind the turtle excluder device (TED).

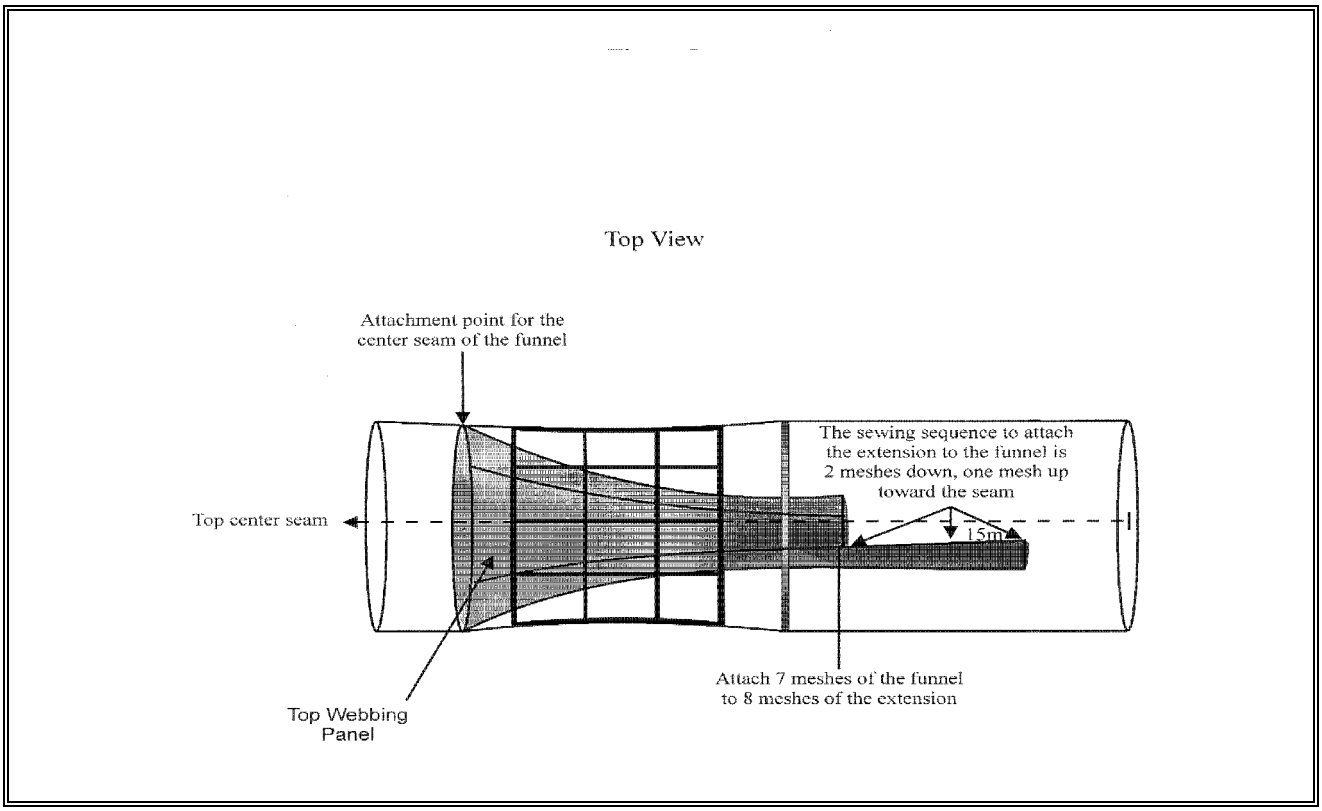


Figure 32. Large Mesh Extended Funnel BRD (Source: Watson 1995).
One side of the funnel is extended vertically to provide passage for shrimp to the codend and to create an area of reduced water flow to allow for fish escapement through the larger mesh outer netting. A legal description and instructions for installation of large mesh extended funnel BRDs are included in Appendix D.

The second BRD type is the fisheye (Figure 33). The fisheye BRD is an industry developed design which consists of a football or round shaped frame inserted into a trawl extension or cod-end to provide an opening for fish to escape (Figure 34) . The fisheye is extensively used in North Carolina to meet existing regulations requiring bycatch reduction devices in shrimp trawls in state waters. Placement is vital to the success of the fisheye and NMFS recommends the fisheye be installed in the top of the codend either in the center or 15 meshes to the side of the center and no further than 11 feet forward of the codend tie-off rings. State researchers determined that to meet the weakfish reduction target the fisheye must be placed in a manner in which the BRD length to tail bag ratio does not exceed 0.7. A legal description and instructions for installation of the fisheye BRD are included in Appendix D.

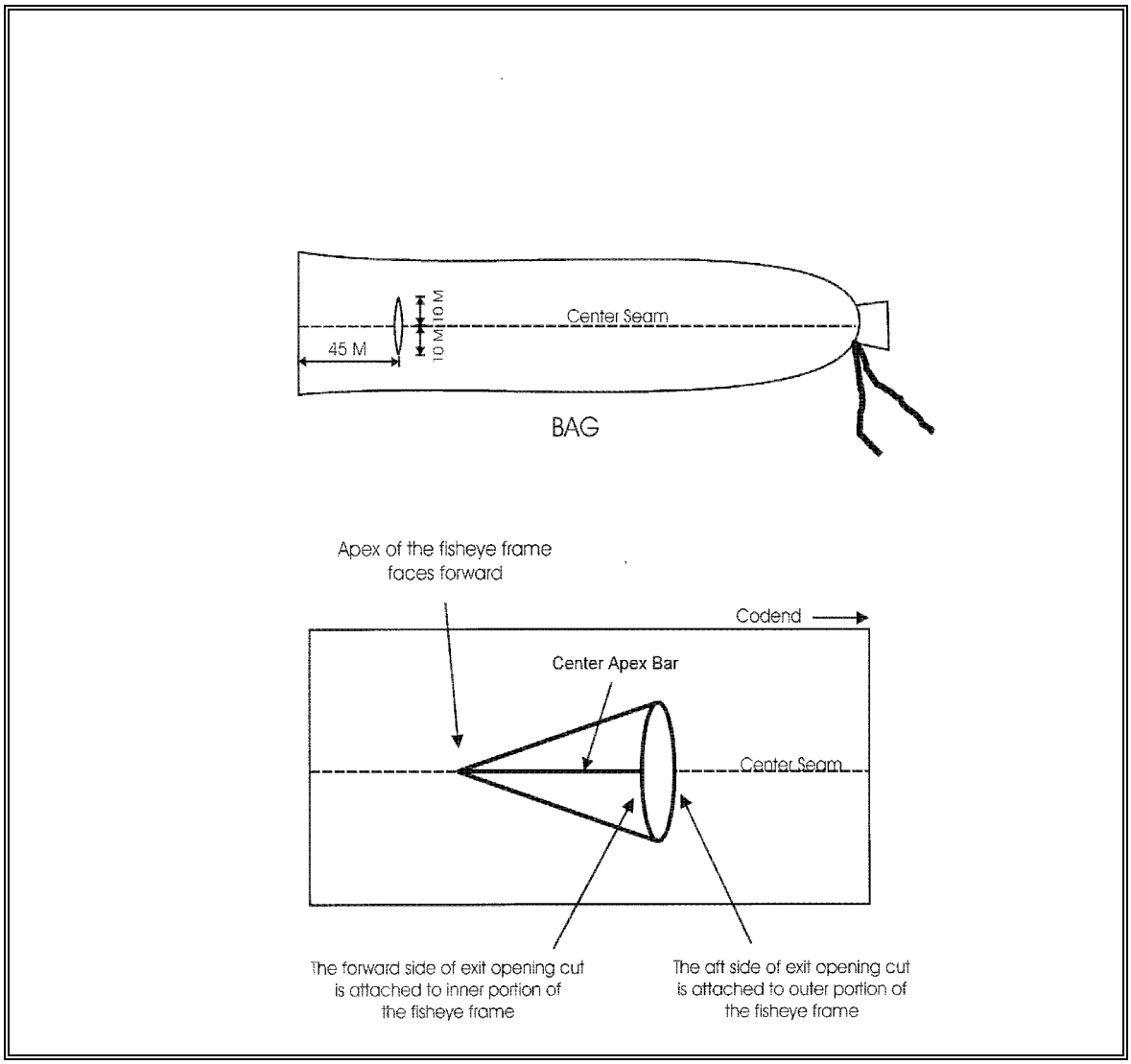


Figure 33. Fisheye bycatch reduction device (Source: Watson 1995).

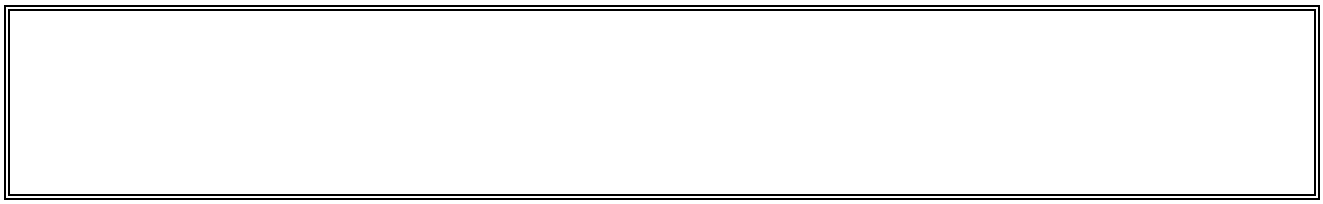


Figure 34. Fisheye position in net (Source: Watson 1995).

Biological Impacts

Trawling in the South Atlantic occurs over thousands of trips, and millions of hours in which large amounts of finfish bycatch are discarded dead. Impacts of bycatch and discards may include Alverson et al. (1994) indicated: (1) significant biological waste, (2) biological overfishing of target and bycatch species, (3) economic losses imposed on target fisheries, (4) modification of biological community structures in ecosystems, and (5) impacts on severely depleted, threatened, or endangered species. Bycatch in the South Atlantic shrimp fishery consists of up to 40% (by weight) small juvenile finfish which include species of commercial and/or recreational value (spot, croaker, Spanish mackerel, king mackerel, weakfish, etc.). If left to mature, these juvenile fish would produce significantly higher yield in weight compared to the discarded weight. The biological impacts or benefits of requiring BRDs in the EEZ, while targeted at individual species including weakfish and Spanish mackerel, are accrued by the entire ecosystem. Requiring use of BRDs will reduce finfish catch by at least 40% by weight. The reduction of total finfish may result in greater percent reductions in individual species bycatch mortality. Species benefiting the greatest will include the sciaenids (spot, croaker, and weakfish) and scombrids (Spanish mackerel and king mackerel). This reduction will provide large benefits to fisheries resources currently harvested and discarded dead as non-targeted bycatch in the shrimp trawl fishery.

One perception held by some members of the public and industry is that non-marketable species of fish are undesirable and are considered trash with no economic value. However, the systematic elimination of a species no matter how unimportant they are perceived to be, may create future problems in other fisheries. If for example, a prey species is found to be important to the overall community or provides an essential part of a managed predator species' diet, then a reduction in that prey species could translate to reduced survivorship of the recreationally and/or commercially important predator species and the negative economic impact of that reduction (Nelson et al. 1995).

An example of a modification of the marine ecosystem through continued discards can be seen with Atlantic croaker in the Gulf of Mexico. The average size and number of age classes have both been significantly reduced (Browder 1992). The other ecosystem related impact is a change in the trophic structure with the predator and prey species being transformed. It has been speculated that continued discards has resulted in decreased predator food sources and increased food for and increased numbers of scavenger species such as crabs, sharks, and catfish (Brown et al. 1991). An examination of relative biomass and relative consumption of upper trophic level predators indicated that consumption of prey

biomass by coastal pelagic predators such as mackerels is nearly as great as that by reef fish, although the biomass of coastal pelagics is smaller (Brown et al. 1991). This suggests that mackerel may be more sensitive to any decrease in prey availability. In addition, Brown et al. (1991) concluded that annual consumption of prey biomass required to support the standing stock of predator fish in the Gulf of Mexico is roughly 80 percent of the total biomass of prey. Brown et al. (1991) estimated existing fisheries to take 13 percent of the prey biomass with prey stock needing to reproduce and grow at least 93 percent of their biomass annually to maintain stability.

Additional insight into the potential impacts of continued discards on the marine ecosystem can be drawn from an energy flow model that was developed for the north central Gulf of Mexico. This model relates discards to the entire nutrient system and validated the previous predator-prey relationships elaborated by Brown et al. (1991) as energetically realistic. Researchers found that the introduction of special trawls to reduce finfish biomass did not result in a long-term effect on shrimp stocks or harvest. Browder (1992) indicated the reduction of finfish bycatch stimulated production at the lower end of the food chain and increased the quantity of biomass. Browder's (1992) findings indicate organisms contribute more to nutrient cycling by living, growing, reproducing, eating, and depositing wastes than by dying and being discarded.

The proposed measure requires all fishing vessels fishing for penaeid shrimp (white, brown, and pink shrimp) in the South Atlantic EEZ utilize BRDs in their trawls, and that such devices must reduce the bycatch component of fishing mortality for Spanish mackerel *(Scomberomorus maculatus)* and weakfish *(Cynoscion regalis)* by 50 percent or demonstrate a reduction of 40% in numbers of fish. The National Marine Fisheries Service (NMFS) Harvesting Systems Division evaluated 82 BRD designs between 1990 and 1994 and recommended 24 of these designs for proof of testing. These designs included modified trawl designs, modified TED designs, fisheye designs, funnel designs, and fish stimulator designs (Watson et al. 1993). Two of these designs: the top position fisheye, the large mesh extended funnel were approved by the gear review panel for operational evaluation based on their proof of concept phase.

During 1993 and 1994 observers documented the catches of over 400 tows in the South Atlantic Bight. Analysis of the data showed that shrimp comprised 20% of the catch, finfish 47%, and invertebrates 33% by weight. This gives a shrimp to finfish ratio of 1:2.35, much lower than that obtained for the Gulf of Mexico.

Watson (NMFS, pers. comm. 1995) provided the Council with updated data on bycatch reduction attributable to BRDs that will, upon implementation of the amendment, be certified for use in the South Atlantic EEZ. Bycatch reduction rates (kgs per hour) were compiled for two certified gear types. The large mesh extended funnel, in tests conducted by the GSAFDF and NMFS, was shown to reduce Spanish mackerel catch rate by 38%. The midsize fisheye placed in the 30 mesh position with a hard TED was shown to reduce weakfish catch rate by 40%. The large mesh extended funnel reduced weakfish by 37% and Spanish mackerel by 41% with an increase in shrimp retention. The NC Division of Marine Fisheries tested BRDs that are able to achieve a 58% reduction in catch rate for weakfish and a 34% reduction for Spanish mackerel. In addition, the Division tested the

large mesh extended funnel with great success finding it effective at reducing the catch rate of weakfish by 58% and Spanish mackerel by 83%. The sum total of operational testing with the large mesh extended funnel or the fisheye shows ranges of reduction for weakfish and Spanish mackerel, depending on time and area, of 34% to 83%.

Fishing mortality reduction analyses have not been completed for the devices that have passed the operational testing phase of the cooperative bycatch research program. However, fisheyes and large mesh extended funnels (as specified in Appendix D) meet the alternative criteria, of a 40% reduction in numbers of fish (weakfish and Spanish mackerel). Therefore, both BRDs certified for use upon implementation of the amendment (fisheyes and large mesh extended funnels), and BRDs certified in the future, will be based on consistent bycatch reduction criteria.

States have also been mandated by Amendment 3 to the ASMFC Weakfish Plan to reduce the bycatch of weakfish in state waters by 40% in numbers. BRDs that are approved for use in South Atlantic states (also fisheyes and large mesh extended funnels) reduce weakfish bycatch by at least 40% in numbers of fish.

Given the above results, requiring use of the fisheye or the large mesh extended funnel (as specified in Appendix D) will achieve at least a 40% reduction in numbers of both weakfish and Spanish mackerel subsequently reducing the bycatch component of fishing mortality for either species. However, the reduction rates vary for the recommended BRDs by species and in combination with different TED designs which also have variable reduction rates.

Economic Impacts

Alverson et al. (1994) estimate between 17.9 and 39.5 million tons (average 27.0 million) of fish are discarded globally each year in commercial fisheries. The Northwest Pacific accounts for the highest quantities of discards. Tropical shrimp trawl fisheries generate a higher proportion of discards than any other type, accounting for one third of the global total. In the Gulf of Mexico shrimp fisheries, Murray et al. (1992) report an estimated five billion croaker *(Micropogonias undulatus)*, 19 million red snapper *(Lutjanus spp.)*, and three million Spanish mackerel *(Scomberomorus cavalla)* were reported discarded in 1989. Various reports estimate the shrimp to bycatch ratio (mainly finfish) is anywhere in the range of 1:2.3 to 1:5 depending on the season, depth, and area fished. It is reported that higher bycatch rates are associated with deeper waters in the South Atlantic region.

Discards introduce a variety of biological, ecological, economic, and social costs. Reports on the analyses of the economic impact of discards on commercial fisheries indicate the economic costs are far from trivial. For example, Murawski's (1994) analysis of the Northwest Atlantic groundfish fishery found that $50 million of the income was forgone to the local trawl fisheries as a result of the premature harvest and discard of the 1987 year class of yellowtail flounder. Alverson et al. (1994) report that the value of the Gulf of Maine fisheries could double if discarding could be eliminated. Also, the aggregate Bering Sea and Gulf of Alaska losses of commercially harvested species resulting from discards has been in excess of $250 million annually. These studies provide insight into the economic

costs of discards. However, such studies are few and only provide a glimpse of the global scope of economic costs imposed by fishery discards.

Various methods have been utilized to assess the economic impact of discards. The one by Smith and Lloyd (1989) relates economic impact to the group bearing the burden of the identified costs. The authors indicate that discard impact costs are felt by those harvesting, processing, marketing, or consuming any species discarded by the target fishery. A second category, control costs, are the costs of measures taken by the target fishery to minimize its discards. The third category, management costs, are tied to measures attempting to regulate discards. While the last two categories of costs are fairly straightforward to measure, the first category, which perhaps is the most important is the most difficult to measure. This is partly because the data needed for such analyses are not readily available or in most cases have not been collected.

The following analysis utilizes this approach to the extent possible in determining the impact of the proposed measure. Recent reports estimate about 30 million pounds (heads on) of shrimp are harvested annually in the South Atlantic area, with an ex–vessel value of $60 million (NMFS & SA States 1995). Assuming the certified BRDs would likely result in a 3% reduction in shrimp catch, total annual shrimp catch in the South Atlantic could be reduced by 0.9 million pounds. This would result in a reduction in total annual revenue to the shrimp industry of $1.8 million. It should be noted the 3% reduction in shrimp retention is caused by an induced decrease in efficiency of the shrimp trawl due to installation of BRDs. Thus, the 3% shrimp that is not retained by the shrimp trawl per haul is still available for harvest. Theoretically, what this means is that each shrimp trawl could maintain its annual total catch obtained before installing the BRD by increasing annual fishing effort by 3% or by some other magnitude. However, it is unlikely that every shrimp vessel would be able to recapture this 3% by increasing fishing effort. Depending on the levels of fishing efficiency of the vessels, trawling grounds, and other factors, some vessels would recapture more than 3% thus increasing their annual total catch further, while others would recapture less than 3%. The important point is the 3% loss in retention per haul is available to the fishery and is likely to be harvested. This means the fishery as a whole would likely experience minimal if any loss in harvest as a result of using BRDs.

There is a cost to shrimpers for installing BRDs. The cost of a BRD ranges from about $20 for a fisheye design to less than $100 for the large mesh extended funnel (Watson, NMFS SEFSC, pers. comm., 1995). There are currently about 1,100 large shrimp vessels licensed in Florida, Georgia, and South Carolina. Vessels are not specifically licensed as shrimpers in North Carolina, but there are probably about 300 large vessels in the fishery that would fish in the EEZ. Thus, there are approximately 1,400 large shrimp vessels in the South Atlantic region (SEAMAP 1995). Very few small vessels and boats trawl for shrimp in Georgia and South Carolina because of restrictions on estuarine fishing areas. There are probably about 1,000 or more small vessels and boats which have a significant dependence on shrimp trawling in the South Atlantic area, most in North Carolina. However, these vessels fish mainly in state waters and are currently required to use BRDs.

Assuming only the 1,400 large vessels are capable of trawling in the South Atlantic EEZ and will be fitted with BRDs, the following costs will be incurred by the industry. If all vessels use two nets simultaneously, the total cost of installing BRDs would be approximately $56,000 at the lower end or $280,000 at the higher end. This assumes BRDs are bought from manufacturers. If they are made by the fishermen, these estimates could be reduced by as much as 50%. It has become an increasing trend now, particularly for large vessels to be fitted with four nets. If all 1,400 vessels are fitted with four nets, the cost would range from $112,000 to $560,000. However, it is unlikely this situation would occur. If 50% use two nets and the rest four nets, the cost would range from $84,000 to $420,000.

In the worst case scenario, assuming there is no recapture of the 3% loss per trawl, the reduction in annual gross profit to the industry would be in the range of $1,856,000 to $2,360,000. This assumes each vessel utilizes one set of BRDs each year. The cost would be much higher if BRDs are replaced more often. However, it is highly unlikely the 3% loss would be completely forgone by the entire industry. If the 3% loss is recaptured, then the reduction in annual gross profit to industry would range from $1,256,000 to $1,760,000 depending on the number of nets utilized by shrimp vessels. If 1% is recaptured, the reduction in annual gross profit would range from $656,000 to $1,160,000. Also, if 2% is recaptured, the reduction in annual gross profit would range from $656,000 to $1,160,000.

Management costs associated with this regulation include the costs of preparing this document, conducting scoping meetings and public hearings which is estimated at $20,000. NMFS annual technology transfer costs are estimated to be $50,000. Law enforcement costs associated with enforcing the regulations are estimated to be zero since there are existing requirements for TEDs enforcement. It should be noted that NMFS' costs could be reduced significantly if most vessels end up using BRDs reviewed and recommended by state agencies meeting the criteria specified in this amendment because NMFS will not be involved in reviewing the testing phase.

Benefits from this measure can be evaluated in terms of the potential increase in sustainable yields in those fisheries affected by the 40% reduction in numbers species interaction in terms of larger numbers within the ecosystem, and reduction in culling time for shrimpers. The two main species targeted under this measure are Spanish mackerel and weakfish. Shrimp bycatch generally consists of ages 0 and 1 fish which are known to have high natural mortality. Assuming a high percentage of those released by BRDs survive and contribute to the spawning stock, fishermen fishing for those species should benefit from increased sustainable yields at least in the short-term.

If these fisheries are operated under open access conditions, the higher sustainable yields will attract new entrants or induce present participants to increase fishing effort causing harvest levels to increase. With a relatively elastic market demand, increase in supply would not affect prices for these species and net benefits from these fisheries would increase. This assumes the fisheries would be exploited at sustainable levels. If market demand is relatively inelastic, an increase in supply will result in a price decrease and net benefits could increase, decrease, or remain the same depending on the magnitude of the price decrease.

The weakfish fishery is currently managed by season/area closures and gear restrictions. The Spanish mackerel fishery is managed by both quota and trip and bag limits. Thus, these measures, though economically inefficient, could assist in achieving optimum harvest levels.

With the reduction in bycatch, not only for weakfish and Spanish mackerel, there would be greater species interaction within the ecosystem. This would positively impact the trophic level resulting in increased biomass. The long-term effect, other things considered equal, would likely result in increased net benefit to society. No information is available to assess the magnitude of this benefit.

Benefits could accrue to shrimpers since a reduction in bycatch would likely reduce the time required for culling unwanted species (usually referred to as bycatch/discards). This will reduce bycatch of weakfish and Spanish mackerel by 40% in numbers. The net effect would likely result in a reduction in operating costs with a possible increase in net revenue per trawling operation. Although there are no data to assess the benefit to shrimpers, anecdotal information from North Carolina shrimpers already using BRDs (mainly the fisheye) indicate they favor its use for this reason.

Social Impacts

The problem of shrimp trawl bycatch reduction can be separated into two distinct issues: 1) a short-term problem of forced technological change and its immediate impact; and 2) the longer term recovery of finfish stocks and its subsequent impact. The first is assumed to be a negative impact by the industry, while the second is assumed to be a positive impact for society as a whole. Although there may be several benefits to the industry through the use of BRDs, i.e.. reduced drag and less fuel consumption; shortened culling time and less fatigue for crewmembers, these benefits have not been documented well enough to contribute to any social impact assessment. There is another implicit assumption that the long-term impacts of finfish bycatch reduction outweigh the short-term impacts upon the industry and that those short-term impacts can be lessened. Because there is so little information concerning BRDs and their implementation in the South Atlantic, this discussion will focus on the how impacts upon the industry might be lessened by examining research conducted previously about the implementation of TEDs in the South Atlantic and recent research on perceptions concerning BRDs in the Gulf of Mexico.

Although BRDs are going to be required in state waters in the South Atlantic and many shrimp fishermen are and will necessarily be using them soon, the social impacts are difficult to determine without important information about the harvesting sector. Some information regarding attitudes toward BRDs might be extrapolated from previous research on beliefs and perceptions about the use of TEDs in the South Atlantic. Although they are conceptually used for different purposes, TED design was partially derived from and once named a Trawling Efficiency Device.

Kitner (1987) conducted survey research among South Atlantic shrimp fishermen concerning their beliefs and perceptions about TEDs. Although Kitner's sample was not random and is not representative of the South Atlantic shrimp fishery as a whole, it does provide an interesting case study. She found 35 shrimpers out of 63 had previously used TEDs for more than one trip. A

comparative analysis of perceptions regarding TEDs by separating shrimpers on the basis of their previous use of TEDs is revealing.

Of those who had used a TED before, 63% said their reason for pulling a TED was to eliminate jellyballs and 31% said their reason for pulling TEDs was to eliminate miscellaneous trash, i.e., rays, horseshoe crab, etc. This finding suggests that it is likely that fishermen have experimented with BRDs and are likely to use them when needed. Ironically, the state in which Kitner found the least familiarity with TEDs was North Carolina, while shrimpers from South Carolina and Georgia were most familiar with TEDs. Today anecdotal information from North Carolina fishermen, who are currently required to use BRDs in state territorial waters, indicates that BRDs increase efficiency and are widely accepted as an improvement in trawling operations. The benefits derived from using BRDs is often lost in the controversy and should be documented and made clear.

Fishermen who have been exposed to BRDs may have substantially different views than those who have not. Kitner found that fishermen who were familiar with TEDs were less likely to see shrimp loss or loss of salable fish as a disadvantage of TED use compared to those who had not used a TED before. In addition, almost 30% of those who had used them saw no important disadvantage to using TEDs. These differences in perceptions based solely upon familiarity with TEDs have meaningful implications for the implementation of BRD regulations (Kitner 1987).

As with TEDs a major worry with BRDs will most likely be the loss of shrimp and the economic impact it will have on the fishing operation. Kitner (1987) found that when asked what are the greatest problems facing the industry shrimp fishermen were primarily concerned with financial issues. Imported shrimp, price and inflation were the top three perceived problems facing the industry at that time. TEDs were expected to exacerbate those problems and have an overall impact on the ability to meet financial obligations. A similar finding was recently described in the Gulf shrimp fishery where few fishermen perceived an ability to continue to support their family or meet boat payments with the implementation of bycatch regulations (Thomas et. al, 1995).

Thomas (1995) recommended that if BRDs were to be required that fishermen be included early in the decision making process and be given a range of technological options (BRDs) from which to choose. This parallels Kitner's (1987) finding that shrimp fishermen felt excluded from the process and were relieved to know they had a choice of TEDs and weren't going to be required to use the NMFS TED. In both cases, it seems that the uncertainty about the impacts regarding the technology affect shrimp fishermen's perceptions and their attitude toward adoption. By providing as much detailed information as possible and incorporating fishermen into the process of decision making the Council may avoid much of the controversy which surrounded the TEDs issue. Reducing the uncertainty about the impacts of BRDs will most likely enhance implementation.

This was certainly reflected in public hearings held by the Council. In almost every case shrimp fishermen who were familiar with BRDs indicated that they worked well with minimal shrimp loss. One seafood dealer polled approximately a dozen captains prior to one hearing and was told that they intend to put BRDs in their nets and thought they were a good thing. Unfortunately, public comment on BRDs was scant and although public hearings were well

attended, few individuals spoke to the issues in the FMP. There was substantial notice and public hearing documents were distributed well in advance of the hearings.

Overall, public comment on BRDs was brief and opposition to the Council's FMP was rare. The lack of substantial comment during the public hearings by the commercial shrimping industry could be indicative of resignation that, like TEDs, they will be forced to use BRDs. However, given reports from fishermen who have used BRDs it seems that the benefits derived from their use may outweigh whatever detractors the devices may have. Public hearing comments in opposition to the Council's FMP were primarily directed toward the general increase in regulations and forced technological change. Many of these comments came from fishermen in Florida who recently experienced a ban on the use of entanglement nets in state waters and others who consider BRDs and their implementation an added burden on an industry which has not recovered from TEDs and their implementation.

Because many states held hearings on the use of BRDs prior to the Council's public hearings may explain the lack of substantial participation by industry. Again, it is difficult to assess how the industry views these devices without the proper social and economic data. As mentioned before, forced technological change can often have varied impacts especially when those who are being required to change are unfamiliar with the technology. In the case of BRDs, the industry may be more familiar with these devices and therefore opposition may be slight. However, some individuals will oppose any further regulation in light of recent events concerning the use of TEDs and gear bans. Although the Council was not always involved with previously contentious issues, fishermen do not always distinguish one regulatory agency from another and will at times view all regulation with disdain. It is not always who is regulating them, but the combined effects of all regulations they consider whether from the state, regional, or federal level.

The above discussion is explicitly tied to the certification criteria and protocol. Choosing criteria that is amenable to the industry will certainly encourage acceptance. Furthermore, making the certification process of new or modified BRDs as agreeable as possible will also reduce concerns over forced technological change and the uncertainties involved.

Conclusion

The Council is requiring use of certified BRDs in all shrimp trawls to accomplish the management objective of reducing the significant bycatch of non-target finfish and invertebrates which are currently being discarded dead. The Council is also addressing the recommendation of the Southeast Enforcement Division of NMFS, that BRD requirements be year round in all waters and consistent between state and federal waters. These bycatch requirements will reduce waste of resources and improve other fisheries which are directed at these discard species. This action will also enhance existing and future state bycatch regulations by providing for development of compatible state/federal regulations. This action will specifically address the two species of immediate concern to the Council, weakfish and Spanish mackerel, and will benefit these and other resources impacted by shrimp trawling activities.

The Council is mandated to insure that gear utilized by a fishery in the South Atlantic region does not adversely impact other non-target marine resources. This action will provide significant benefits to species currently impacted by shrimp trawling activities and contribute to the long-term sustainability of other species under management. This action will reduce bycatch mortality of Spanish mackerel and weakfish and benefit these stocks. These two species are of immediate concern to the Council because the weakfish resource is severely overfished and bycatch mortality incorporated into the 1996 assessment for Spanish mackerel has resulted in a decrease in the ABC range and the SPR value. The poor condition of the weakfish resource resulted in a closure of the EEZ on December 21, 1996 through Secretarial action (DOC 1995). However, a Federal judge issued an order that overturned the moratorium on February 16, 1996. The South Atlantic States are being required by Amendment 3 to the Atlantic States Marine Fisheries Commission's Weakfish Fishery Management Plan (ASMFC 1996), to require the use of BRDs that reduce weakfish trawl bycatch by 40% by number or 50% reduction of bycatch mortality in state waters by the beginning of the 1996 shrimp season. Mandating use of BRDs in the South Atlantic shrimp fishery prosecuted in the EEZ will provide for a consistent set of bycatch conservation regulations for all areas. The adoption of compatible regulations will aid enforcement, simplify the regulatory burden on the industry, and insure the biological goal of bycatch reduction set forth in this amendment, as well in each South Atlantic state weakfish reduction plan are achieved.

Rejected Options for Action 4:

Rejected Option 1. BRD use by season or area. Require use of NMFS approved BRDs in all penaeid shrimp trawl vessels fishing in the EEZ off South Carolina, Georgia, and the Florida East Coast North of 30° N latitude; OR off North Carolina; OR off the Florida East Coast south of 30° N latitude in the months of December, January, and February; OR March, April, May, and June; OR in the months of September, October, and November.

Biological Impacts

The seasons and areas listed track the available information included in the SEAMAP bycatch characterization summary. Even though area or seasonal closures may reduce bycatch, estimating that benefit in terms of reduced numbers of fish or reduced fishing mortality is a problem given the limited shrimp effort data.

Economic Impacts

Observers' data indicate bycatch mortality and composition vary by season, areas, and depth fished. Thus, this option could reduce bycatch mortality. However, the available data do not allow for any meaningful assessment of the impact.

Social Impacts

Requiring use of BRDs for only part of the year may reduce some concern over the impacts of this technology. However, the concerns of shrimp fishermen

over the loss of shrimp and subsequent impacts on their ability to make a living will remain over any use of BRDs, no matter how limited. See social impacts under Action 4.

Conclusion

The Council rejected this option because of the transboundary nature of the penaeid shrimp fishery and the fact that implementing mandatory BRD use by area of the EEZ would create serious enforcement problems that would compromise both proposed state and federal regulations. The minimal biological benefits of requiring BRDs only in various portions of the EEZ at various times of the year would most likely not outweigh the cost of enforcing such regulations. The overall reduction would be less than with the proposed action.

Rejected Option 2. Season or area closures to all shrimp trawling in the EEZ off South Carolina, Georgia, and Florida East Coast North of 30° N latitude; OR North Carolina; OR off the Florida East Coast south of 30° N latitude in the months of December, January, and February; OR March, April, May, and June; OR in the months of September, October, and November.

Biological Impacts

Use of area and season closures to reduce bycatch from the shrimp fishery in the Gulf of Mexico was found by Hendrickson and Griffin (1993) to be ineffective and costly. In order to achieve the desired bycatch reduction of weakfish and Spanish mackerel, closures would need to be associated with the highest catch periods corresponding with periods of high catch rates of penaeid shrimp. Effort would be shifted to other areas possibly negating the effectiveness of the measure. In addition, age 0 and 1 weakfish are found year-round in many depths and any redirected effort may not reduce weakfish or Spanish mackerel bycatch.

Economic Impacts

The states would have to effect concurrent closure of their shrimp fisheries to avoid enforcement problems. A three or four month closure of the fishery in certain areas would likely cause hardship for fishermen because of lack of income for those periods. This is particularly true if they cannot engage in other fisheries. However, the available data do not allow for any meaningful assessment of the impact.

Social Impacts

It is difficult to assess the impacts of closing the EEZ. Impacts would depend upon which combination of season and area were chosen. It may be difficult to find any combination that would be acceptable to all groups of shrimp fishermen since they have such diverse harvesting patterns. While some may fish close to shore and stay in their home region, others fish both inshore and offshore and travel great distances fishing in many states. Without detailed information concerning harvest patterns it would be difficult to assess impacts. In addition, it is not known whether this option would be more acceptable than the requirement of BRDs.

Conclusion

The Council rejected this option because no additional state closures are being proposed under the state weakfish reduction plans and implementing season/area closures may result in an undue burden on the industry with minimal biological benefit. Many South Atlantic states already have seasonal closures for shrimp and any additional closures may seriously disrupt the ability of fishermen to make a living.

Rejected Option 3. No action.

Biological Impacts

The no action alternative will have negative biological impacts on weakfish and Spanish mackerel as well as the other non-targeted bycatch species in the penaeid shrimp trawl fishery. Although currently the negative impacts for most species are not quantifiable, in the case of weakfish it has been determined that at least a 40% reduction in shrimp trawl bycatch mortality is necessary to begin rebuilding the resource. The draft 1996 mackerel stock assessment report indicates trawl bycatch was factored into the calculations for the first time and has resulted in a decrease in both the ABC range and SPR value for Atlantic Spanish mackerel.

Economic Impacts

Taking no action to reduce bycatch mortality from the shrimp fishery will continue the large economic loss to other fisheries. For example, it has been determined that a 40% reduction in weakfish bycatch is required to rebuild the weakfish resource to an acceptable SPR level. The discussion under Action 4 details the economic losses as a result of shrimp trawl and other bycatch. Taking no action option would continue the further dissipation of economic rents in other fisheries.

Social Impacts

If no action is taken regarding bycatch reduction the Council will have inconsistent regulations with the states in its jurisdictional area. State regulations promulgated to reduce bycatch in the shrimp trawl fishery will be compromised and possibly rendered unenforceable. At the same time, the long-term recovery for some finfish stocks may be jeopardized and net benefits to society would be reduced. The short-term negative impacts to the shrimp industry would be eliminated. However, any positive benefits to the industry that might be realized through implementation of BRDs would be forgone.

Conclusion

The Council rejected the no action option because it will not achieve the management objective of reducing the large bycatch of non-target finfish and invertebrates which are discarded dead from the shrimp trawl fishery. No action will have negative biological impacts on weakfish and Spanish mackerel, two species of immediate concern to the Council. Also, taking no action would result in incompatible federal and state regulations to reduce shrimp trawl bycatch throughout the range of the shrimp fishery.

4.2.5 ACTION 5. Establish a framework procedure for BRD certification which specifies, and provides for modification of certification criteria and BRD testing protocol.

Bycatch reduction device certification, certification criteria, and BRD testing protocol.

The Council desires to have a rapid and effective certification process in place upon implementation of this amendment that affords a flexible and workable mechanism providing industry the chance to use conservation engineering in the development of new or modified BRDs. The NMFS Regional Director is responsible for review and certification of BRDs for use in the South Atlantic EEZ. The Council approved two procedures for certification of BRDs:

1. BRDs reviewed and recommended by state agencies meeting the bycatch reduction criteria and testing protocol specified by the Council may be used in the EEZ when certified by NMFS.
2. Certification of BRDs would be administered by NMFS with the Regional Director making the decision based on direct application to NMFS.

The following framework is for the administration and handling of BRD certification. A BRD will be certified through public notice in the Federal Register if the Regional Director determines that it met the certification criteria and testing protocol specified by the Council. The principal advantage of this process is that it should lead to faster processing of BRD certification applications. Additionally, it would help to ensure the confidentiality of BRD design specifications and testing data, if appropriate. BRDs reviewed and recommended by state agencies meeting the criteria and testing protocol specified in the amendment may be used throughout the South Atlantic EEZ when certified by NMFS.

This framework defines a consistent methodology for certifying BRDs. The framework recognizes the considerable contributions made by the South Atlantic state fishery management agencies and universities in developing and testing various BRDs for reducing the bycatch of selected finfish species. Specifically, it identifies a procedure where a state fishery management agency, a university, and other scientific investigators can work with shrimp fishermen and others in developing and testing BRDs for certification. Most finfish bycatch falls under the jurisdiction of the states in state waters and under the Council and NMFS jurisdiction in federal waters.

This BRD certification framework does not establish shrimp loss criteria. However, it is a requirement that shrimp loss data accompany any BRD application for certification. Without these data, shrimp fishermen would not be able to judge which BRD minimizes shrimp loss while at the same time satisfying bycatch reduction requirements. Additionally, the applicant should provide information on cost and operational considerations. (e.g., ease of handling and any special operating tactics such as hauling back while towing away from high seas to minimize shrimp loss."

A. BRDs reviewed and recommended by state agencies meeting the bycatch reduction criteria and testing protocol specified by the Council may be used throughout the South Atlantic EEZ when certified by NMFS.

1. The state official with principal marine management responsibility serving on the Council, or their designee, may request the Regional Director (RD) certify a BRD that has been reviewed and recommended by the state for use throughout the South Atlantic EEZ. Upon receiving the request from one or more states, the RD will evaluate data supporting the request and determine compliance with the certification criteria and testing protocol. If these data indicate the state marine fishery agency staff has reviewed and recommended the BRD based on the fact that NMFS' BRD testing protocol was used and the tested BRD meets the certification criteria, the RD will certify for use throughout the South Atlantic EEZ through publication in the Federal Register.

2. Certification of state reviewed and recommended BRDs by the Regional Director would be at the state's request. To make such a request, it is not required that State regulations already be in place. The States may adopt new BRD regulations after they are first approved by the Secretary. The state official with principal marine management responsibility, or their designee, will forward a recommendation that is based on a scientific review of the testing procedures used and the ability of the new BRD to achieve the reduction criteria. This process would insure that BRD requirements in a state's territorial sea and the EEZ are compatible to the maximum extent practicable.

3. The RD determines if the required reports and supporting materials are complete, the testing protocol was followed, and the BRD meets, or exceeds, the bycatch reduction criteria. If the applicant complies with the published criteria and testing protocol (4. a and 4. b), the RD will certify the BRD (with or without special conditions) and announce the certification by technical amendment to the list of certified BRDs.

4. The RD will consider the following factors when certifying BRDs for use in the South Atlantic EEZ. These factors include both the bycatch reduction certification criteria as well as compliance with BRD testing protocol.

   a. Bycatch Reduction Criteria for Certification of BRDs:
   Bycatch reduction criteria are established by the Council. The NMFS RD will certify new BRDs for use throughout the South Atlantic EEZ based on the following criteria:

   The BRD must reduce the bycatch component of fishing mortality for Spanish mackerel and weakfish by 50%, or demonstrate a 40% reduction in number of fish.

b. Compliance with the BRD Testing Protocol:
The RD will determine if the researcher has complied with testing parameters that include:

- sample size
- experimental design
- season and area of testing
- time of day
- required measurements
- length of tows
- description of devices in nets
- shrimp loss
- and any other relevant parameters

This list is demonstrative and not intended to be exhaustive. In addition, the statistical guidelines for the testing protocol will be developed and specified by the Council based on recommendations from the BRD Advisory Panel and after review by the Scientific and Statistical Committee.

B. Certification of BRDs will be administered by NMFS with the Regional Director making the decision based on direct application to NMFS.

1. For each new BRD proposed for certification, the applicant must submit to the Regional Director a complete report on the BRD testing. This report must contain a comprehensive description of the tests including a summary of all data collected together with copies or listings of all data collected during the certification trials, and analyses of the data according to the criteria and testing protocol. An applicant will provide photographs, drawings, and similar material describing the BRDs. In addition, any unique or special circumstances of the tests should be described.

2. The RD will consider the same factors specified above under Section A. 4. a. and 4. b. when certifying BRDs for use in the South Atlantic EEZ. These factors include both the bycatch reduction certification criteria as well as compliance with BRD testing protocol.

C. BRDs not certified and resubmission procedures:
The Regional Director will advise the applicant in writing if a BRD is not certified. This notification will explain why he did not certify the BRD and what the applicant may do to either modify the BRD or the testing procedures to improve the chances of having the BRD certified in the future. If the BRD is not certified because the RD was not supplied sufficient information, the applicant will have 60 days from notification to reapply for certification. If after receiving all needed information, the RD subsequently certifies the BRD, he will announce the certification by technical amendment to the list of certified BRD's.

D. Decertification of BRDs:

The Regional Director will decertify a BRD through notice action (publication in the Federal Register) if he determines the BRD does not satisfy the bycatch reduction criteria. Before any final action is taken to decertify a BRD, the Council, and public will be advised and provided an opportunity to comment on the advisability of the proposed decertification.

Modification of BRD testing protocol and BRD certification criteria and requirements.

A. A Bycatch Reduction Device (BRD) Advisory Panel (Panel) will be appointed by the Council. The Panel will develop and specify the statistical guidelines for the BRD testing protocol for review by the SSC and approval by the Council. The Panel will also convene at the request of the Council to consider modifying BRD testing protocol as well as make recommendations on the specific bycatch reduction criteria and management measures approved by the Council. The Panel will operate according to Council guidelines for advisory panels.

The Panel shall be composed of one shrimp or shrimping gear specialist from each South Atlantic state, two university gear specialists, one NMFS gear specialist, and one statistics expert. The Panel will address the following:

1. Modification of BRD testing protocol.
   a. The BRD testing protocol will be developed and modified when appropriate by the Council based on recommendations from the BRD panel and after review by the SSC. The testing protocol, including changes or additions, will be published in the Federal Register. The testing protocol will be established specifying the following testing parameters.

      - sample size
      - experimental design
      - season and area of testing
      - time of day
      - required measurements
      - length of tows
      - description of devices in nets
      - shrimp loss
      - and any other relevant parameters.

      This list is demonstrative and not intended to be exhaustive. In addition, the statistical guidelines for the testing protocol will be developed and specified by the Council based on recommendations from the BRD Advisory Panel and after review by the Scientific and Statistical Committee.

b. The certification tests will follow a standardized testing protocol where paired identical trawls are towed by a trawler in areas expected to contain concentrations of shrimp and the target species or species groups.

c. One of the identical trawls will contain the test BRD while the other is the control. The control and test nets must be rotated daily, or as needed, to ensure that any positioning bias is eliminated.

d. Identical TEDs are required in each of the trawls unless other arrangements have been made through the Regional Director. Individuals must also coordinate with the state fishery management agency if an exemption from TEDs in the control net is needed when testing is to occur in state waters.

e. The contents of each trawl will be separated and sorted following each paired tow. Shrimp and finfish species will be identified, counted, and weighed. Samples of selected shrimp and finfish species will be measured. Length frequencies of the target species will be obtained. Complete records will be required for all tows made for certification. Standardized sample data sheets may be obtained from the Regional Director.

f. All certification tests must be conducted with a state or NMFS approved observer on the trawler. These observers can be from NMFS, state fishery management agencies, universities, or private industry. It is the responsibility of the applicant, or his agent, conducting the certification tests to ensure that a qualified observer is on board during the tests. Compensation, if necessary, will be paid by the applicant, or his agent.

g. Before conducting any certification test, or series of tests, the appropriate state director or designee, should be notified prior to conducting tests. In the event that the applicant plans to submit the certification proposal directly to the RD, the RD should be notified in writing. This notification should identify the sponsor of the tests, when and where the tests will be conducted, the vessel or vessels involved, any special conditions or requirements of the tests, the statistical design (based on the BRD testing protocol) that will be followed, the names and affiliations of the observers, data that will be collected (based on the BRD testing protocol), a complete description of the BRDs including detailed descriptions of how the BRDs will be installed in the nets, and types of TEDs that will be used.

h. All tests must be conducted in accordance with state or federal laws unless permission has been obtained from the RD or appropriate state agency to do otherwise.

i. The appropriate state director or designee, will review the submitted notification information and if adequate will issue the applicant authority to conduct tests in state waters. These tests have to be in accordance with state fishing regulations unless the state director has authorized an exception to these regulations. Similarly, if testing in the EEZ is required, the state director will submit the applicant's notification to the RD, with the director's recommendation. Once the RD determines that the notification is complete and all applicable regulations are satisfied, the RD will issue the applicant a letter of authorization to conduct BRD testing in Federal waters. An applicant planning to use shrimp trawls for testing which do not have legal and fully operational TEDs installed, regardless of where the testing is to take place, must obtain a special permit from NMFS as authorized under the sea turtle conservation regulations.

2. Modification of bycatch reduction criteria and requirements.
   a. All bycatch reduction criteria will be specified by the Council and may be established for individual or groups of finfish species after considering target species, affected sizes and age classes, fishing mortalities including that attributed to bycatch, impacts of bycatch on directed harvests, ecological effects of bycatch, and social and economic factors related to bycatch in affected commercial and recreational fisheries. Additionally, the criteria will be based on best available information and realistic expectations of the reduction levels that can be achieved with available, or soon to be available, technology.

   b. The new criteria will be specified in terms of percentage levels of reduction in fishing mortality or numbers of fish to be achieved. These percentage levels will be for target species or species groups, and may be qualified according to:

      - age classes,
      - size classes,
      - target seasons,
      - and geographic area,
      - other relevant factors.

      Additionally, the percentage levels will be identified along with the desired statistical confidence limits.

   c. Before the Council takes final action on new criteria, the criteria will be reviewed by the Council's BRD Advisory Panel and SSC so that their comments can be considered by the Council. Of paramount concern is that criteria can be achieved without placing an unreasonable burden on the industry.

d. It is assumed that in establishing the bycatch reduction criteria, the Council will consider other factors related to the shrimp fishery such as changes in fishing effort (i.e., increases or decreases) and other state or federal management measures that may affect bycatch. Such measures could include, but are not limited to, changes in TED regulations, closed areas, and limitations on the types and sizes of trawl gear.

B. The Panel will prepare a written report on its recommendations regarding changes in testing protocol or bycatch reduction criteria or management measures for submission to the Council, by such date as may be specified by the Council. The report will contain the scientific basis for their recommendations.

C. The Council will consider the report and recommendations of the Panel and such public comments as are relevant to the Panel's submission. A Public hearing will be held at the time and place where the Council considers the report and recommendations. The Council may convene the Shrimp Advisory Panel and will convene the Scientific and Statistical Committee to review the report and provide advice prior to taking final action. The Council will consider information that surfaces separate from the BRD Advisory Panel. If changes are needed in the BRD testing protocol or bycatch reduction measures and criteria, the Council will advise the Regional Director in writing of its recommendations, accompanied by the BRD Advisory Panel report, relevant background material and public comment.

D. The RD will review the supporting rationale, public comments and other relevant information, and will make a preliminary determination as to the recommendations' consistency with the FMP objectives and provisions, the Magnuson Act, and other applicable law. If he concurs with the Council's recommendations, the RD will draft regulations in accordance with the recommendations. If the RD rejects the recommendations, he will provide written reasons for rejection. In the event the RD rejects the recommendations, existing regulations shall remain in effect until revised.

E. If the RD concurs that the Council recommendation is consistent with the goals and objectives of the plan, the National Standards, and other applicable law, he shall implement the regulation by proposed and final rule in the Federal Register.

Appropriate regulatory changes which may be implemented by the Regional Director by proposed and final rules in the Federal Register are:

1. Establish and modify BRD certification testing protocol.
2. Adopt new or modified bycatch reduction criteria.
3. Specify types of net gear required to use BRDs.
4. Redefine types of shrimp trawls or try nets.
5. Specify times and locations for required use of BRDs.

6. Modify bycatch reduction requirements.

Biological Impacts

Establishing this framework procedure which specifies BRD certification criteria, a BRD testing protocol and certification process, will provide the maximum flexibility in the development and certification of BRDs. Complying with the process will direct the development of new BRDs so they meet biological objectives for bycatch reduction established in this amendment. Fishermen will be innovative in developing new or modified BRDs which are tested under the specified protocol and achieve the required reduction in weakfish and Spanish mackerel. By allowing for criteria and other modifications to be made through framework procedure, the Council may be able to respond quickly to either the needs of the stock or the fishermen.

Mandating a reduction of the bycatch component of fishing mortality for both Spanish mackerel and weakfish will also benefit other invertebrates and finfish, especially other sciaenids (e.g., spot and croaker) and fisheries that target these species. It is estimated that commercial shrimp trawls catch only 20% by weight and 29% by number of penaeid shrimp relative to total catch including discarded bycatch of finfish (including weakfish and Spanish mackerel) invertebrates, and crustaceans (NMFS 1995).

The weakfish population is severely depleted and reduction in any fishery related effort, including mortality attributable to bycatch, will aid the stock's ability to recover. Estimates of bycatch mortality of age 0 and age 1 weakfish in a preliminary coastwide weakfish stock assessment prepared by Gibson (1995) indicated that mortality associated with shrimp bycatch was a significant source of the mortality for those age classes. Over 20 million age 0 and two million age 1 weakfish were discarded in 1994 (Gibson 1995). Although currently the negative impacts for most species are not quantifiable, in the case of weakfish it has been determined that at least a 40% reduction in shrimp trawl bycatch is necessary to begin rebuilding the resource. On the average, greater than a 40% reduction in bycatch in numbers of weakfish and Spanish mackerel will be achieved through the use of BRDs in the South Atlantic region. The Council views the establishment of this criteria as a reasonable first step in reducing bycatch in the South Atlantic shrimp trawl fishery. The Council will continue bycatch monitoring in the fishery and the development of BRDs in years to come. The Council will therefore strive to find ways to achieve higher reductions in bycatch with less impact on the industry in the future.

Economic Impacts

Establishing this procedure will provide fishermen with the opportunity to be innovative and develop new or modified BRDs which have even less shrimp loss and still achieve a 40% reduction numbers of fish or a 50% reduction in bycatch mortality for both weakfish and Spanish mackerel. Therefore, it is likely net benefits could be achieved for both species. The net benefits from both fisheries could increase in the short-term if market conditions are favorable, and in the long-term if measures are taken to insure optimal harvest levels. This action will

provide additional flexibility in management and positive net benefits to user groups can be expected.

Social Impacts

Fishermen may feel constrained by a limited choice of BRDs. Providing a certification process and criteria for approval which will allow for the maximum flexibility, yet meet standards for bycatch reduction, may enhance implementation and possibly compliance. By allowing fishermen to innovate and petition for the use of new or modified BRDs, concerns over forced technological change may be lessened. By allowing for criteria and other modifications to be made through framework procedures, the Council may be able to respond quickly to either the needs of the stock or the fishermen.

Conclusion

The Council concluded that establishing a BRD certification process and specifying criteria that reduce the bycatch component of fishing mortality are the most effective ways to achieve the long-term well being of weakfish and Spanish mackerel stocks while providing flexibility to the industry.

By establishing species related criteria for certification of BRDs, the Council will ensure that gear technology is directed toward reducing the impact of the fishery on species harvested by other sectors of the fishing public. If warranted, the Council will use the framework procedures to revise bycatch reduction criteria, testing protocol, or management measures based on new information. This will provide the Council maximum flexibility to respond to the development of new technology and allow for industry developed technology to enter the shrimp fishery expeditiously. The bycatch reduction criteria established represent a first step in reducing the impact of shrimp trawls on the environment.

Rejected Options for Action 5.

Rejected Option 1. No Action.

Biological Impacts

The Council concluded not establishing a BRD certification process or not specifying reduction criteria would preclude the development of new more innovative BRDs that may further reduce bycatch of weakfish and Spanish mackerel. Taking no action would not provide the maximum flexibility to the states and shrimp fishermen in developing new gear or modifying existing gear to comply with bycatch reduction mandates under the ASMFC weakfish plan as well as under this amendment.

Economic Impacts

This option would not provide industry and other interested parties the option of developing new and improved BRDs for use in the EEZ that could be more efficient in reducing finfish bycatch and at the same time minimizing shrimp loss. However, fishermen can (and have) voluntarily developed BRDs. They could do this in state waters under the no action alternative.

Social Impacts

The no action option would not facilitate fishermen initiating any type of innovation which might benefit the fishery and/or the industry. Fishermen are innovative and experiment with gear configurations continually. With no action they would be restricted to the select group of BRDs mentioned earlier. As discussed under the social impacts of Action 4, compliance and acceptance may be enhanced if fishermen are given the opportunity to expand the number of certified BRDs from which they can choose.

Conclusion

The Council rejected not establishing a BRD certification process, or not specifying criteria on which to base certification, because taking no action would compromise future and ongoing bycatch research intended on providing industry with new possibly more efficient gear to reduce bycatch.

Rejected Option 2. Other Criteria Considered.

1. Shrimp loss rates (by weight) must be acceptable to fishermen or be less than (3% to 20%); and minimum overall reduction rates in numbers of fish between (30% and 50%) for either: the combined number of all finfish, or a species complex (e.g. sciaenids/scombrids).

Biological Impacts

There are no biological impacts associated with establishing a certification process. Selecting various reductions in numbers of bycatch species will result in varying impacts. If total bycatch of finfish in numbers is selected as the criteria the biological impacts would be highly variable because of varying sizes, ages, and magnitude of catch. This approach would be easier to quantify in BRD testing but the differences in impact of individual BRDs which may reduce total finfish bycatch by 50%, vary significantly for example in weakfish reduction.

Selecting a 50% reduction in numbers of weakfish as the criteria may be problematic based on NMFS test results which indicate a 40% weakfish reduction in numbers may be the maximum achievable with existing BRD types. It would be more stringent than the present proposed criteria. A reduction in numbers of weakfish will probably translate to a significantly higher reduction in bycatch mortality as was seen with red snapper in the Gulf of Mexico where a 26% reduction in numbers resulted in a 40% to 50% reduction in the bycatch component of fishing mortality (Watson, NMFS, pers. comm. 1995).

Economic Impacts

BRD test results indicate that some designs could reduce bycatch mortality of weakfish by up to 40% in number. This reduction will contribute to an increase in the spawning stock and hence to the sustainable yield for weakfish. However, lack of data precludes any evaluation of economic impacts. Other criteria may not be appropriate being either unmeasurable at this time or benefits from there establishment can not be estimated at this time. Once adequate information is available, criteria may be modified if benefits from their establishment can be anticipated.

Social Impacts

Having the maximum flexibility with regard to a combination of percentage shrimp retention and finfish bycatch reduction would be advantageous to shrimp fishermen. However, bycatch reduction mortality rates may not apply to all species of finfish, so any level chosen should be attainable for all species. It is important that criteria chosen be practicable. On the other hand, the long-term recovery of some finfish stocks would not fair as well if fishermen were to prefer a device that did not reduce bycatch to the highest degree and the Council may be out of compliance with other mandates if a criterion of 50% reduction in the bycatch component or 40% in numbers of fish are not met.

Conclusion

The Council rejected other criteria until other more acceptable avenues are available on which to base a reduction in weakfish and Spanish mackerel bycatch is not appropriate at this time. The Council has not been provided guidance on how reduction in a species complex could be calculated but this is an avenue that will be further investigated in the future considering the concern over the ecosystem impacts and the decline of so many species due to discarded bycatch. The criteria established under this amendment may be modified in the future once adequate information is available to justify it.

4.3. Research Needs

The research needs listed below are specified to bycatch. Refer to the original FMP (SAFMC 1993) and Amendment 1 for other shrimp research needs.

1. Characterization of bycatch in the rock and royal red shrimp fisheries.
2. Determine the impact of shrimp trawl bycatch on the habitat and all non-target species of fish and invertebrates (i.e., include impacts on habitat and all incidental species, not just the impact on other “fishery resources”).

The following research needs are summarized from recommendations presented in the draft bycatch characterization report for the South Atlantic region (SEAMAP 1995):

1. Shrimp effort data needs to be collected to provide estimates based on time fished (or number of tows), rather than at the trip level. Future sampling needs to be improved with respect to collection of both shrimp effort and bycatch characterization data.
2. Future characterization effort should be expanded to include important strata for which no observer data is available and strata which have low sample sizes.
3. Bycatch monitoring should be conducted regularly if data are to be used in stock assessments. Conduct characterization for 5 years after implementation of state and federal bycatch reduction regulations to determine the effectiveness of the gears used, and to establish new baseline bycatch estimates for stock assessments.
4. Long-term characterization data sets should be funded.

4.4. Unavoidable Adverse Effects

There are no unavoidable adverse effects. Implementation of bycatch reduction requirements will reduce the impact of the penaeid shrimp trawl fishery in the EEZ on non-target commercial and recreationally important species as well

as benefit the entire ecosystem by reducing total discards and reducing impact on the environment.

4.5. Relationship of Short-term Uses and Long-term Productivity

Penaeid shrimp have a short life cycle that lasts from 20 to 22 months at the optimum. Generally they are thought of as an annual crop. Considering all South Atlantic shrimp vessels will be required to use BRDs in state waters at the beginning of the 1996 season, proposed measures would likely impose minor if any losses on fishermen. The level of reduction proposed is necessary to ensure the long-term productivity of the other federal and interjurisdictional fishery resources. Without such regulations, the long-term yield of Spanish mackerel, weakfish, and other non-target species may be jeopardized.

The Council weighed the likely short-term losses to fishermen against the long-term yield in target and bycatch species, and the effect of the shrimp trawl fishery on the ecosystem and concluded that the proposed action would likely result in net benefits to society.

4.6. Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of resources associated with the proposed actions. If the Council does not take action to regulate the bycatch associated with the white, brown, and pink shrimp fisheries there will be a reduction in yields of non-target bycatch species.

4.7. Effects of the Fishery on the Environment

4.7.1 Damage to Ocean and Coastal Habitats

The proposed actions are expected to have a positive effect on ocean and coastal habitats. Implementing a requirement that all vessels participating in the shrimp fishery in the South Atlantic EEZ must use BRDs will reduce the negative impact of the fishery on the environment. The fishery, as presently prosecuted, does have a significant bycatch of non-target marine species.

4.7.2 Public Health and Safety

The proposed actions, and their alternatives, are not expected to have any substantial adverse impact on public health or safety. The proposed BRDs do not increase hazards for vessels or crew safety.

4.7.3 Endangered Species and Marine Mammals

The proposed actions, and their alternatives, are not expected to adversely affect any endangered or threatened species or marine mammal populations. A Section 7 consultation was reinitiated for the southeastern shrimp fishery and the updated Endangered Species Act Biological Opinion is included in Appendix F of Amendment 1. The Secretary of Commerce regulates the shrimp fishery pursuant to the Endangered Species Act, and thereby addresses the amendment problem statement pertaining to the bycatch of threatened and endangered species in shrimp trawls.

4.7.4 Cumulative Effects

The proposed actions, and their alternatives, are not expected to result in cumulative adverse effects that could have a substantial effect on the white, brown, or pink shrimp resources or any related stocks, including sea turtles. In fact, the proposed measures will reduce and minimize the portion of fishing mortality associated with bycatch.

4.8. Public and Private Costs

Preparation, implementation, enforcement, and monitoring of this and any federal action involves expenditure of public and private resources which can be expressed as costs associated with the regulation. Costs associated with this specific action include:

Council costs of document preparation, meetings, public hearings* and information dissemination	$94,244
NMFS administrative costs of document preparation, meetings and review	$20,000
No additional NMFS law enforcement costs	$0
NMFS annual technology transfer costs	$50,000
Total	$164,244

*Costs are lower because shrimp amendment 2 and mackerel amendment 8 public hearings were held concurrently.

4.9. Effects on Small Businesses

Introduction

The purpose of the Regulatory Flexibility Act is to relieve small businesses, small organizations, and small governmental entities from burdensome regulations and record keeping requirements. The category of small entities likely to be affected by the proposed plan is that of commercial fishermen, processors, and businesses having a high dependence on penaeid shrimp. The impacts of the proposed action on these entities have been discussed in Section 4. Environmental Consequences. The following discussion of impacts focuses specifically on the consequences of the proposed actions on the mentioned business entities. A "threshold–type analysis" is done to determine whether the impacts would have a "significant or non–significant economic impact on a substantial number of small entities.". If impacts are determined to be significant, then an Initial Regulatory Flexibility Analysis (IRFA) is conducted to analyze impacts of the proposed action and alternatives on individual business entities. In addition to the analyses conducted for the Regulatory Impact Review (RIR), the IRFA provides an estimate of the number of small businesses affected, a description of the small businesses affected, and a discussion of the nature and size of the impacts.

Determination of Significant Economic Impact on a Substantial Number of Small Entities

In general, a "substantial number" of small entities is more than 20 percent of those small entities engaged in the fishery (NMFS 1992a). For the 1994 fishing season, about 1,100 large shrimp vessels were licensed in Florida,

Georgia, and South Carolina, and probably about 300 large vessels in North Carolina. In addition, there were probably 1,000 or more small vessels and boats which have a significant dependence on shrimp trawling in the South Atlantic area, most in North Carolina. However, these fish mainly in state waters.

The Small Business Administration (SBA) defines a small business in the commercial fishing activity as a firm with receipts of up to $2.0 million annually. Most holders of state licenses that have reported penaeid shrimp landings readily fall within the definition of small business. Since the proposed action will directly and indirectly affect many of these licensees, the "substantial number" criterion will be met.

Economic impacts on small business entities are considered to be "significant" if the proposed action would result in any of the following: a) reduction in annual gross revenues by more than 5 percent; b) increase in total costs of production by more than 5 percent as a result of an increase in compliance costs; c) compliance costs as a percent of sales for small entities are at least 10 percent higher than compliance costs as a percent of sales for large entities; d) capital costs of compliance represent a significant portion of capital available to small entities, considering internal cash flow and external financing capabilities; or e) as a rule of thumb, 2 percent of small business entities being forced to cease business operations (NMFS 1992a).

The Council examined the following actions and rejected options:
Add brown and pink shrimp to the FMP for the Shrimp Fishery of the South Atlantic region (Section 4.2.1).
Define overfishing for brown and pink shrimp (Section 4.2.2).
Define optimum yield (OY) for brown and pink shrimp (Section 4.2.3).
Require the use of certified BRDs in all penaeid shrimp trawls in the EEZ (Section 4.2.4).
Establish framework for BRD certification process and certification criteria for new and modified BRDs (Section 4.2.5).

Given that for each action (a) any impact would be equivalent to much less than a 5% reduction in annual gross revenues, (b) any increase in compliance costs would be less than a 5% increase in total costs of production, (c) all entities involved are small entities, (d) capital costs of compliance represent a very small portion of capital, and (e) no entities are expected to be forced to cease business operations, the Council determined that the resulting impacts will not have a significant economic impact on a substantial number of small entities.

Explanation of Why the Action is Being Considered

Refer to Section 1.0, Purpose and Need. This amendment provides a mechanism for including brown and pink shrimp in the management unit to allow implementation of measures to reduce bycatch and discards. Biological productivity of non-target bycatch species would decline in the long-term if the Secretary does not implement the measures in this amendment.

Objectives and Legal Basis for the Rule

Problems in the fishery which are addressed by Amendment 2 include: (1) Shrimp trawls have a significant bycatch of nontarget finfish and invertebrates, most of which are discarded dead. This may reduce ecosystem diversity, adversely impact other fauna, and significantly reduce yield in other fisheries directed at these discard species; (2) South Atlantic states (NC-FL) are directed under the interjurisdictional weakfish management plan to implement management measures that will reduce mortality of weakfish in shrimp trawls by 50% for the 1996 season. Lack of consistent/compatible regulations addressing bycatch in federal waters may result in unenforceable state regulations and preclude effective reduction of weakfish bycatch throughout the range of the species; and (3) There will be a compliance problem with fishermen participating in a transboundary penaeid shrimp fishery if reduction strategies are not standardized.

Management objectives addressed by Amendment 2 are: (1) Reduce the bycatch of non-target finfish and invertebrates; (2) Coordinate development of measures reducing bycatch to enhance enforceability of both state and federal regulations with South Atlantic states; and (3) Enhance compliance of trawl fishermen participating in a transboundary penaeid shrimp fishery through standardization of bycatch reduction strategies.

The Magnuson Fishery Conservation and Management Act of 1976 as amended provides the legal basis for the rule.

Demographic Analysis

Refer to the original FMP (SAFMC 1993) and Section 3.0 of this amendment. Data on fishermen are very limited.

Cost Analysis

Refer to the summary of the impacts (Sections 4.7 and 4.9) and the summary of public and private costs (Section 4.8). The Council concluded that the benefits of the preferred alternatives would likely outweigh the costs.

Competitive Effects Analysis

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

Identification of Overlapping Regulations

The proposed action does not create overlapping regulations with any state regulations or other Federal laws. In fact, these regulations are intended to compliment state regulations and enhance enforceability of state regulations.

Conclusion

The proposed measures for the South Atlantic shrimp fishery will not have a significant effect on small businesses.

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Special thanks are due Professor Robert L. Cross with the English Department at the College of Charleston, for providing valuable guidance in the final composition and editing of this document.

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SAFMC Shrimp Advisory Panel
SAFMC Habitat Advisory Panel
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South Carolina Coastal Zone Management Program
Florida Coastal Zone Management Program
Florida Department of Environmental Protection
Florida Marine Fisheries Commission
Georgia Department of Natural Resources
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Gulf of Mexico Fisheries Management Council
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Atlantic Coast Conservation Association
Atlantic States Marine Fisheries Commission
North Carolina Fisheries Association
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Southeastern Fisheries Association

7.0 OTHER APPLICABLE LAW

7.1 Vessel Safety

PL. 99-659 amended the Magnuson Act to require that a fishery management plan or amendment must consider, and may provide for, temporary adjustments (after consultation with the U.S. Coast Guard and persons utilizing the fishery) regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safety of the vessels.

No vessel will be forced to participate in the fishery under adverse weather or ocean conditions as a result of the imposition of management regulations set forth in this amendment. Therefore, no management adjustments for fishery access will be provided.

There are no fishery conditions, management measures, or regulations contained in this amendment which would result in the loss of harvesting opportunity because of crew and vessel safety effects of adverse weather or ocean conditions. No concerns have been raised by people engaged in the fishery or the Coast Guard that the proposed management measures directly or indirectly pose a hazard to crew or vessel safety under adverse weather or ocean conditions. Therefore, there are no procedures for making management adjustments in this amendment due to vessel safety problems because no person will be precluded from a fair or equitable harvesting opportunity by the management measures set forth.

There are no procedures proposed to monitor, evaluate, and report on the effects of management measures on vessel or crew safety under adverse weather or ocean conditions.

7.2 Coastal Zone Consistency

Section 307(c)(1) of the federal Coastal Zone Management Act of 1972 requires that all federal activities which directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. While it is the goal of the Council to have complementary management measures, with those of the states, federal and state administrative procedures vary and regulatory changes are unlikely to be fully instituted at the same time. Based upon the assessment of this amendment's impacts in previous sections, the Council has concluded that this amendment is an improvement to the federal management measures for penaeid shrimp, will compliment state regulations and will reduce the impact of the fishery on other species of commercial and recreational value that are caught as bycatch in normal fishing operations.

This amendment is consistent with the Coastal Zone Management Plan of Florida, South Carolina, and North Carolina to the maximum extent possible; Georgia is in the process of developing a federal Coastal Zone Management Program.

This determination has be submitted to the responsible state agencies under Section 307 of the Coastal Zone Management Act administering approved Coastal Zone Management Programs in the states of Florida, South Carolina, and North Carolina.

7.3 Endangered Species and Marine Mammal Acts

The proposed actions are not expected to have any adverse impacts on endangered or threatened species or marine mammal population. A Section 7 consultation was conducted for the original fishery management plan and it was determined the fishery management plan was not likely to jeopardize the continued existence of threatened or endangered animals or result in the destruction or adverse modification of habitat that may be critical to those species. A Section 7 consultation for the shrimp fishery was reinitiated on November 15, 1994 by the NMFS Southeast Regional Office. An updated biological assessment which determines if the southeastern shrimp fishery is having a negative impact on threatened or endangered species or marine mammals, was prepared and is included in Appendix F of Amendment 1. Appendix E presents the Emergency Response Plan implemented pursuant to the biological assessment and Appendix F summarizes 1995 Plan activities.

Listed and protected species under the Endangered Species Act (ESA) and Marine Mammals Protection Act (MMPA) and governed by the jurisdiction of NMFS include:

Whales:
(1) The northern right whale- *Eubalaena glacialis*(ENDANGERED)
(2) The humpback whale- *Magaptera novaeangliae* (ENDANGERED)
(3) The fin whale- *Balaenoptera physalus* (ENDANGERED)
(4) The sei whale- *Balaenoptera borealis* (ENDANGERED)
(5) The sperm whale- *Physeter macrocephalus* (ENDANGERED)
(6) The blue whale- *Balaenoptera musculus* (ENDANGERED)

Sea Turtles:
(1) The Kemp's ridley turtle- *Lepidochelys kempii* (ENDANGERED)
(2) The leatherback turtle- *Dermochelys coriacea*(ENDANGERED)
(3) The hawksbill turtle- *Eretmochelys imbricata*(ENDANGERED)
(4) The green turtle- *Chelonia mydas* (THREATENED/ENDANGERED)
(5) The loggerhead turtle- *Caretta caretta* (THREATENED)

Other:
(1) The manatee- *Trichechus manatus* (ENDANGERED)

7.4 Paperwork Reduction Act

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

The Council is not proposing any measures under this amendment that will involve increased paperwork and consideration under this Act.

7.5 Federalism

No federalism issues have been identified relative to the actions proposed in this amendment and associated regulations. The affected states have been closely involved in developing the proposed management measures and the principal state officials responsible for fisheries management in their respective states have not expressed federalism related opposition to adoption of this amendment.

7.6 National Environmental Policy Act

The discussion of the need for this amendment, proposed actions and alternatives, and their environmental impacts are contained in Sections 1.0 and 2.0 of this amendment/environmental assessment. A description of the affected environment is contained in Section 3.0.

The proposed amendment is a major action having significant positive impact on the quality of the marine or human environment of the South Atlantic. The proposed action will have a significant positive impact by bringing brown and pink shrimp fisheries under federal management and reducing bycatch in the entire penaeid shrimp fishery. The proposed action should not result in impacts significantly different in context or intensity from those described in the Draft Supplemental Environmental Impact Statement. A formal Environmental Impact Statement (EIS) was prepared for the shrimp fishery for the original fishery management plan (SAFMC 1993).

Mitigating measures related to proposed actions are unnecessary. No unavoidable adverse impacts on protected species, wetlands, or the marine environment are expected to result from the proposed management measures in this amendment.

The proposed regulations will further protect other species presently caught and discarded as unwanted bycatch. Overall, the benefits to the nation resulting from implementation of this amendment are greater than management costs.

Environmental Significance and Impact of the Fishery, Proposed Action and Alternatives.

The Council's preferred actions add brown and pink shrimp to the management unit, require all vessels shrimping in the South Atlantic EEZ to use certified BRDs, and require that the bycatch component of fishing mortality for Spanish mackerel and weakfish be reduced by 50%. Section 4.0 describes the Council's management measures in detail.

Section 1508.27 of the CEQ Regulations list 10 points to be considered in determining whether or not impacts are significant. The analyses presented below are based on the detailed information contained in Section 4.0 Environmental Consequences including the Regulatory Impact Review and Regulatory Flexibility Determination.

Beneficial and Adverse Impacts

There are beneficial and adverse impacts from the proposed actions. The impacts are described for each action in Section 4.0 and summarized in Section 2.0.

Requiring the use of BRDs on vessels shrimping in the South Atlantic EEZ may result in lost harvest to penaeid shrimp fishermen in the short-term. Significantly cleaner catches should occur with the proposed requirement for bycatch reduction devices. This should result in reduced sorting time and increased quality of landed product, thereby offsetting the minor loss in shrimp catch.

Information is limited to assess the benefits in dollar terms from requiring use of BRDs in the EEZ, thus it cannot be quantitatively determined whether the benefits from requiring BRDs would outweigh the costs, particularly in lost income to shrimp fishermen and processors. It is known that the bycatch reduction of total biomass, specifically finfish, will benefit both the essential ecological environment for managed species as well as the individual stocks.

Beneficial impacts are unquantifiable but requiring BRDs in the shrimp fishery will minimize the impact of the shrimp trawl fishery on other fishery resources.

Public Health or Safety

The proposed actions are not expected to have any significant adverse impact on public health or safety. BRDs designs are compact enough and should not pose a safety hazard if installed and fished correctly.

Unique Characteristics

The proposed actions have no impacts on characteristics of the area such as proximity to historic or cultural resources, park lands, wetlands, or ecologically critical areas.

Controversial Effects

The proposed actions are not expected to have significant controversial effects. Fishermen have been very much involved in developing BRD designs and the testing of BRDs. The Council has provided for extensive input by holding scoping meetings, public hearings, and by providing the opportunity for interested persons to provide written comments. During development of this FMP the Council has incorporated suggestions from the public. Additionally, states incorporate public input into their management measures which track the federal measures.

Uncertainty or Unique/Unknown Risks

The proposed actions are not expected to have any significant effects on the human environment that are highly uncertain or involve unique or unknown risks. Benefits from management cannot be quantified but the direction and relative magnitude are known and are positive. If the proposed actions were not implemented there would be a high level of uncertainty as to the future status of the species being impacted.

Precedent/Principle Setting

The proposed actions are not expected to have any significant effects by establishing precedent and do not include actions which would represent a decision in principle about a future consideration.

Relationship/Cumulative Impact

The proposed actions are not expected to have any significant cumulative negative impacts that could have a substantial effect on the shrimp resource or any related stocks, including sea turtles. In fact, the proposed measures will reduce bycatch mortality for weakfish and Spanish mackerel. The net positive cumulative impacts to the marine environment could be large in preserving ecosystem diversity and the existing trophic structure.

Historical/Cultural Impacts

The proposed actions are not expected to have any significant effects on historical sites listed in the National Register of Historic Places and will not result in any significant impacts on significant scientific, cultural, or historical resources.

Endangered/Threatened Species Impacts

The proposed actions are not expected to have any significant effects on any endangered or threatened species or marine mammal population. A Section 7 consultation for the shrimp fishery was reinitiated and a Biological Opinion prepared in November 1994 by the NMFS Southeast Regional Office. The Shrimp Emergency Response Plan, one of the components directed to be completed pursuant to the Opinion, allows the fishery to continue without jeopardy (Appendix E). A summary of 1995 Emergency Response Plan activities is included in Appendix F. The updated biological assessment which determines if the southeastern shrimp fishery is having a negative impact on threatened or endangered species or marine mammals, was prepared and is included in Appendix F of Amendment 1. NMFS has reinitiated Section 7 consultation for the Gulf of Mexico and South Atlantic shrimp fisheries.

Interaction With Existing Laws for Habitat Protection

The proposed actions are not expected to have any significant interaction which might threaten a violation of federal, state or local law or requirements imposed for the protection of the environment. The Council has adopted a number of positions that direct the protection of essential habitat. These positions are contained in the original Shrimp FMP and Environmental Impact Statement (SAFMC 1993). The Council has subsequently adopted a seagrass policy statement and presented available distribution maps of this habitat essential to shrimp stocks as well as many other managed and non-managed species.

Additional points analyzed by the Council are presented below:

Effects of the Fishery on the Environment

Section 3.0 Affected Environment discusses penaeid shrimp habitat. Section 4.0 Environmental Consequences presents the detailed information on the impacts of the proposed actions and alternatives on the environment. The implementation of the management measures proposed under this amendment

will reduce the impact of the fishery on other fishery and marine resources captured as unwanted bycatch. The required use of BRDs in the South Atlantic EEZ will limit the impact of the fishery whose discards may reduce ecosystem diversity, adversely impact other fauna, and significantly reduce yield in other fisheries directed at these discard species.

Management measures proposed in this amendment will enhance and complement state (NC-FL) conservation regulations directed under the interjurisdictional weakfish management plan to reduce mortality of weakfish in shrimp trawls by 50% for the 1996 season. In addition, Council coordination which leads to more consistent and compatible regulations addressing bycatch in federal waters would result in enforceable state regulations and facilitate effective reduction of weakfish bycatch throughout the range of the species.

Bycatch

The Council began the NEPA and MFCMA scoping process in February 1995 on bycatch in all South Atlantic shrimp fisheries. This amendment has been developed to implement regulations reducing bycatch in the South Atlantic penaeid shrimp fishery prosecuted in the EEZ while cooperatively working with the states to ensure proposed state bycatch reduction regulations achieve their conservation goals and are enforceable.

8.0 REFERENCES

Alverson, D.L., M.H. Freeberg, J.G. Pope, and S.A. Murawski. 1994. A global assessment of fisheries bycatch and discards. FAO Fisheries Technical Paper. No. 339. Rome, FAO.

ASMFC. 1996. Fisheries Management Report No.__ of the Atlantic States Marine Fisheries Commission. Draft Amendment #3 to the Fishery Management Plan for Weakfish. Public Hearing Document. January 19, 1996. 61 pp.

ASMFC. 1994. Special Report No. 33 of the Atlantic States Marine Fisheries Commission. 1994 annual review of interstate fishery management plans, October 1994, 120 pp.

Browder, J. 1992. An application of the ecosystem approach to fishery management research in the Gulf of Mexico. Proceedings of the Shrimp Trawl Bycatch Workshop. Center for Marine Conservation, Washington, DC.

Brown, B.E., J.A. Browder, J. Powers, and C.D. Goodyear. 1991. Biomass, yield models, and management strategies for the Gulf of Mexico ecosystem. p 125-163 in: K. Sherman (ed.) Biomass, Yield Models, and Management Strategies. AAAS Publication, Westview Press Bolder, CO.

DOC. 1995. Draft Environmental Impact Statement for Fishery Management Plan for Atlantic Coast Weakfish. Department of Commerce. NOAA, NMFS. 72 pp.

Gibson, M. R. 1995. Assessment of Atlantic Coast Weakfish in 1994. Draft Report to the Atlantic States Marine Fisheries Commission Weakfish Technical Committee and Management Board. September, 1995. 20pp.

Hendrickson, H.M., and W.L. Griffin. 1993. An analysis of management policies for reducing shrimp bycatch in the Gulf of Mexico. North American Journal of Fisheries Management. 13pp.

Interogranizational Committee on Guidelines and Principles. 1994. Guidelines and principles for social impact assessment. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-16, 29 pp.

Kitner, K.R. 1987. TEDS: A study of the South Atlantic shrimp fishermen's beliefs, opinions and perceptions regarding the use of turtle excluder devices. SAFMC Tech. Rep. No. 5. 47pp.

McKenna, S. 1995. Summary report on the status of bycatch reduction device development in North Carolina. Report to SAFMC Shrimp Committee Advisory Panel, and Plan Development Team. August 1, 1995. 14 pp.

Mercer, L.P. 1994. Fishery management plan for the weakfish (Cynoscion regalis) fishery. ASMFC Fisheries Management Report No. 7. North Carolina Department of Natural Resources and Community Development. Division of Marine Fisheries Special Scientific Report No. 46. 129pp.

Murawski, S.A. 1994. Opportunities in bycatch mitigation. In: R. Stroud, ed. Conserving U.S. Fisheries: A National Symposium on the Magnuson Act. National Coalition for Marine Conservation, Savannah, Georgia.

Murray, J.D., J.J. Bahen, and R.A. Rulifson. 1992. Management considerations for bycatch in the North Carolina and southeast shrimp fishery. Fisheries Vol. 17 (1):21–26.

Nelson, R, C. Koenig, F. Coleman, F.S. Kennedy, and W.H. Teehan. 1995. State agency perspective on shrimp trawl related bycatch. Proceedings of an International Workshop on Bycatch. Session 4: 29-32.

National Academy of Sciences, National Research Council. 1990. Decline of the Sea Turtles: Causes and Prevention. Washington, D.C. National Academy Press. 189pp.

NMFS. 1995. Cooperative research program addressing finfish bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries. A report to Congress. April, 1995.

NMFS. 1992a. Guidelines on regulatory analysis of fishery management actions. In Operational guidelines for fishery management plan process. NMFS Silver Spring, Maryland.

NMFS. 1992b. Shrimp trawl bycatch characterization. Sampling protocol manual for data collection. NMFS, SEFSC. March 11, 1992. 34 pp.

NMFS. 1991. Shrimp trawl bycatch research requirements. NMFS Southeast Regional Office, St. Petersburg, Florida, 66 pp.

NMFS and SA states. 1995. Commercial statistics reports from NMFS SEFSC, NCDMF, SCDNR, GDNR, and FDEP.

NCDMF. 1995. Report to ASMFC Weakfish Management Board. The effectiveness of bycatch reduction devices in North Carolina' shrimp trawl fishery. 10pp.

Smith, T.P., and D.S. Lloyd. 1989. Effects of bycatch allocations to trawl fisheries for groundfish in the Bering Sea. Report to the American Fisheries Society. Institute of Social and Economic Research, University of Alaska – Anchorage, Alaska.

SAFMC. 1996. Amendment 1 to the fishery management plan for the shrimp fishery of the South Atlantic region (rock shrimp). South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407, 196 pp.

SAFMC. 1995. Amendment 3 to the fishery management plan for coral, coral reefs and live /hard bottom habitats of the South Atlantic region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407, 237 pp.

SAFMC. 1993. Fishery Management Plan for Shrimp Fishery of the South Atlantic Region Including a Final Environmental Impact Statement and Regulatory Impact Review. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407, 300 pp.

SAFMC. 1981. Profile of the penaeid shrimp fishery in the South Atlantic. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407, 321 pp.

SEAMAP. 1995. Estimates of finfish bycatch in the South Atlantic shrimp fishery. Revised Draft for AFS review. SEAMAP work group report. 69 pp.

SCDNR. 1995. Report to ASMFC Weakfish Management Board. Weakfish bycatch reduction plan.

Thomas, J.S., Johnson, G.D. Formichella, C.M. and C.A. Riordan 1995 Gulf Shrimp Fishermen on the Eve of Bycatch Regulations: A Final Report. MARFIN #NA37FF0049.

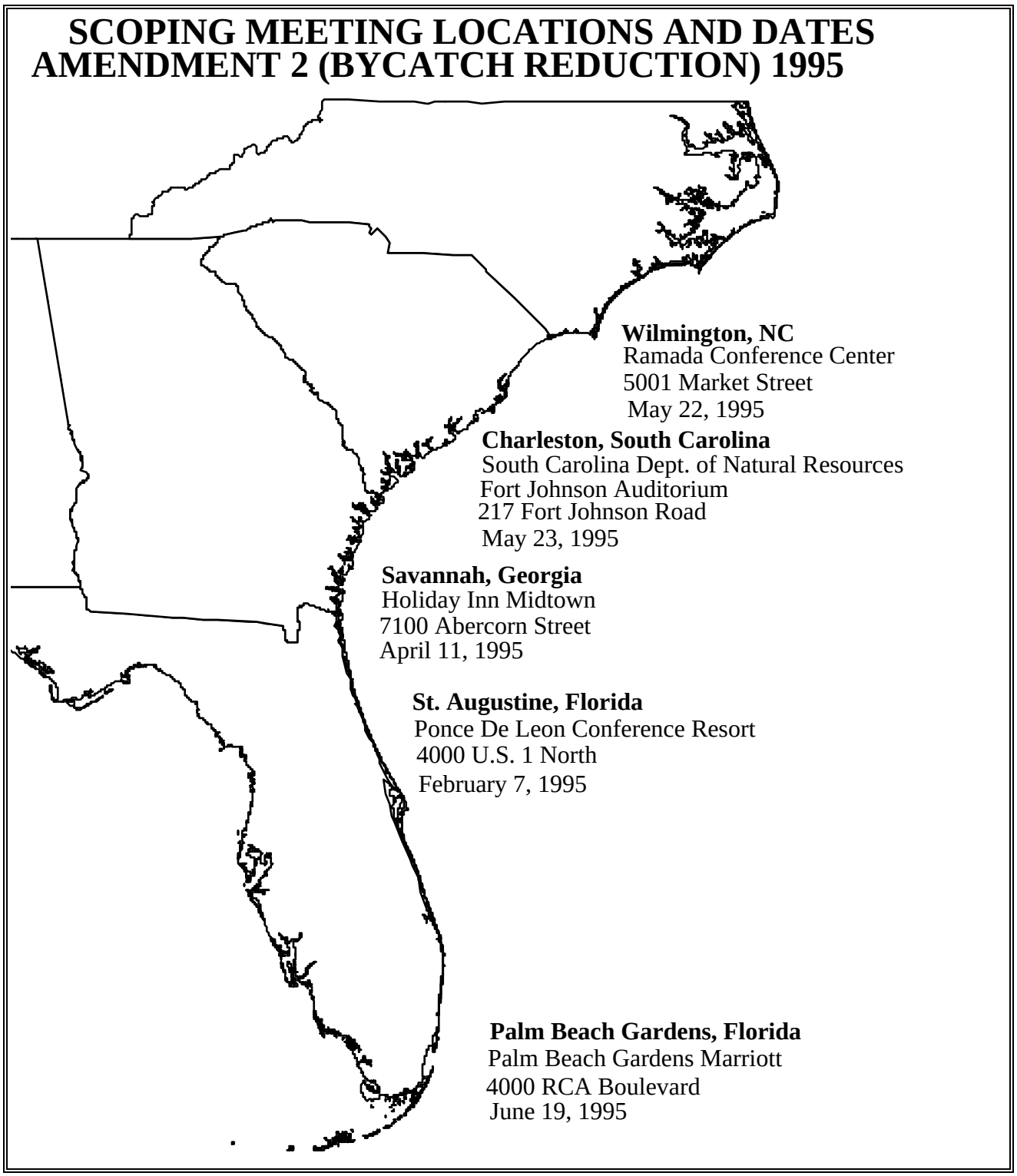
Watson, J. W., 1995. Summary report on the status of bycatch reduction device development. Presented to the South Atlantic Fishery Management Council, April 1995.

Watson, J. W., Ian Workman, Dan Foster, Charles Taylor, Arvind Shah, James Barber, and Dominy Hataway, 1993. Status report on the potential of gear modifications to reduce finfish bycatch in shrimp trawls in the Southeastern United States: 1990-1992. NOAA Technical Memorandum NMFS - SEFSC - 327, 131 pp.

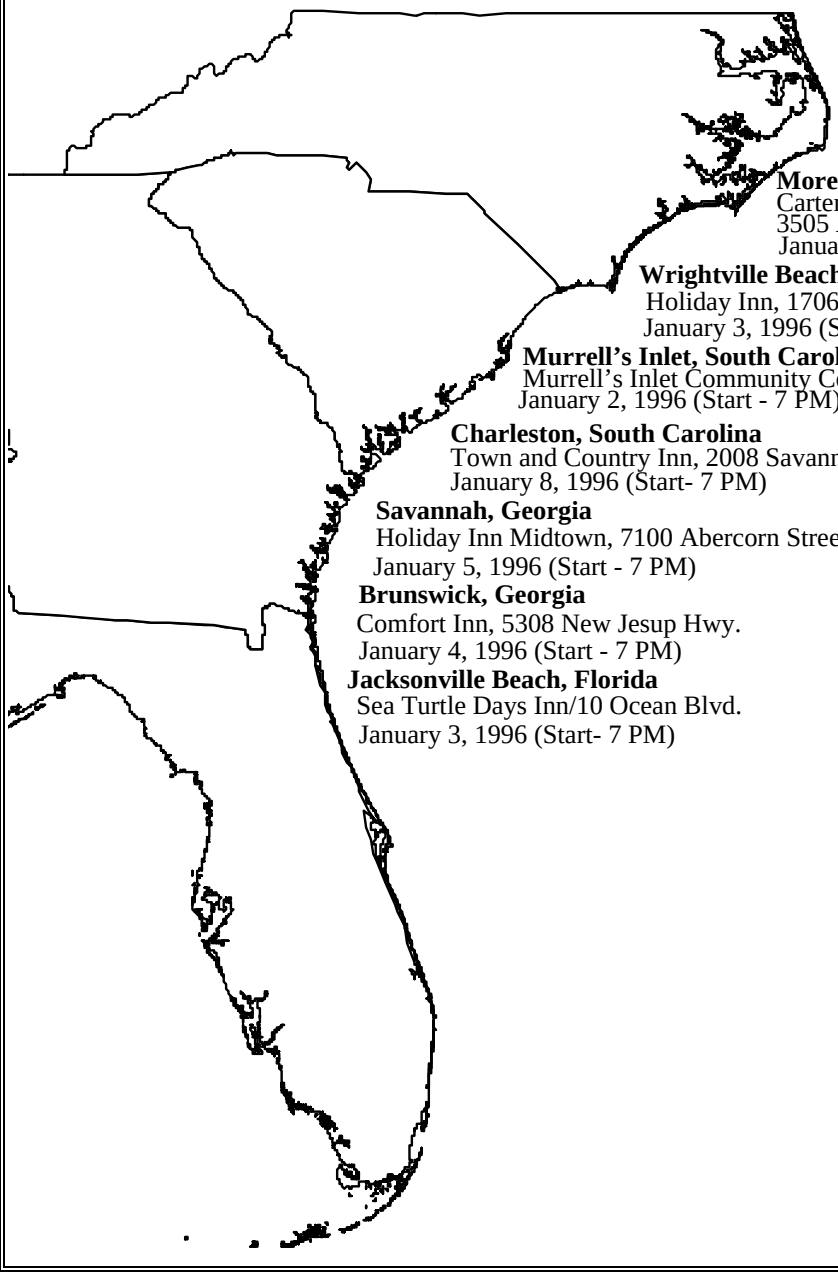
Watson, J.W., 1992. Status of Knowledge in the United States Relating Fish Behavior to the Reduction of Bycatch. Proceedings of an International Workshop on Bycatch. Session 4: 185:196.

Whitaker, D.J., 1992. Shrimp “Baitfishing” in South Carolina and preliminary notes on bycatch research. Proceedings of an International Workshop on Bycatch. Session 5: 215:228.

9.0 SCOPING MEETING AND PUBLIC HEARING LOCATIONS AND DATES.



SHRIMP AMENDMENT #2 (BYCATCH REDUCTION) 1996
PUBLIC HEARING LOCATIONS AND DATES



Morehead City, North Carolina
Carteret Community College
3505 Arendell Street
January 4, 1996 (Start- 7 PM)

Wrightville Beach, North Carolina
Holiday Inn, 1706 N. Lumina Ave.
January 3, 1996 (Start- 7 PM)

Murrell's Inlet, South Carolina
Murrell's Inlet Community Center/4450 Murrell's Inlet Rd
January 2, 1996 (Start - 7 PM)

Charleston, South Carolina
Town and Country Inn, 2008 Savannah Hwy.
January 8, 1996 (Start- 7 PM)

Savannah, Georgia
Holiday Inn Midtown, 7100 Abercorn Street
January 5, 1996 (Start - 7 PM)

Brunswick, Georgia
Comfort Inn, 5308 New Jesup Hwy.
January 4, 1996 (Start - 7 PM)

Jacksonville Beach, Florida
Sea Turtle Days Inn/10 Ocean Blvd.
January 3, 1996 (Start- 7 PM)

10.0 APPENDICES

Appendix A. Problems, management objectives, and management measures contained in the Fishery Management Plan For the Shrimp Fishery of the South Atlantic Region (Source: SAFMC 1993).

Management Unit. The management unit is the population of white shrimp occurring along the U.S. Atlantic coast from the east coast of Florida to the North Carolina/Virginia border. Brown, pink, rock, and royal red shrimp are included in the fishery but not in the management unit because regulations in this plan only address white shrimp at this time. Although all three species of penaeid shrimp are also harvested in the Gulf of Mexico, it is believed that the Atlantic and Gulf populations are essentially isolated from one another.

Optimum Yield. Optimum yield for the white shrimp fishery is defined as the amount of harvest that can be taken by U.S. fishermen without reducing the spawning stock below the level necessary to ensure adequate reproduction. Optimum yield for the rock shrimp fishery is defined as the amount of harvest that can be taken by U.S. fishermen without reducing the spawning stock below the level necessary to ensure adequate reproduction.

Definition of Overfishing. Overfishing is indicated when the overwintering white shrimp population within a state's waters declines by 80 percent or more following severe winter weather resulting in prolonged cold water temperatures. Continued fishing following such a decline may reduce the reproductive capacity of the stock affecting subsequent recruitment and would be considered overfishing. Relative population abundance will be determined by catch per unit effort (CPUE) during standardized assessment sampling.

Problems in the Fishery:

1. Unregulated commercial fishing in the EEZ on overwintering white shrimp following severe winter cold kills may reduce subsequent recruitment and fall shrimp production.

2. Shrimp trawls have a significant bycatch of nontarget finfish and invertebrates, most of which are discarded dead. This is wasteful and may significantly reduce yield in other fisheries directed at these discard species. In addition, shrimp trawls have a bycatch of endangered, threatened, and/or protected species (e.g., leatherback turtles) that are too large to be excluded by TEDs.

3. Shrimp mariculture operations may inadvertently release exotic species and/or diseases or parasites into local waters. The impact of such releases on domestic shrimp stocks is unknown, but potentially serious.

4. Habitat alteration (including beach renourishment and dredge and fill projects) and pollution in coastal areas may reduce shrimp production.

Management Objectives:

1. Eliminate fishing mortality on overwintering white shrimp following severe winter cold kills.

2. Reduce the bycatch of non-target finfish, invertebrates and threatened, protected and endangered species.

3. Encourage states with mariculture facilities to carefully monitor these operations, and require safeguards to prevent exotic species from escaping and/or diseases from entering the environment.

4. Reduce or eliminate loss and/or alteration of the habitat on which shrimp depend or degradation of water quality through pollution that would reduce shrimp production.

Management Measures:

1. States may request concurrent closure of the EEZ adjacent to their closed state waters following severe winter cold weather that results in an 80 percent or greater reduction in the population of overwintering white shrimp.

a. Exempt royal red and rock shrimp fisheries from any closures of the EEZ for the harvest of white shrimp.

b. Exempt the whiting fishery (*Menticirrhus sp.*) from a closure for white shrimp.

2. Establish a buffer zone extending seaward from shore 25 nautical miles, inside of which no trawling would be allowed with a net having less than 4 inch stretch mesh during an EEZ closure. Vessels trawling inside this buffer zone could not have a shrimp net aboard (i.e., a net with less than 4 inch stretch mesh) in the closed portion of the EEZ. Transit of the closed EEZ with less than 4 inch stretch mesh aboard while in possession of Penaeus species will be allowed provided that the nets are in an unfishable condition which is defined as stowed below deck.

Recommendations to the States:

The Council requests that the states in the South Atlantic region adopt the following recommendations:

1. The Council requests that states having shrimp mariculture facilities, either research or commercial, institute strict controls and guidelines to minimize the possibility of inadvertently introducing either exotic shrimp species or diseases into the environment. The Council further recommends that states comply with Amendment 1 to the Atlantic States Marine Fisheries Commission's (ASMFC) Procedural Plan to Control Interjurisdictional Transfers and Introductions of Shellfish.

2. The Council recommends that states minimize or eliminate alteration of shrimp habitat, especially the fragile and highly productive salt marsh and estuarine areas. These areas are considered critical habitat for all species of penaeid shrimp addressed by this FMP.

Research Recommendations:

1. Determine the possible impacts on indigenous shrimp species of inadvertent introductions of exotic shrimp species and diseases from mariculture operations, and develop methods and protocol to prevent such introductions.
2. Assess the potential utility of releasing maricultured white shrimp into the environment to supplement natural reproduction, especially following cold kills.
3. Assess the potential of controlled closures and other measures to enhance the production and economics of the South Atlantic shrimp fishery.
4. Determine the effects of beach renourishment projects on subsequent shrimp production.
5. Evaluate the impacts of habitat and water quality alteration on shrimp growth, survival, and productivity.
6. Investigate the costs, benefits, and utility of limited entry programs in the shrimp fishery of the South Atlantic.
7. Determine the impact of shrimp trawl bycatch on the habitat and all nontarget species of fish and invertebrates (i.e., expand the congressionally mandated study to include impacts on habitat and all incidental species, not just the impact on other “fishery resources”).
8. Determine the relationship between absolute number of adults (or adult biomass) and subsequent recruitment to allow development of a threshold level of population size to serve as a trigger to request a closure of the EEZ.
9. Determine the biological, economic, and sociological status of the rock shrimp fishery.

Appendix B. Commercial statistics for the shrimp fishery of the South Atlantic region.

Table 8. Shrimp landings (heads on) by species for combined South Atlantic States for 1957-94 (Source: Fishery Statistics of the U. S., NMFS, and states).

YEAR	WHITE	BROWN	PINK
57	14,712,461	9,740,164	2,157,243
58	11,092,893	9,189,603	823,467
59	12,823,217	9,434,893	2,061,216
60	18,788,016	9,038,236	1,226,496
61	14,033,378	2,495,614	1,747,822
62	12,133,840	11,532,694	2,246,510
63	7,268,926	7,646,291	554,339
64	8,119,217	7,089,616	1,948,048
65	16,304,005	8,126,345	1,687,237
66	9,162,164	11,604,450	531,230
67	10,902,104	7,978,838	1,579,998
68	16,945,887	5,919,510	1,337,930
69	16,914,732	8,570,168	1,698,021
70	12,491,819	7,133,124	860,584
71	18,810,304	9,764,458	1,914,656
72	16,635,560	7,725,422	788,277
73	18,241,500	4,502,900	1,518,395
74	13,375,345	11,088,656	2,118,261
75	15,910,990	6,713,349	2,015,874
76	14,370,316	9,651,432	1,815,048
77	4,961,115	10,605,268	801,227
78	8,913,478	6,601,646	561,297
79	17,014,249	6,643,381	1,775,764
80	14,255,717	13,368,442	1,573,926
81	8,367,526	4,372,667	871,121
82	10,517,276	8,915,451	1,749,785
83	12,404,793	6,711,871	2,699,625
84	4,088,105	7,209,256	1,391,292
85	7,727,811	16,318,704	1,438,953
86	10,968,861	8,702,924	2,101,628
87	13,086,952	3,024,169	3,139,447
88	10,909,691	8,143,448	2,929,585
89	13,851,605	9,231,743	3,393,081
90	12,613,723	8,734,294	1,651,188
91	18,272,539	10,680,481	2,699,144
92	17,232,468	5,404,936	2,261,211
93	16,643,867	9,772,739	1,862,354
*94	12,440,312	3,249,016	302,936
57-93 AVE	12,675,344	8,346,397	1,713,067

Table 9. White Shrimp landings (heads on) by species for combined South Atlantic States for 1957-94 (Source: Fishery Statistics of the U. S., NMFS and states).

YEAR	NC	SC	GA	FLEC	TOTAL
57	648,583	3,900,934	6,576,861	3,586,083	14,712,461
58	78,477	2,249,989	4,727,212	4,037,215	11,092,893
59	112,361	4,095,348	5,216,225	3,399,282	12,823,217
60	359,746	5,158,065	7,573,674	5,696,531	18,788,016
61	156,349	2,769,849	5,706,930	5,400,250	14,033,378
62	50,424	2,861,469	5,523,192	3,698,755	12,133,840
63	0	282,860	3,495,723	3,490,344	7,268,926
64	15,782	794,657	3,913,559	3,395,220	8,119,217
65	871,400	4,292,015	6,646,212	4,494,378	16,304,005
66	409,635	799,911	4,256,283	3,696,334	9,162,164
67	197,085	1,732,120	4,824,792	4,148,107	10,902,104
68	129,066	4,777,083	7,805,991	4,233,748	16,945,887
69	269,987	4,585,000	7,546,430	4,513,315	16,914,732
70	367,820	3,082,664	4,975,150	4,066,185	12,491,819
71	588,271	7,999,371	7,709,590	2,513,072	18,810,304
72	1,571,139	5,837,570	5,553,705	3,673,146	16,635,560
73	1,796,405	6,536,872	7,639,590	2,268,633	18,241,500
74	195,411	5,351,021	5,812,399	2,016,515	13,375,345
75	628,166	6,473,724	6,745,243	2,063,857	15,910,990
76	383,566	5,858,674	5,888,469	2,239,607	14,370,316
77	8,869	669,087	2,991,786	1,291,373	4,961,115
78	40,654	2,561,146	4,359,238	1,952,440	8,913,478
79	236,160	5,235,053	7,920,692	3,622,344	17,014,249
80	567,489	4,395,248	6,222,753	3,070,227	14,255,717
81	11,366	1,593,165	4,018,171	2,744,824	8,367,526
82	172,697	3,397,868	4,904,916	2,041,795	10,517,276
83	450,305	3,585,574	5,962,712	2,406,202	12,404,793
84	97,035	513,667	1,609,312	1,868,091	4,088,105
85	44,666	652,390	4,528,191	2,502,564	7,727,811
86	112,063	3,339,146	5,480,518	2,037,134	10,968,861
87	290,001	4,651,656	5,927,412	2,217,883	13,086,952
88	83,583	2,668,534	5,714,233	2,443,341	10,909,691
89	695,502	5,098,423	5,614,467	2,443,213	13,851,605
90	1,149,207	4,208,303	5,117,243	2,138,971	12,613,723
91	1,410,993	6,837,507	7,165,012	2,859,027	18,272,539
92	873,172	5,353,385	6,586,357	4,419,554	17,232,468
93	1,517,839	5,089,055	5,717,401	4,319,572	16,643,867
94	***	3,817,494	5,802,366	2,820,452	12,440,312
57-93 AVE	405,722	3,681,313	5,590,682	3,093,429	12,771,146

Table 10. Brown Shrimp landings (heads on) by species for combined South Atlantic States for 1957-94 (Source: Fishery Statistics of the U. S., NMFS and states).

YEAR	NC	SC	GA	FLEC	TOTAL
57	4,792,371	2,323,444	1,468,471	1,155,877	9,740,164
58	1,516,393	3,220,750	3,398,517	1,053,943	9,189,603
59	3,920,914	2,919,946	1,824,539	769,495	9,434,893
60	4,128,674	2,303,411	2,051,671	554,479	9,038,236
61	968,285	848,259	559,984	119,087	2,495,614
62	3,509,871	3,612,666	2,958,377	1,451,780	11,532,694
63	2,819,651	1,917,838	1,892,719	1,016,082	7,646,291
64	2,326,357	1,834,302	1,966,591	962,366	7,089,616
65	2,857,557	2,502,629	1,937,440	828,719	8,126,345
66	4,758,268	3,463,488	2,218,237	1,164,457	11,604,450
67	3,142,585	2,356,037	1,813,475	666,741	7,978,838
68	3,162,011	1,550,580	729,433	477,486	5,919,510
69	5,887,227	1,232,014	900,721	550,206	8,570,168
70	3,831,761	1,868,276	1,020,421	412,666	7,133,124
71	5,111,811	2,753,251	1,152,836	746,560	9,764,458
72	3,203,847	2,246,790	1,704,196	570,589	7,725,422
73	1,696,660	1,719,267	608,157	478,816	4,502,900
74	6,132,690	2,077,977	1,414,905	1,463,084	11,088,656
75	2,578,038	2,380,937	1,295,992	458,381	6,713,349
76	4,489,759	2,763,003	1,883,169	515,501	9,651,432
77	4,999,192	3,280,296	1,595,785	729,995	10,605,268
78	2,479,863	2,420,160	1,241,579	460,044	6,601,646
79	3,142,761	1,882,467	1,157,064	461,089	6,643,381
80	7,863,807	2,783,439	1,813,348	907,848	13,368,442
81	1,831,907	1,328,817	692,152	519,791	4,372,667
82	5,263,879	1,874,914	1,186,351	590,307	8,915,451
83	3,030,727	1,776,356	1,301,928	602,860	6,711,871
84	3,662,603	1,815,438	1,193,868	537,347	7,209,256
85	10,377,162	2,693,466	1,999,815	1,248,261	16,318,704
86	4,118,661	2,723,698	1,298,935	561,630	8,702,924
87	1,104,847	1,038,644	479,352	401,326	3,024,169
88	5,315,539	1,626,473	655,454	545,982	8,143,448
89	5,080,971	2,134,401	1,307,806	708,565	9,231,743
90	5,147,228	1,575,974	#N/A	859,393	#N/A
91	6,772,056	2,337,335	1,099,599	471,491	10,680,481
92	2,639,281	1,259,453	698,434	807,768	5,404,936
93	3,673,767	3,185,858	1,635,214	1,277,900	9,772,739
94	***	1,597,888	874,216	776,912	3,249,016
57-94 AVE	3,877,342 (Ave 57-93)	2,134,101	1,389,294	714,995	8,016,313

Table 11. Pink Shrimp landings (heads on) by species for combined South Atlantic States for 1957-94 (Source: Fishery Statistics of the U. S., NMFS, and states).

YEAR	NC	SC	GA	FLEC	TOTAL
57	2,118,722	9,120	24,770	4,632	2,157,243
58	813,074	0	10,394	0	823,467
59	2,060,976	0	240	0	2,061,216
60	1,226,496	0	0	0	1,226,496
61	1,747,822	0	0	0	1,747,822
62	2,244,342	0	0	2,168	2,246,510
63	554,339	0	0	0	554,339
64	1,936,688	0	11,360	0	1,948,048
65	1,687,237	0	0	0	1,687,237
66	529,392	0	1,838	0	531,230
67	1,579,158	0	0	840	1,579,998
68	1,324,648	6,080	0	7,202	1,337,930
69	1,697,003	0	0	1,018	1,698,021
70	854,776	0	1,240	4,568	860,584
71	1,914,656	0	0	0	1,914,656
72	788,277	0	0	0	788,277
73	1,511,318	0	0	7,077	1,518,395
74	2,112,112	0	0	6,149	2,118,261
75	1,957,416	11,458	0	47,000	2,015,874
76	1,769,419	31,587	0	14,042	1,815,048
77	592,272	47,394	6,714	154,848	801,227
78	440,413	11,877	25,498	83,510	561,297
79	1,558,913	4,438	13,336	199,077	1,775,764
80	1,371,190	9,951	18,128	174,657	1,573,926
81	711,384	13,083	16,141	130,513	871,121
82	1,590,733	17,922	26,931	114,199	1,749,785
83	2,633,067	6,557	9,800	50,201	2,699,625
84	1,277,111	29,001	6,521	78,659	1,391,292
85	1,254,851	39,079	33,821	111,202	1,438,953
86	1,904,050	20,460	43,653	133,465	2,101,628
87	3,018,230	15,106	17,549	88,562	3,139,447
88	2,711,655	40,935	42,147	134,848	2,929,585
89	3,146,334	12,845	23,967	209,935	3,393,081
90	1,502,300	1,034	12,144	135,710	1,651,188
91	2,547,989	3,996	20,867	126,292	2,699,144
92	1,995,753	8,844	10,269	246,346	2,261,212
93	1,467,430	1,270	3,565	390,089	1,862,354
94	***	11,802	4,036	287,098	302,936
57-94 AVE	1,625,717	9,312	10,130	77,471	1,679,848

Table 12. Number of North Carolina licensed vessels indicating shrimp trawl use for 1982-1993 (Source: NCDMF).

	CHARTERBOAT		FULL TIME COMMERCIAL		PART TIME COMMERCIAL		PLEASURE		TOTAL
	#	%	#	%	#	%	#	%	
82			1,758	20%	2,931	34%	4,047	46%	8,736
83			1,725	21%	2,634	32%	3,966	48%	8,325
84	2	0.03%	1,694	22%	2,632	34%	3,316	43%	7,644
85	4	0.05%	1,894	23%	2,540	31%	3,656	45%	8,094
86	3	0.04%	2,059	25%	2,510	31%	3,520	43%	8,092
87			1,879	26%	2,274	31%	3,166	43%	7,319
88			1,929	28%	2,005	29%	2,867	42%	6,801
89	2	0.03%	2,003	30%	1,910	28%	2,874	42%	6,789
90	2	0.03%	1,956	30%	1,832	28%	2,786	42%	6,576
91			2,280	32%	2,008	28%	2,812	40%	7,100
92	only a 6 month license- Data not valid								
93			2,312	37%	1,763	28%	2,218	35%	6,293

Table 13. Number of South Carolina shrimp trawl licenses from 1960-95 (Source: SCWMRD).

FISCAL YEAR JULY 1-JUNE 30)	RESIDENT	NON-RESIDENT	TOTAL
1960 - 1961	287	134	421
1961 - 1962	281	89	370
1962 - 1963	305	156	461
1963 - 1964	269	97	366
1964 - 1965	221	111	332
1965 - 1966	251	116	367
1966 - 1967	271	97	368
1967 - 1968	294	196	490
1968 - 1969	321	166	487
1969 - 1970	365	251	616
1970 - 1971	368	211	579
1971 - 1972	491	356	847
1972 - 1973	573	305	878
1973 - 1974	667	389	1056
1974 - 1975	624	336	960
1975 - 1976	689	302	991
1976 - 1977	838	291	1129
1977 - 1978	593	196	789
1978 - 1979	693	311	1004
1979 - 1980	944	454	1398
1980 - 1981	1084	418	1502
1981 - 1982	742	312	1054
1982 - 1983	828	393	1221
1983 - 1984	885	465	1350
1984 - 1985	608	206	814
1985 - 1986	644	192	836
1986 - 1987	633	285	918
1987 - 1988	655	323	978
1988 - 1989	630	254	884
1989 - 1990	586	311	897
1990 - 1991	604	355	959
1991 - 1992	599	417	1016
1992 - 1993	548	304	852
1993 - 1994	540	269	809
1994 - 1995	544	275	819

Table 14. Historic Georgia commercial shrimp trawler license data from 1979-94 (Source: GDNR).

Length Category (feet, loa)	1979	1980	1981	1982	1983	1984	1985	1986	1987
<20	511	458	227	317	345	167	212	171	127
20 - 29	284	226	114	169	199	104	148	119	91
30 - 39	64	59	42	42	52	38	45	54	58
40 - 49	87	85	59	74	69	54	64	79	51
50 - 59	128	124	93	96	96	73	84	89	80
60 - 69	219	203	141	153	166	139	154	183	133
70 - 79	135	155	76	96	107	73	81	101	93
80 - 89	7	11	6	9	9	5	15	13	11
90 - 99	0	1	0	0	1	1	0	0	0
>100	0	0	0	0	0	0	0	0	2
Unknown	36	38	7	3	2	4	17	10	12
Total	1471	1360	765	959	1046	658	820	819	658

1988	1989	1990	1991	1992	1993	1994	79-88 AVG	89-93 AVG	79-93 AVG
97	95	82	82	53	40	47	263	70	199
100	92	54	79	62	44	56	156	64	125
57	46	32	29	34	27	29	51	34	45
59	56	46	56	47	44	45	68	50	62
92	80	68	84	77	70	71	96	76	89
147	126	108	126	130	107	118	164	119	149
102	106	97	110	101	89	85	102	100	101
3	11	4	9	9	8	9	9	8	9
0	3	0	0	2	1	0	0	1	1
2	1	1	1	1	1	1	0	1	1
7	5	4	5	1	0	0	14	3	10
666	622	490	570	517	431	461	922	526	790

Table 15. Georgia commercial shrimp trawler license summary for 1994-95 license year (Source: GDNR).

Length Category (feet, loa)	FL	GA	SC	NC	UNK	Commercial Food Total	Live Bait GA	Food & Bait Total
<20'	1	46	0	0	0	47	31	78
20 - 29'	3	52	0	0	1	56	23	79
30 - 39'	4	25	0	0	0	29	0	29
40 - 49'	3	41	1	0	0	45	0	45
50 - 59'	3	57	8	3	0	71	0	71
60 - 69'	16	82	12	8	0	118	0	118
70 - 79'	17	59	5	4	0	85	0	85
80 - 89'	1	5	0	3	0	9	0	9
90 - 99'	0	0	0	0	0	0	0	0
> or = 100'	0	1	0	0	0	1	0	1
Unknown	0	0	0	0	0	0	0	0
Total	48	368	26	18	1	0 461	54	515

Appendix C. Summary of shrimp management laws and regulations for the South Atlantic States.

LAWS AND REGULATORY MEASURES	NORTH CAROLINA	SOUTH CAROLINA	GEORGIA	FLORIDA*
I. Restrictions on Gear or Method				
A. General	No regulations.	Stop netting illegal.	Stop netting illegal.	Stop netting illegal.
B. Mesh Size, Minimum	Shrimp trawls - 1 1/2" stretched mesh. Channel, float, butterfly nets, and seines 1 1/4" stretched mesh.	Seines - 1" stretched.	Seines under 12' <1" Stretched; up to 100 ft. < 1 1/4" stretched. Bait trawls 1" stretch minimum.	Region-wide mesh restrictions.
C. Net Restrictions				
(1) Channel Nets	Legal most areas.	Legal, by permit (80' max. width). Closes Nov. 15 but can be extended to Dec. 15.	Illegal, state waters.	Not allowable gear.
(2) Seines	Legal, all waters open to shrimp trawling.	Legal, all waters year round (40' max. length).	Legal, inside waters; (<12') barrier island beaches (up to 100')	Legal only in certain areas with size restrictions; recreational only.
(3) Cast Nets	Legal, all waters open to shrimp trawling. 100 per person per day in closed areas.	Legal, all waters year round. Casting over bait requires a permit and is limited to a 60-day season.	Legal, all waters year round. Baiting illegal No count size or quantity limit to date.	Legal in most inside waters; with size restrictions recreational only.
(4) Dip or drop nets, bridge nets.	No rules.	Legal all waters year round.	No provisions.	Legal in most areas with size restrictions.
(5) Butterfly, float nets.	Only in areas open to shrimp trawling.	Legal only in channel net areas and legal trawling areas.	Illegal in state waters.	Legal for live bait, food in S.E. Region
(6) Shrimp Trawls	Legal in open areas (no restrictions, except mesh size).	Legal in open areas (no size restrictions).	Legal in open areas (size limit on bait trawls 10' headrope recreational and 20' commercial bait	Legal in open areas, size restrictions in inshore and nearshore waters.
D. Catch Limits	None.	Recreational fishery limit is 48 qt. (heads on).	Recreational live bait shrimp trawling, personal use. 2 qts.pers up to 4 qts/boat commercial possession limit of 50 qts/boat and 200 qts a facility.	No commercial. Recreational 5 gal. head-on.

*Additional restriction July 1, 1995 due to the net ban.

Appendix C. Summary of shrimp management laws and regulations for the South Atlantic States (Cont.).

LAWS AND REGULATORY MEASURES	NORTH CAROLINA	SOUTH CAROLINA	GEORGIA	FLORIDA*
II. Trawling Season(s)	Set by Division and based on shrimp size and abundance of juveniles of other species of economic importance.	Offshore - May 15 - Dec. 31. (DNR Board may open or close any area by discretion). Winyah and N. Santee Bays may be opened by Board.	Food shrimp: Offshore - on or after June 1 - Dec. 31, provided count is 45 or above. Also may open in Jan., Feb. if count is below 50. Must meet criteria of wildlife research and management mandated in law.	Set by Marine Fisheries Commission. Closed to trawling April and May.
III. Trawling Areas, Legal	Specified by regulation (legal in off-shore waters, most inside waters). Most tributaries to sounds and rivers closed.	Two bays, offshore waters only.	Commercial: Nearshore waters only in recent years. Six sounds are infrequently opened on a conditional basis. Recreational and Commercial Bait: Only in designated bait collection areas in rivers and creeks.	Specific area designated as sanctuaries closed permanently to trawling.
IV. Shrimp Count Law (Minimum)	No provisions.	No provisions.	Commercial Food Shrimping: 45/lb. heads-on (50/lb. Jan., Feb.) (to open) No count size for live bait shrimp.	Varies by region. Where required: 47 heads on/70 heads off.
V. Bait Shrimp Trawling	Only in areas open to shrimp trawling.	No specific provisions; trawling illegal in restricted areas.	Legal in designated zones. Recreational - 10' trawl (max.). Commercial 20' trawl (max.).	Legal in most waters, under restrictions and permit requirements. Push nets and wing nets legal in some areas. Gear configuration restrictions mesh 1" bag, 1 1/4" body.
VI. Other	Trawling prohibited between one hour after sunset Fri. to one hour before sunset Sun.	Night trawling illegal opening- Sept. 15: 5:00 am to 9:00 pm Sept. 16- closing : 6:00 am to 7:00 pm.	Night trawling illegal, for commercial food shrimping 8 pm to 5 am EST.	Night shrimping unlawful except during June - August.

*Additional restriction July 1, 1995 due to the net ban.

Appendix D. Technical specifications for installation of large mesh, extended funnel, and fisheye bycatch reduction devices (Watson, NMFS, pers. comm. 1995).

Appendix E. Shrimp emergency response plan (Source: NMFS 1995).

Appendix F. 1995 shrimp emergency response plan activities (Source: NMFS 1996).

Appendix G. SAFMC Policy Statement for Protection and Enhancement of Marine Submerged Aquatic Vegetation (SAV) Habitat.

The South Atlantic Fishery Management Council (SAFMC) and the Habitat and Environmental Protection Advisory Panel has considered the issue of the decline of Marine Submerged Aquatic Vegetation SAV (or seagrass) habitat in Florida and North Carolina as it relates to Council habitat policy. Subsequently, the Council's Habitat Committee requested that the Habitat Advisory Panel develop the following policy statement to support Council efforts to protect and enhance habitat for managed species.

Description and Function:

In the South Atlantic region, SAV is found primarily in the states of Florida and North Carolina where environmental conditions are ideal for the propagation of seagrasses. The distribution of SAV habitat is indicative of its importance to economically important fisheries: in North Carolina, total SAV coverage is estimated to be 200,000 acres; in Florida, the total SAV coverage is estimated to be 2.9 million acres. SAV serves several valuable ecological functions in the marine systems where it occurs. Food and shelter afforded by SAV result in a complex and dynamic system that provides a primary nursery habitat for various organisms that is important both to the overall system ecology as well as to commercial and recreationally important fisheries. SAV habitat is valuable both ecologically as well as economically; as feeding, breeding, and nursery ground for numerous estuarine species, SAV provides for rich ecosystem diversity. Further, a number of fish and shellfish species, around which is built several vigorous commercial and recreational fisheries, rely on SAV habitat for a least a portion of their life cycles. For more detailed discussion, please see Appendix 1.

Status:

SAV habitat is currently threatened by the cumulative effects of overpopulation and consequent commercial development and recreation in the coastal zone. The major anthropogenic threats to SAV habitat include:

(1) mechanical damage due to:
- (a) propeller damage from boats,
- (b) bottom-disturbing fish harvesting techniques,
- (c) dredging and filling;

(2) biological degradation due to:
- (a) water quality deterioration by modification of temperature, salinity, and light attenuation regimes;
- (b) addition of organic and inorganic chemicals.

SAV habitat in both Florida and North Carolina has experienced declines from both natural and anthropogenic causes. However, conservation measures taken by state and federal agencies have produced positive results. The national

Marine Fisheries Service has produced maps of SAV habitat in the Albemarle-Pamlico Sound region of North Carolina to help stem the loss of this critical habitat. The threats to this habitat and the potential for successful conservation measures highlight the need to address the decline of SAV. Therefore, the South Atlantic Council recommends immediate and direct action be taken to stem the loss of this essential habitat. For more detailed discussion, please see Appendix 2.

Management:

Conservation of existing SAV habitat is critical to the maintenance of the living resources that depend on these systems. A number of federal and state laws and regulations apply to modifications, either direct or indirect, to SAV habitat. However, to date the state and federal regulatory process has accomplished little to slow the decline of SAV habitat. Furthermore, mitigative measures to restore or enhance impacted SAV have met with little success. These habitats cannot be readily restored; the South Atlantic Council is not aware of any seagrass restoration project that has ever prevented a net loss of SAV habitat. It has been difficult to implement effective resource management initiatives to preserve existing seagrass habitat resources due to the lack of adequate documentation and specific cause/effect relationships. (for more detailed discussion, please see Appendix 3)

Because restoration/enhancement efforts have not met with success, the South Atlantic Council considers it imperative to take a directed and purposeful action to protect remaining SAV habitat. The South Atlantic Council strongly recommends that a comprehensive strategy to address the disturbing decline in SAV habitat in the South Atlantic region. Furthermore, as a stepping stone to such a long-term protection strategy, the South Atlantic Council recommends that a reliable status and trend survey be adopted to verify the scale of local declines of SAV.

The South Atlantic Council will address the decline of SAV, and consider establishing specific plans for revitalizing the SAV resources of the South Atlantic region. This may be achieved by the following integrated triad of efforts:

Planning:

- The Council promotes regional planning which treats SAV as a integral part of an ecological system.

- The Council supports comprehensive planning initiatives as well as interagency coordination and planning on SAV matters.

- The Council recommends that the Habitat Advisory Panel members actively seek to involve the Council in the review of projects which will impact, either directly or indirectly, SAV habitat resources.

Monitoring and Research:

- Periodic surveys of SAV in the region are required to determine the progress toward the goal of a net resource gain.

- The Council supports efforts to
  (1) standardize mapping protocols,
  (2) develop a Geographic Information System databases for essential habitat including seagrass, and
  (3) research and document causes and effects of SAV decline including the cumulative impacts of shoreline development.

Education and Enforcement:

- The Council supports education programs designed to heighten the public's awareness of the importance of SAV. An informed public will provide a firm foundation of support for protection and restoration efforts.

- Existing regulations and enforcement need to be reviewed for their effectiveness.

- Coordination with state resource and regulatory agencies should be supported to assure that existing regulations are being enforced.

SAFMC SAV Policy Statement- Appendix 1

DESCRIPTION AND FUNCTION

Worldwide, Submerged Aquatic Vegetation (SAV) constitutes one of the most conspicuous and common shallow-water habitat types. These angiosperms have successfully colonized standing and flowing fresh, brackish, and marine waters in all climatic zones, and most are rooted in the sediment. Marine SAV beds occur in the low intertidal and subtidal zones and may exhibit a wide range of habitat forms, from extensive collections of isolated patches to unbroken continuous beds. The bed is defined by the presence of either aboveground vegetation, its associated root and rhizome system (with living meristem), or the presence of a seed bank in the sediments, as well as the sediment upon which the plant grows or in which the seed back resides. In the case of patch beds, the unvegetated sediment among the patches is considered seagrass habitat as well.

There are seven species of seagrass in Florida's shallow coastal areas: turtle grass (Thalassia testudium); manatee grass (Syringodium filiforme); shoal grass (Halodule wrightii); star grass (Halophila engelmanni); paddle grass (Halophila decipiens); and Johnson's seagrass (Halophila johnsonii) (See distribution maps in Appendix 4). Recently, H. johnsonii has been proposed for listing by the National Marine Fisheries Service as an endangered plant species. Areas of seagrass concentration along Florida's east coast are Mosquito Lagoon, Banana River, Indian River Lagoon, Lake Worth and Biscayne Bay. Florida Bay, located between the Florida Keys and the mainland, also has an abundance of seagrasses, but is currently experiencing an unprecedented decline in SAV distribution.

The three dominant species found in North Carolina are shoalgrass (Halodule wrightii), eelgrass (Zostera marina), and widgeongrass (Ruppia maritima). Shoalgrass, a subtropical species has its northernmost distribution at Oregon Inlet, North Carolina. Eelgrass, a temperate species, has its southernmost distribution in North Carolina. Areas of seagrass concentration in North Carolina are southern and eastern Pamlico Sound, Core Sound, Back Sound, Bogue Sound and the numerous small southern sounds located behind the beaches in Onslow, Pender, Brunswick, and New Hanover Counties (See distribution maps in Appendix 4).

Seagrasses serve several valuable ecological functions in the marine estuarine systems where they occur. Food and shelter afforded by the SAV result in a complex and dynamic system that provides a primary nursery habitat for various organisms that are important both ecologically and to commercial and recreational fisheries. Organic matter produced by these seagrasses is transferred to secondary consumers through three pathways: herbivores that consume living plant matter; detritivores that exploit dead matter; and microorganisms that use seagrass-derived particulate and dissolved organic compounds. The living leaves of these submerged plants also provide a substrate for the attachment of detritus and epiphytic organisms, including bacteria, fungi, meiofauna, micro- and marcroalgae, macroinvertebrates. Within the seagrass system, phytoplankton

also are present in the water column, and macroalgae and microalgae are associated with the sediment. No less important is the protection afforded by the variety of living spaces in the tangled leaf canopy of the grass bed itself. In addition to biological benefits, the SAVs also cycle nutrients and heavy metals in the water and sediments, and dissipate wave energy (which reduces shoreline erosion and sediment resuspension).

There are several types of association fish may have with the SAVs. Resident species typically breed and carry out much of their life history within the meadow (e.g., gobiids and syngnathids). Seasonal residents typically breed elsewhere, but predictably utilize the SAV during a portion of their life cycle, most often as a juvenile nursery ground (e.g., sparids and lutjanids). Transient species can be categorized as those that feed or otherwise utilize the SAV only for a portion of their daily activity, but in a systematic or predictable manner (e.g., haemulids).

In Florida many economically important species utilize SAV beds as nursery and/or spawning habitat. Among these are spotted seatrout (Cynoscion nebulosus), grunts (Heaemulids), snook (Centropomus sp.), bonefish (Albulu vulpes), tarpon (Megalops atlanticus) and several species of snapper (Lutianids) and grouper (Serranids). Densities of invertebrate organisms are many times greater in seagrass beds than in bare sand habitat. Penaeid shrimp, spiny lobster (Panulirus argus), and bay scallops (Argopecten irradians) are also dependent on seagrass beds.

In North Carolina 40 species of fish and invertebrates have been captured on seagrass beds. Larval and juvenile fish and shellfish including gray trout (Cynoscion regalis), red drum (Sciaenops ocellatus), spotted seatrout (Cynoscion nebulosus), mullet (Mugil cephalus), spot (Leiostomus xanthurus), pinfish (Orthopristis chrysoptera), gag (Mycteroperca microlepis), white grunt (Haemulon plumieri), silver perch (Bairdiella chrysoura), summer flounder (Paralichthys dentatus), southern flounder (P. lethostigma), blue crabs (Callinectes sapidus), hard shell clams (Mercenaria mercenaria), and bay scallops (Argopecten irradains) utilize the SAV beds as nursery areas. They are the sole nursery grounds for bay scallops in North Carolina. SAV meadows are also frequented by adult spot, spotted seatrout, bluefish (Pomatomus saltatrix), menhaden (Brevortia tyrannus), summer and southern flounder, pink and brown shrimp, hard shell clams, and blue crabs. Offshore reef fishes including black sea bass (Centropristis striata), gag, gray snapper (Lutianus griseus), lane snapper (Lutjanus synagris), mutton snapper (Lutianus annalis), and spottail pinfish (Displodus holbrooki). Ospreys, egrets, herons, gulls and terns feed on fauna in SAV beds, while swans, geese, and ducks feed directly on the grass itself. Green sea turtles (Chelonia mydas) also utilize seagrass beds, and juveniles may feed directly on the seagrasses.

SAFMC SAV Policy Statment- Appendix 2

STATUS

The SAV habitat represents a valuable natural resource which is now threatened by overpopulation in coastal areas. The major anthropogenic activities that impact seagrass habitats are: 1) dredging and filling, 2) certain fish harvesting techniques and recreational vehicles, 3) degradation of water quality by modification of normal temperature, salinity, and light regimes, and 4) addition of organic and inorganic chemicals. Although not caused by man, disease ("wasting disease" of eelgrass) has historically been a factor. Direct causes such as dredging and filling, impacts of bottom disturbing fishing gear, and impacts of propellers and boat wakes are easily observed, and can be controlled by wise management of our seagrass resources (See Appendix 3). Indirect losses are more subtle and difficult to assess. These losses center around changes in light availability to the plants by changes in turbidity and water color. Other indirect causes of seagrass loss may be ascribed to changing hydrology which may in turn affect salinity levels and circulation. Reduction in flushing can cause an increase in salinity and the ambient temperature of a water body, stressing the plants. Increase in flushing can mean decreased salinity and increased turbidity and near-bottom mechanical stresses which damage or uproot plants.

Increased turbidity and decreasing water transparency are most often recognized as the cause of decreased seagrass growth and altered distribution of the habitats. Turbidity may result from upland runoff, either as suspended sediment or dissolved nutrients. Reduced transparency due to color is affected by freshwater discharge. The introduction of additional nutrients from terrigenous sources often leads to plankton blooms and increased epiphytization of the plants, further reducing light to the plants. Groundwater enriched by septic systems also may infiltrate the sediments, water column, and near-shore seagrass beds with the same effect. Lowered dissolved oxygen is detrimental to invertebrate and vertebrate grazers. Loss of these grazers results in overgrowth by epiphytes.

Large areas of Florida where seagrasses were abundant have now lost these beds from both natural and man-induced causes. (This is not well documented on a large scale except in the case of Tampa Bay). One of these depleted areas is Lake Worth in Palm Beach County. Here, dredge and fill activities, sewage disposal and stormwater runoff have almost eliminated this resource. North Biscayne Bay lost most of its seagrasses from urbanization. The Indian River Lagoon has lost many seagrass beds from stormwater runoff has caused a decrease in water transparency and reduced light penetration. Many seagrass beds in Florida have been scarred from boat propellers disrupting the physical integrity of the beds. Vessel registrations, both commercial and recreational, have tripled from 1970-71 (235, 293) to 1992-93 (715,516). More people engaged in

marine activities having an effect on the limited resources of fisheries and benthic communities, Florida's assessment of dredging/propeller scar damage indicates that Dade, Lee, Monroe, and Pinellas Counties have the most heavily damaged seagrass beds. Now Florida Bay, which is rather remote from human population concentrations, is experiencing a die-off of seagrasses, the cause of which has not yet been isolated. Cascading effects of die-offs cause a release of nutrients resulting in algal blooms which, in turn, adversely affect other seagrass areas, and appear to be preventing recolonization and natural succession in the bay. It appears that Monroe County's commercial fish and shellfish resources, with a dockside landing value of $50 million per year, is in serious jeopardy.

In North Carolina total SAV coverage is estimated a 200,000 acres. Compared to the state's brackish water SAV community, the marine SAVs appear relatively stable. The drought and increased water clarity during the summer of 1986 apparently caused an increase in SAV abundance in southeastern Pamlico Sound and a concomitant increase in bay scallop densities. Evidence is emerging, however, that characteristics of "wasting disease" are showing up in some of the eelgrass populations in southern Core Sound, Back Sound, and Bogue Sound. The number of permits requested for development activities that potentially impact SAV populations is increasing. The combined impacts of a number of small, seemingly isolated activities are cumulative and can lead to the collapse of large seagrass biosystems. Also increasing is evidence of the secondary removal of seagrasses. Clam-kicking (the harvest of hard clams utilizing powerful propeller wash to dislodge the clams from the sediment) is contentious issue within the state of North Carolina. The scientific community is convinced that mechanical harvesting of clams damages SAV communities. The scallop fishery also could be harmed by harvest-related damage to eelgrass meadows.

SAFMC SAV Policy Statement- Appendix 3

MANAGEMENT

Conservation of existing SAV habitat is critical to the maintenance of the living resources that depend on these systems. A number of federal and state laws require permits for modification and/or development in SAV. These include Section 10 of the Rivers and Harbors Act (1899), Section 404 of the Clean Water Act (1977), and the states' coastal area management programs. Section 404 prohibits deposition of dredged or fill material in waters of the United States without a permit from the U.S. Army Corps of Engineers. The Fish and Wildlife Coordination Act gives federal and state resource agencies the authority to review and comment on permits, while the National Environmental Policy Act requires the development and review of Environmental Impact Statements. The Magnuson Fisheries Conservation and Management Act has been amended to require that each fishery management plan include a habitat section. The Council's habitat subcommittee may comment on permit requests submitted to the Corps of Engineers when the proposed activity relates to habitat essential to managed species.

State and federal regulatory processes have accomplished little to slow the decline of SAV habitat. Many of the impacts cannot be easily controlled by the regulations as enforced. For example, water quality standards are written so as to allow a specified deviation from background concentration, in this manner standards allow a certain amount of degradation. An example of this is Florida's class III water transparency standard, which defines the compensation depth to be where 1% of the incident light remains. The compensation depth for seagrass is in excess of 10% and for some species is between 15 and 20%. The standard allows a deviation of 10% in the compensation depth which translates into 0.9% incident light or an order of magnitude less than what the plants require.

Mitigative measures to restore or enhance impacted areas have met with little success. SAV habitats cannot be readily restored; in fact, the South Atlantic Council is not aware of any seagrass restoration project that has ever avoided a net loss of seagrass habitat. It has been difficult to implement effective resource management initiatives to preserve seagrass habitat due to the lack of documentation on specific cause/effect relationships. Even though studies have identified certain cause/effect relationships in the destruction of these areas, lack of long-term, ecosystem-scale studies precludes an accurate scientific evaluation of the long-term deterioration of seagrasses. Some of the approaches to controlling propeller scar damage to seagrass beds include: education, improved channel marking restricted access zones, (complete closure to combustion engines, pole or troll areas), and improved enforcement. The South Atlantic Council sees the need for monitoring of seagrass restoration and mitigation not only to determine success from plant standpoint but also for recovery of faunal populations and functional attributes of the essential habitat type. The South Atlantic Council also encourages long-term trend analysis monitoring of distribution and abundance using appropriate protocols and Geographic Information System approaches.

SAFMC SAV Policy Statement- Appendix 4

(SAV Distribution Maps in SAFMC 1995)

Appendix H. SAFMC Policy Statement Concerning Dredging and Dredge Material Disposal Activities.

Ocean Dredged Material Disposal Sites (ODMDS)

The shortage of adequate upland disposal sites for dredged materials has forced dredging operations to look offshore for sites where dredged materials may be disposed. These Ocean Dredged Material Disposal Sites (ODMDSs) have been designated by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) as suitable sites for disposal of dredged materials associated with berthing and navigation channel maintenance activities. The South Atlantic Fishery Management Council (SAFMC; the Council) is moving to establish its presence in regulating disposal activities at these ODMDSs. Pursuant to the Magnuson Fishery Conservation and Management Act of 1976 (the Magnuson Act) , the regional fishery management Councils are charged with management of living marine resources and their habitat within the 200 mile Exclusive Economic Zone (EEZ) of the United States. Insofar as dredging and disposal activities at the various ODMDSs can impact fishery resources or essential habitat under Council jurisdiction the following policies concerning its role in the designation, operation, maintenance, and enforcement of activities in the ODMDSs:

Policies:

The Council acknowledges that living marine resources under its jurisdiction and their essential habitat may be impacted by the designation, operation, and maintenance of ODMDSs in the South Atlantic. The Council may review the activities of EPA, COE, the state Ports Authorities, private dredging contractors, and any other entity engaged in activities which impact, directly or indirectly, living marine resources withinthe EEZ.

The Council may review plans and offer comments on the designation, maintenance, and enforcement of disposal activities at the ODMDSs.

ODMDSs should be designated or redesignated so as to avoid the loss of live or hard bottom habitat and minimize impacts to all living marine resources.

Notwithstanding the fluid nature of the marine environment, all impacts from the disposal activities should be contained within the designated perimeter of the ODMDSs.

The final designation of ODMDSs should be contingent upon the development of suitable management plans and a demonstrated ability to implement and enforce that plan. The Council encourages EPA to press for the implementation of such management plans for all designated ODMDSs.

All activities within the ODMDSs are required to be consistent with the approved management plan for the site.

The Council's Habitat and Environmental Protection Advisory Panel when requested by the Council will review such management plans and forward comment to the Council. The Council may review the plans and recommendations received from the advisory sub-panel and comment to the appropriate agency. All federal agencies and entities receiving a comment or recommendation from the Council will provide a detailed written response to the Council regarding the matter pursuant to 16 U.S.C. 1852 (i). All other agencies and entities receiving a comment or recommendation from the Council should provide a detailed written response to the Council regarding the matter, such as is required for federal agencies pursuant to 16 U.S.C.
1852 (i).

ODMDSs management plans should indicate appropriate users of the site. These plans should specify those entities/ agencies which may use the ODMDSs, such as port authorities, the U.S. Navy, the Corps of Engineers, etc. Other potential users of the ODMDSs should be acknowledged and the feasibility of their using the ODMDSs site should be assessed in the management plan.

Feasibility studies of dredge disposal options should acknowledge and incorporate ODMDSs in the larger analysis of dredge disposal sites within an entire basin or project. For example, Corps of Engineers analyses of existing and potential dredge disposal sites for harbor maintenance projects should incorporate the ODMDSs. as part of the overall analysis of dredge disposal sites.

The Council recognizes that EPA and other relevant agencies are involved in managing and/or regulating the disposal of all dredged material. The Council recognizes that disposal activities regulated under the Ocean Dumping Act and dredging/filling carried out under the Clean Water Act have similar impacts to living marine resources and their habitats. Therefore, the Council urges these agencies apply the same strict policies to disposal activities at the ODMDSs. These policies apply to activities including, but not limited to, the disposal of contaminated sediments and the disposal of large volumes of fine-grained sediments. The Council will encourage strict enforcement of these policies for disposal activities in the EEZ. Insofar as these activities are relevant to disposal activities in the EEZ, the Council will offer comments on the further development of policies regarding the disposal/ deposition of dredged materials.

The Ocean Dumping Act requires that contaminated materials not be placed in an approved ODMDS. Therefore, the Council encourages relevant agencies to address the problem of disposal of contaminated materials. Although the Ocean Dumping Act does not specifically address inshore disposal activities, the Council encourages EPA and other relevant agencies to evaluate sites for the suitability of disposal and containment of contaminated dredged material. The Council further encourages those agencies to draft management plans for the disposal of contaminated dredge materials. A consideration for total removal from the basin should also be considered should the material be contaminated to a level that it would have to be relocated away from the coastal zone.

<u>Offshore and Nearshore Underwater Berm Creation</u>

The use of underwater berms in the South Atlantic region has recently been proposed as a disposal technique that may aid in managing sand budgets on inlet and beachfront areas. Two types of berms have been proposed to date, one involving the creation of a long offshore berm, the second involving the placement of underwater berms along beachfronts bordering an inlet. These berms would theoretically reduce wave energy reaching the beaches and/or resupply sand to the system.

The Council recognizes offshore berm construction as a disposal activity. As such, all policies regarding disposal of dredged materials shall apply to offshore berm construction. Research should be conducted to quantify larval fish and crustacean transport and use of the inlets prior to any consideration of placement of underwater berms. Until the impacts of berm creation in inlet areas on larval fish and crustacean transport is determined, the Council recommends that disposal activities should be confined to approved ODMDSs. Further, new offshore and nearshore underwater berm creation activities should be reviewed under the most rigorous criteria, on a case-by-case basis.

Maintenance Dredging and Sand Mining for Beach Renourishment

The Council recognizes that construction and maintenance dredging of the seaward portions of entrance channels and dredging borrow areas for beach re nourishment occur in the EEZ. These activities should be done in an appropriate manner in accordance with the policies adopted by the Council.

The Council acknowledges that endangered and threatened species mortalities have occurred as a result of dredging operations. Considering the stringent regulations placed on commercial fisherman, dredging or disposal activities should not be designed or conducted so as to adversely impact rare, threatened or endangered species. NMFS Protected Species Division should work with state and federal agencies to modify proposals to minimize potential impacts on threatened and endangered sea turtles and marine mammals.

The Council has and will continue to coordinate with Minerals Management Service (MMS) in their activities involving exploration, identification and dredging/mining of sand resources for beach renourishment. This will be accomplished through membership on state task forces or directly with MMS. The Council recommends that live bottom/hard bottom habitat and historic fishing grounds be identified for areas in the South Atlantic region to provide for the location and protection of these areas while facilitating the identification of sand sources for beach renourishment projects.

Open Water Disposal

The SAFMC is opposed to the open water disposal of dredged material into aquatic systems which may adversely impact habitat that fisheries under Council jurisdiction are dependent upon.

The Council urges state and federal agencies, when reviewing permits considering open water disposal, to identify the direct and indirect impacts such projects could have on fisheries habitat.

The SAFMC concludes that the conversion of one naturally functioning aquatic system at the expense of creating another (marsh creation through open water disposal) must be justified given best available information.

Appendix I.SAFMC Policy Statement Concerning Oil and Gas Exploration, Development, and Transportation.

Appendix J. Bycatch Reduction Device Development & Testing Protocol. (Source: NMFS 1995)

The following is a summary of the BRD testing protocol used during the Cooperative Bycatch Research Program as presented in the NMFS report to Congress (NMFS 1995). The South Atlantic Council, through the efforts of a BRD Advisory Panel and Scientific and Statistical Committee, will review and revise the existing protocol, and adopt a modified BRD testing protocol for publication in the Federal Register.

For additional information on BRD testing and development, individuals should refer to the following detailed reports:

GSAFDF. 1992. A Research Plan Addressing Finfish Bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries. Gulf and South Atlantic Fisheries Development Foundations, Inc. August, 1992. 114pp.

NMFS. 1995. Cooperative research program addressing finfish bycatch in the Gulf of Mexico and South Atlantic Shrimp Fisheries. A report to Congress. April, 1995.

NMFS. 1992. Evaluation of bycatch reduction devices. Sampling protocol manual for data collection. NMFS, SEFSC. September 14, 1992. 62 pp.

NMFS. 1991. Shrimp trawl bycatch research requirements. NMFS Southeast Regional Office, St. Petersburg, Florida, 66 pp.

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