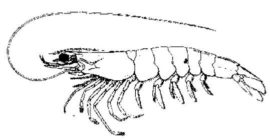
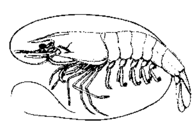
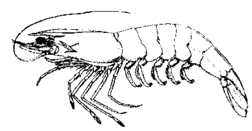
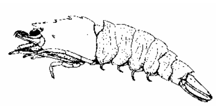
FINAL
AMENDMENT 6
TO THE
FISHERY MANAGEMENT PLAN
FOR THE
SHRIMP FISHERY
OF THE
SOUTH ATLANTIC REGION

INCLUDING A FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, INITIAL REGULATORY FLEXABILITY ANALYSIS, REGULATORY IMPACT REVIEW, SOCIAL IMPACT ASSESSMENT/ FISHERY IMPACT STATEMENT AND BIOLOGICAL ASSESSMENT



December 2004

South Atlantic Fishery Management Council
1 Southpark Circle, Suite 306, Charleston, South Carolina 29407-4699
(843) 571-4366 / FAX (843) 769-4520, Toll Free: 866-SAFMC-10
email: safmc@safmc.net

National Marine Fisheries Service, Southeast Regional Office
9721 Executive Center Drive, St. Petersburg, Florida 33702
(727) 570-5301 / FAX (727) 570-5300

This is a publication of the South Atlantic Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award No. NA04NMF4410022

AMENDMENT 6 TO THE FISHERY MANAGEMENT PLAN FOR THE SHRIMP FISHERY OF THE SOUTH ATLANTIC REGION

INCLUDING A FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, INITIAL REGULATORY FLEXIBILITY ANALYSIS, REGULATORY IMPACT REVIEW, SOCIAL IMPACT ASSESSMENT/FISHERY IMPACT STATEMENT AND BIOLOGICAL ASSESSMENT

Proposed actions: Amend the Bycatch Reduction Device (BRD) Framework to adjust Council authority in regard to modifications of the BRD testing protocol; Adjust the framework's criteria for the certification of new BRDs; Establish a method to monitor and assess bycatch in the South Atlantic rock shrimp and penaeid shrimp fisheries; Minimize bycatch in the rock shrimp fishery to the extent practicable; Require a federal penaeid shrimp permit; and Revise, establish and/or retain status determination criteria for penaeid and rock shrimp stocks.

Lead agencies: Fishery Management Plan (FMP) – South Atlantic Fishery Management Council
Environmental Impact Statement (EIS) – NOAA Fisheries

For Further Information Contact:

Responsible Agencies

South Atlantic Fishery Management Council
Contact: Robert K. Mahood
Executive Director
1 Southpark Circle, Suite 306
Charleston, South Carolina 29407-4699
(843) 571-4366; FAX (843) 769-4520
Toll Free: 1-866-SAFMC-10
Email: safmc@safmc.net

National Marine Fisheries Service
Contact: Dr. Roy Crabtree
Regional Administrator
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702
(727) 570-5301; FAX (727) 570-5300

Name of Action:

Type of Action:	(X) Administrative	( ) Legislative
Type of NEPA Document:	( ) Draft	(X) Final
Comments received by:	______________	

Abstract:
The South Atlantic Fishery Management Council (SAFMC) proposes seven actions to amend the current Shrimp Fishery Management Plan (FMP). Four of the actions serve to address the federal mandates to develop a standardized reporting methodology to assess the amount and type of bycatch in a fishery, and to include conservation and management measures that minimize to the extent practicable the mortality of bycatch that cannot be avoided. More specifically, the Council seeks to more effectively address bycatch through investigating various ways to reduce bycatch in the rock shrimp fishery, amend the BRD Framework to give NOAA Fisheries the authority to make appropriate revisions to the BRD testing protocol, adjust the Council's criteria for the certification of

new BRDs and establish a method to regularly monitor and assess bycatch in the penaeid and rock shrimp fisheries.

To further comply with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), additional actions proposed by the Council would establish status determination criteria, or proxies thereof, as necessary, for white, brown, pink and rock shrimp, and would require that shrimp trawlers in federal waters participating in the shrimp fishery or with shrimp on board possess a federal penaeid shrimp permit.

The proposed actions would be consistent with the goals and objectives of the Shrimp FMP. It is not anticipated that the preferred alternatives will have significant detrimental effects on the social and economic environment. The proposed federal permit requirement and bycatch reporting methodology would present direct costs to the industry related to application fees and the completion of paper logbook data, respectively. However, the increased information from a permit system and bycatch reporting is expected to significantly improve management of the resource and provide associated long-term social and economic benefits. Likewise, the other proposed actions are expected to generate beneficial effects, either directly or indirectly, to the industry, shrimp resource and other species identified in the affected environment.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

PAGE

LIST OF APPENDICES

ACTIONS IN SHRIMP AMENDMENT 6

EXECUTIVE SUMMARY

The South Atlantic Fishery Management Council (the Council) proposes seven actions to amend the current Shrimp Fishery Management Plan (FMP) of the South Atlantic Region. The reasons for the changes are to further satisfy the requirements of the Magnuson-Stevens Fishery Conservation and Management Act. More specifically, the Council seeks to:

- Improve the identification and quantification of bycatch from penaeid and rock shrimp trawls,
- Improve the identification and quantification of the known universe of penaeid shrimp vessels via a federal permit,
- Reduce the current levels of bycatch from rock shrimp trawls,
- Promote the use of more effective BRDs by amending the BRD Framework system, and
- Establish status determination criteria, or proxies thereof, as necessary, for penaeid and rock shrimp stocks.

Section 1 of this FMP Amendment/FSEIS describes the purpose and need for the proposed actions. Section 3 of this document describes the environmental setting, including a description of the affected shrimp species, protected species, economic markets and human communities. Section 4 provides a detailed description of the alternatives, including the Council's preferred, to the proposed action. Section 4 also details the biological, protected resources, economic and social impacts stemming from the alternatives. Under each proposed action is a conclusory section that summarizes the impacts and details the reasons for the Council's decision for the designation of the preferred alternative. Section 2 summarizes the impacts discussed in detail in Section 4, while briefly outlining the differences between the alternatives.

<u>Preferred Alternatives</u>

The preferred alternatives seek to maximize the biological effects to the affected environment, while minimizing any adverse effects to the industry. The preferred alternatives in this FMP Amendment/FSEIS are:

1) Modify the BRD framework procedure to remove the authority and procedural requirements of the Council to modify the BRD Testing protocol and transfer to NOAA Fisheries the authority to make appropriate revisions to the Protocol.

2) For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the total weight of finfish by at least 30%.

3) Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.

4) Require a NOAA Fisheries-approved BRD be utilized on all rock shrimp trips in the South Atlantic.

5) For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.

6) Using the established MSY (maximum sustainable yield) and OY (optimum yield) values, revise or establish overfishing and overfished definitions for penaeid shrimp based on an MSY control rule. Overfishing (MFMT) for all penaeid species is a fishing mortality rate that diminishes the stock below the designated MSY stock abundance (B_{MSY}) for two consecutive years and MSST is established with two thresholds: (a) if the stock diminishes to ½ MSY abundance (½ B_{MSY}) in one year, or (b) if the stock is diminished below MSY abundance (B_{MSY}) for two consecutive years. In addition, white shrimp would be considered overfished when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. A proxy for B_{MSY} would be established for each species using CPUE information from SEAMAP-SA data as the lowest values in the 1990-2003 time period that produced catches meeting MSY the following year.

7) Establish stock status determination criteria consistent with those of penaeid shrimp, where MSY/OY for rock shrimp is the mean total landings for the South Atlantic during 1986 through 2000 (4,912,927 pounds heads on), where overfishing (MFMT) for rock shrimp would be a fishing mortality rate that led to annual landings larger than two standard deviations (9,774,848 pounds heads on) above MSY (4,912,927 + 9,774,848 = 14,687,775 pounds heads on) for two consecutive years, and MSST would be parent stock size less than ½ (B_{msy}) for two consecutive years.

<u>Non-preferred alternatives</u>

In addition to the preferred alternatives, this FMP amendment/FSEIS evaluates the environmental consequences of a reasonable range of alternatives to the seven proposed actions. The reader is to refer to Section 2 or 4 for a list of the other, non-preferred alternatives. Appendix A contains the alternatives that the Council considered but eliminated from detailed study and a brief discussion of the reasons for being eliminated.

<u>Affected Environment</u>

Shrimp species

In the southeastern United States, the shrimp industry is based mainly on three shallow-water species of the family Penaeidae: the white shrimp, *Litopenaeus setiferus*, the brown shrimp, *Farfantepenaeus aztecus*, and the pink shrimp, *Farfantepenaeus duorarum*. The rock shrimp, *Sicyonia brevirostris* (family Sicyoniidae), is important to the Florida shrimp fishery. The royal red shrimp, *Pleoticus robustus* (family Solenoceridae), occurs in deeper water than the three penaeid species and is of lesser importance to this fishery.

The Human Environment

The commercial fishing area for penaeid shrimp species in the South Atlantic is mainly concentrated from Fort Pierce, Florida to Pamlico Sound and Ocracoke Inlet, North Carolina. There is another fishery off the Florida Keys where the main target is pink shrimp. In North Carolina, the important shrimping areas are in Pamlico Sound, Core Sound, major rivers and off the southern coast, south of Ocracoke Inlet. The most important fishing area in Florida is in the northeastern part of the state, between Fernandina Beach and Melbourne, just south of Cape Canaveral. In Georgia, shrimping takes place along the entire coast. In South Carolina, the most important shrimping areas are from Georgetown (Winyah Bay) south. Internal waters of South Carolina and Georgia are closed to trawling. In North Carolina, the important shrimping areas are in Pamlico Sound and off the southern coast, south of Ocracoke Inlet. Commercial shrimp catches in all four states predominantly come from internal waters or state waters out to three miles, and to a lesser extent, from the EEZ. Most of the shrimp in these states are caught by otter trawls.

The South Atlantic shrimp fishery generates more revenue for the commercial harvesting sector than any other fishery in this region. During 2001 and 2002 the average dockside value of shrimp harvested in the South Atlantic amounted to $63.56 million annually. For comparison, the overall ex-vessel revenue from landings of all seafood in the South Atlantic averaged $175 million during those years. The relative economic importance of the commercial shrimp industry varies by state. During 2001 and 2002 the proportion of all commercial ex-vessel revenue derived from shrimp landings was 75% in Georgia, 40% in South Carolina, 38% in Florida and 16% in North Carolina.

Annual ex-vessel revenue and economic performance of the domestic shrimp harvesting sector has been mainly influenced by imports and fuel prices. United States shrimp imports expanded from about 260 million pounds in 1980 to 1.024 billion pounds in 2000 (headless shell-on basis). Price trend data indicate that the real average domestic ex-vessel prices for all shrimp species dropped substantially in the 1990s. More recently, this trend for reduced prices and revenue has continued and average ex-vessel revenue from shrimp landings in 2001 and 2002 decreased by 33% compared to the period 1997-2000. Most of this decline can be attributed to the increased market supply from imports. In recent years, commercial fishermen have also experienced increased prices for fuel. Other factors such as environmental conditions and possible habitat loss would have also affected vessel profitability through their relationship with shrimp production. These conditions are expected to decrease the aggregate profitability of commercial shrimp harvesting and reduce fleet size.

Other sectors of the industry have been affected by imports. The declining trend in shrimp prices and ex-vessel revenue in the shrimp harvesting sector, observed across all states, could play a major role in the financial solvency of dealers and fish houses that depend on domestic shrimp production. Reduced revenues in the shrimp harvesting sector would also result in reduced economic activity to the sectors of the economy that are directly and indirectly associated with the domestic shrimp industry in the South Atlantic such as suppliers of fuel and gear. Also, it has been statistically demonstrated that the increase in imports of value added peeled products contributed to the declining profit margins shrimp processors have been experiencing since the 1980s. In contrast to the industry sectors dependent on the domestic harvest of shrimp, imports increase the aggregate U.S. supply of shrimp leading to lower retail prices for consumers. In addition, many U.S. seafood wholesalers and retailers depend on imports for a substantial portion of their sales volume.

Bycatch from penaeid shrimp trawls

The composition of catch was recorded by NOAA Fisheries-trained observers on penaeid shrimp trawls between February 1992 and 1996 in the waters off the southeast Atlantic coast of the United States (Nance *et al.* 1997). Species that dominated the bycatch in terms of weight per hour included blue crab, cannonball jellyfish, Atlantic menhaden and star drum. A practicability analysis (Section 3.1.12.1.3) concluded that current management measures minimize bycatch and bycatch mortality to the extent practicable in the penaeid shrimp fishery.

Bycatch from rock shrimp trawls

The most recent information on bycatch in this fishery comes from a preliminary report of a NOAA Fisheries observer study conducted during the period September 2001 through December 2002. Nine rock shrimp trips were observed. Six trips occurred off the east coast of Florida, two trips operated in the Gulf of Mexico and off the east coast of Florida and one trip targeted Gulf of Mexico waters exclusively.

A total of 177 tows were sampled from eight trips off the east coast of Florida. A total of 233 unique species were collected. There were 37 species of crustaceans, 166 fish species, 29 other invertebrate species and one category of miscellaneous debris. All of these vessels were using BRDs voluntarily, therefore the results of the sampling reflect the catch and bycatch that was not excluded by the BRDs. It must be noted that this was a pilot study that was conducted during a period when rock shrimp harvests were substantially lower than in previous years. This bycatch observer program is ongoing and the more recent results will be provided to the South Atlantic Council as they become available. Based on existing information, the practicability analysis contained in Section 3.1.12.1.3 concluded that current management measures have not minimized bycatch and bycatch mortality to the extent practicable.

Essential Fish Habitat and Essential Fish Habitat-Habitat Areas of Particular Concern

For penaeid shrimp, essential fish habitat (EFH) includes inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity and all interconnecting water bodies as described in the 1998 Habitat Plan for the South Atlantic Region. Inshore nursery areas include tidal freshwater (palustrine), estuarine and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and intertidal non-vegetated flats. This applies from North Carolina through the Florida Keys. The proposed actions and their alternatives are not expected to have a negative effect on ocean and coastal habitats including those identified as EFH. Refer to Appendix D for a more detailed account of EFH and EFH-HAPCs for other fisheries in the South Atlantic.

Areas that meet the criteria for Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs) for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas) and state-identified overwintering areas.

Environmental Consequences

Biological environment

All the preferred alternatives are expected to have either a direct or indirect beneficial impact to the shrimp resource and other organisms in the affected environment. Measures to implement and improve the efficiency of BRDs promote finfish and invertebrate escapement from nets. A permit system would provide a more accurate and efficient means of identifying participants in this fishery and allow for the collection of more detailed information on gear type and area fished. The Council's preferred definitions of status determination criteria for penaeid and rock shrimp stocks are based on the best available scientific information.

Economic Environment

It is not anticipated that the preferred alternatives will have a substantial negative economic effect on the shrimp industry. The cost imposed by the requirement for BRDs would depend on the shrimp loss associated with the use of these devices. It is estimated that 43 rock shrimp vessels would be affected by this alternative and the average reduction in gross revenue would be $1,382 per vessel annually (0.6% of the average revenue of an affected vessel). The federal penaeid shrimp permit would cost $50 per application ($20 per vessel if the vessel owner holds another federal permit issued by the NOAA Fisheries Permits Office in the Southeast Region). The opportunity cost (time spent completing the application) is estimated at $5 per application per year ($10 under Alternative 3).

The preferred alternatives for addressing the BRD protocol and criteria will result in lower administrative costs and could potentially reduce the research costs associated with testing new BRDs. Collection of information on bycatch in both penaeid and rock shrimp fisheries would increase administrative and research costs. The first phase of implementation of the preferred alternative is likely to cost the agency (NOAA Fisheries) $160,000 annually. Full implementation of the ACCSP program would require research funds in the range of $0.7 million to $1.8 million in a given year depending on the level of sampling. Logbooks as specified in the bycatch monitoring and assessment program would result in some time costs to participants and agency costs from mailing and processing of data. There would be some increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms.

Preferred alternatives are expected to have long-term beneficial effects to the industry. A reduction in bycatch could economically benefit those participants in other fisheries who target species that are commonly caught as shrimp bycatch. Also, it is expected that future indirect non-use economic benefits would also accrue from conserving species that do not support commercial or recreational fisheries. The information collected through the permit could equate to future economic benefits to the industry from better management based on data collected from the known universe of participants and better enforcement of fishing regulations.

Social Environment

Transferring the authority to modify the BRD testing protocol to NOAA Fisheries would result in positive effects as it promotes timeliness, efficiency and responsiveness to changes in the fishery and technological innovations. Through the permit system the industry could experience indirect positive effects through better management of the resource.

Summary

The proposed actions would achieve the underlying purpose and needs and the goals and objectives of the Shrimp FMP. The preferred alternatives are not expected to have significant negative economic and social effects on the industry. However, the actions are expected to have positive effects for the resource in terms of bycatch reduction, in addition to improved enforcement/management through the identification of the universe of vessels and modifications to the BRD Framework.

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

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

( ) Draft Final (X)

TABLE OF CONTENTS	SECTION	PAGE
Cover Sheet		i
Executive Summary		xiii
Introduction (including Purpose and Need for Action)	1.0	1
Alternatives	2.0	13
Affected Environment	3.0	29
Environmental Consequences	4.0	145
List of Preparers	5.0	229
List of Agencies, Organizations and Persons Consulted	6.0	230
References	8.0	236
Index	9.0	256
Alternatives Eliminated From Detailed Study (Appendix A)		Separate document

Notice of Intent to prepare a DSEIS published: 02/19/02
Supplemental Notice of Intent published: 04/30/04
Scoping meetings: 3/7/01, 4/17/01, 4/19/01, 5/15/01, 5/21/01, 3/7/02
Public hearings: 7/26/04, 8/2/04, 8/3/04, 8/5/04, 8/9/04, 8/10/04, 11/22/04 and 12/6/04
DSEIS to NOAA Fisheries: 7/21/04
DSEIS public comments due by: 9/20/04

There was one substantial comment on the DSEIS submitted by the Environmental Protection Agency (EPA) contained in Appendix M. Overall, EPA rated the Shrimp Amendment 6 DSEIS as “LO” (i.e., Lack of Objections) since the agency agreed with the preferred alternatives presented in the DSEIS and would defer to NOAA Fisheries and the Council for choosing preferred alternatives for Actions 6 and 7. However, there were a number of issues and suggested measures proposed by EPA which are addressed as follows:

1. Action 1: Alternative 1 (Address *NOAA funding and resource issues with respect to the success of the transference of the BRD protocol in the Gulf of Mexico; any testing actions requiring NEPA would be NEPA-compliant; and that test sample sizes would be statistically significant (refer to EPA comment 1)).* When the Gulf of Mexico Fishery Management Council established a BRD requirement for shrimp trawlers in the Gulf of Mexico (Amendment 9), it also established authority for NOAA Fisheries to manage the BRD protocol. The action proposed in the South Atlantic Fishery Management Council’s (Council) Shrimp Amendment 6 would give similar authority to NOAA Fisheries. Funding for the evaluations of experimental BRDs has historically come from research grants and awards to various institutions, or from

state-controlled activities. NOAA Fisheries either provides observers for such activities, or ensures that third-party observers used for such certification evaluations are qualified for such activities. NOAA Fisheries has consistently maintained a core group of observers since the early 1990s and provides support and training for third-party observers who work for other institutions such as the Gulf and South Atlantic Fisheries Foundation, Inc. and various state agencies.

All certification testing for experimental BRDs follows procedures outlined in the BRD Certification Protocols of the Gulf of Mexico or South Atlantic region. These Protocols were developed and implemented in accordance with the framework procedures established as part of Amendment 9 for the Gulf of Mexico Shrimp FMP and Amendment 2 for the South Atlantic Shrimp FMP. Both of these amendments, and the resulting Protocols, were accompanied by their respective environmental impact statements that analyzed the impacts of such actions on the human, biological and physical environments.

For both the Gulf of Mexico and South Atlantic BRD Protocols, the established procedures were developed in accordance with recommendations from the Councils' Shrimp (and/or BRD) Advisory Panels, Shrimp Committee and Scientific and Statistical Committee. The sample size selected for use in both Protocols (30 tows) was considered sufficient to generate statistically valid results. This is a standard minimal sample size appropriate for the chosen statistical procedure (a Student t-test). Other data collection procedures outlined in the Protocols include several rigorous requirements designed to reduce the inherent variability associated with marine sampling efforts.

2. Action 2: Alternative 1 and other bycatch issues (Address *whether other species apart from weakfish and Spanish mackerel are substantively impacted as bycatch in the South Atlantic shrimp trawls)*. The most recent systematic surveys of bycatch in the South Atlantic penaeid shrimp fishery were completed during the 1992-1996 time period, as discussed in Amendment 6. Much of this information was summarized in Amendment 2 (e.g., Figure 16, page 34), and was discussed in greater detail in NOAA Fisheries' 1998 Report to Congress (Nance 1998). Information depicting the main species comprising the penaeid shrimp catch can be found in Section 3.1.8. It must be noted that these results are reflective of conditions prior to the use of BRDs in the penaeid shrimp fishery. Implementation of the preferred alternative under Action 3 will provide more accurate data that is reflective of current fishing practices (e.g., use of BRDs and areas fished) to better evaluate if other finfish species are being substantively impacted as bycatch in South Atlantic shrimp trawls.

   For rock shrimp, the information provided by NOAA Fisheries for inclusion in Amendment 6 was collected in 2001 and 2002. The bycatch composition and relative abundance information provided in Amendment 6 is the most current information available at this time (Section 3.1.9 and Appendix C). The rock shrimp observer program is ongoing and additional information will be available in the future to better evaluate the impact on stocks of bycatch species.

   Action 2 does not specifically address the reduction in non-finfish species. The criteria are set to address the reduction in finfish bycatch. The magnitude of the escapement of non-finfish species such as echinoderms and crustaceans from using current devices is unknown. Research protocols for evaluating new BRDs could include collection of information on these invertebrate species and if necessary, future amendments to the South Atlantic BRD Framework would address these species in the criteria for certification of new BRDs.

3. Action 3: Alternative 1 (*Discuss the timetable expected for adoption of the preferred module and indicate if NOAA funds have been secured for the interim observer program).* When the ACCSP module is fully funded it will allow for observer coverage of 2-5% of all trips in the South Atlantic shrimp fishery. In the interim, as discussed in Section 4.2.3.1, NOAA Fisheries proposes to allocate 20 percent of funding for observer coverage in the Southeast to the South Atlantic shrimp fishery. This level of coverage reflects the proportion of the South Atlantic shrimp fishery's contribution to total southeastern shrimp landings. Given the funding level in 2004 of $800,000 and the estimated cost of one day of observer coverage of $1,000, this interim program could include 160 days of observer coverage in the South Atlantic shrimp fishery. The timetable for full implementation of the ACCSP module is unknown and depends on funding availability.

4. Action 4: (*EPA stated that they are not opposed to closed area and seasonal restrictions if the rock shrimp habitat is being substantively damaged by shrimp trawls and/or if the rock shrimp fishery is overfished*). In previous amendments to the South Atlantic Shrimp Plan, the Coral Plan and Comprehensive Habitat Amendment certain sensitive habitat areas were closed to shrimp trawling (Section 3.1.7). Furthermore, Amendment 5 to the Shrimp Plan required the use of vessel monitoring systems (VMS) in the rock shrimp fishery to better enforce the Oculina Bank closed area. Refer to Section 3.1.7 and Appendix D for existing information on rock shrimp habitat. Also, Appendix D contains detailed information on EFH and EFH-HAPCs for other South Atlantic fisheries.

   According to NOAA Fisheries' 2003 report to Congress on the status of U.S. Fisheries rock shrimp are neither overfished nor experiencing overfishing. In this amendment, the Council proposes new actions to set the stock status determination criteria for the penaeid shrimp species and rock shrimp. If an overfishing/overfished determination is made, the Council will convene the Shrimp Review Advisory Panel to evaluate the data upon which this determination was made and other relevant information pertaining to this fishery to determine cause and effect, the geographical extent of the problem and whether management action(s) is required. If management action is necessary, the Shrimp Review Advisory Panel will make appropriate recommendations to the Council on the geographic range and duration of such action (Section 4.2.7).

   Also, EPA expressed concern that this action did not address the penaeid shrimp fishery and was unaware that there is a current requirement for the use of BRDs in the penaeid shrimp fishery. Amendment 6 has been revised to emphasize this existing requirement (Section 1.3; Section 3; and Section 4.2.4).

5. *EPA was also concerned about juvenile shrimp as bycatch.* Given that small penaeid shrimp have market value (e.g., shrimp as small as 120 and 150 count per pound have some market value), even at very small sizes, there should be minimal discard of penaeid shrimp taken from the EEZ. Data collected from the observer program documents the total catch of shrimp by species, but does not provide a comparative value for the shrimp retained and sold relative to what was taken as part of the total catch. However, small juvenile shrimp that are not at marketable size are likely to be an insignificant portion of the catch from the EEZ. If these shrimp were in the area and encountered the net, they are quite likely to pass through the webbing in the cod end of the net. As for rock shrimp, the catch is not sorted by size, and some small rock shrimp are most likely discarded. Again, the mesh size restrictions for this fishery should reduce the catch of small juveniles to an insignificant quantity.

6. Action 5: *(Why was the rock shrimp fishery exempt from this measure?)*
   Federal permitting requirements are already in place for the rock shrimp fishery (Section 1.3; Section 3.2; Section 4.2.5).

7. As suggested by EPA:
   - A list of acronyms and definitions are included in the FSEIS (Appendix L).
   - Appendix N contains diagrams and descriptions of BRDs and TEDs approved for use in the shrimp fishery.

FSEIS to NOAA Fisheries: 12/17/04

FSEIS to EPA: _______

Public Comments on FSEIS requested by: _______

REGULATORY IMPACT REVIEW

This integrated document contains all elements of the Final Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Initial Regulatory Flexibility Analysis (IRFA), Regulatory Impact Review (RIR), Social Impact Assessment (SIA)/Fishery Impact Statement (FIS) and Biological Assessment (BA). The table of contents for the RIR is provided separately to aid the reviewer in referencing corresponding sections of the Amendment.

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.

Executive Order 12866 requires that a Regulatory Impact Analysis be prepared for all regulatory actions that are of public interest. To meet this mandate NOAA Fisheries requires that the Council prepare a Regulatory Impact Review (RIR) for proposed actions. 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 the proposed rule is a "significant regulatory action" under certain criteria provided in Executive Order 12866. This RIR analyzes the probable impacts on society from the proposed actions in this amendment to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region (Shrimp FMP).

In addition, information from the RIR is used to assess the impacts of the proposed actions on small entities. Under the guidelines set forth by the Small Business Administration's Regulatory Flexibility Act (RFA) a determination of significance is required once the Council finalizes its actions. An Initial Regulatory Flexibility Analysis (IRFA) was conducted as detailed in Section 4.9. The criteria used to determine significance under the RFA are not the same as the criteria evaluated for a determination of significance under E.O. 12866.

PROBLEMS AND OBJECTIVES

Problems and objectives addressed by this amendment and the purpose and need for the present amendment are found in Section 1.0 of this document. A list of these management actions and a brief statement of need for action follows:

1. **Amend the BRD Framework to transfer authority to adjust the BRD Testing Protocol from the Council to NOAA Fisheries.** This will allow for timely changes to the Protocol in an effort to facilitate the testing, evaluation and approval of more effective bycatch reduction devices (BRDs) for the shrimp fishery in the South Atlantic.
2. **Adjust the criteria for certification of new BRDs**. This would more effectively address bycatch reduction through the more flexible testing of BRDs and better address the requirements of National Standard 9 to the Magnuson-Stevens Act. It also supports the Council's efforts to achieve an ecosystem approach in fisheries management.
3. **Establish a method to monitor and assess bycatch in the South Atlantic rock and penaeid shrimp fisheries.** The Magnuson-Stevens Act requires the Council to establish a standardized bycatch reporting methodology for Federal fisheries and to identify and implement conservation and management measures that, to the extent practicable and in the following order, (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided (16 U.S.C. 1853(a)(11)). The first step in reducing and minimizing bycatch is to characterize the magnitude and species composition of animals that are discarded.
4. **Minimize bycatch in the rock shrimp fishery to the extent practicable.** The Magnuson-Stevens Act requires the Council to identify and implement conservation and management measures that, to the extent practicable and in the following order, (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided.
5. **Consider the requirement for a federal penaeid shrimp permit in order for a shrimp trawler to fish for or possess penaeid shrimp in the South Atlantic EEZ.** A Federal penaeid shrimp permit would enable efficient identification and enumeration of the number of vessels in the Federal penaeid shrimp fishery and allow for the collection of data that is necessary to better meet the requirements of regulations including the Regulatory Flexibility Act of 1980 (5 U.S.C. 601-612).

6. **Revise, establish and/or retain status determination criteria for penaeid stocks.** The Magnuson-Stevens Act requires that each FMP define reference points in the form of maximum sustainable yield (MSY) and optimum yield (OY). The Council has established these reference points but needs to clarify, revise or establish objective and measurable criteria for identifying when the fishery is overfished and/or undergoing overfishing.
7. **Revise, establish and/or retain status determination criteria for rock shrimp.** The Magnuson-Stevens Act requires that each FMP define reference points in the form of maximum sustainable yield (MSY) and optimum yield (OY). The Council has established these reference points but needs to clarify, revise or establish objective and measurable criteria for identifying when the fishery is overfished and/or undergoing overfishing.

METHODOLOGY AND FRAMEWORK FOR ANALYSIS

The RIR assesses management measures from the standpoint of determining the changes in costs and benefits to society. The net effects should be stated in terms of changes in producer surplus or net profits to the commercial harvesting and for-hire sectors, and consumer surplus to the private recreational fishing sector and final consumers of the resource. The commercial harvest sector refers to harvesters, processors and dealers of shrimp species. Final consumers of the resource refer to the individuals that derive benefits from consuming shrimp. Also, administrative and research costs associated with these measures must be included in the analyses of benefits and costs.

Ideally, all of these changes in costs and benefits need to be accounted for in assessing the net economic benefits to society from these proposed management actions. However, lack of data does not allow for quantitative analyses and these impacts can only be presented in a qualitative manner, as summarized in Table 1. To quantitatively assess the costs and benefits of these alternatives additional data would need to be collected in order to develop models for this fishery as follows:

1. Collection of cost and earnings data for all South Atlantic states since the shrimp fishery in this region differs by state as to the species targeted, seasonality, number of boats and other factors. From cost and earnings data, an indirect cost function could be developed to analyze harvester profit levels. The cost for data collection and analyses could exceed $200,000.
2. A market demand model for shrimp in the U.S. that accounts for the expansion of imports and changing consumer preferences since the last study was carried out in 1989. The costs could exceed $100,000.
3. Bioeconomic models to relate bycatch reduction with the economic effects on other fishing sectors. This data collection and analyses could exceed $300,000.
4. Valuation models to determine the non-use value of common bycatch species observed in the rock shrimp and penaeid shrimp catches. This data collection and analyses could exceed $300,000.

The detailed discussions for the proposed action and its alternatives are incorporated in the text under economic impacts in Section 4.2. These impacts are summarized in Table 1.

Table 1. Summary of expected changes in net benefits (Summary of Regulatory Impact Review-RIR).

Action 1. Amend the Bycatch Reduction Device (BRD) Framework to adjust Council authority in regard to modifications of the BRD testing protocol.			
Alternatives	**Positive impacts**	**Negative impacts**	**Net impacts**
Alternative 1 (Preferred). Modify the BRD framework procedure to remove the authority and procedural requirements of the Council to modify the BRD Testing protocol and transfer to NOAA Fisheries the authority to make appropriate revisions to the Protocol. **Alternative 2.** No action. The BRD Testing Protocol would remain in the BRD framework under the authority of the Council. **Alternative 3.** The Council would retain authority for the BRD framework to modify the BRD Testing Protocol, but would remove the statistical testing methodology established in the Protocol Manual, and transfer authority to establish appropriate statistical testing methodologies to NOAA Fisheries.	Alternatives 1, 2 and 3 would have no direct economic effects on the shrimp harvesting sector. Alternative 1 could indirectly result in higher future economic benefits to other fishery participants and increase future non-use benefits to society. These potential gains would arise from the timely approval of new BRDs that allow for increased escapement of non-targeted finfish species from shrimp nets. Alternative 1 would allow for the modification of the Protocol through the publication of a proposed and final rule. Compared to Alternatives 2 and 3, since the preparation of a regulatory amendment would not be required, administrative costs for framework modifications (e.g., staff time, Council meetings and document preparation) would not be incurred.	Alternatives 1, 2 and 3 would have no direct economic effects on the shrimp harvesting sector. Alternatives 2 and 3 would not provide the expected future indirect benefits as described in Section 4.2.1.3 to participants in other fisheries. Additionally, there would be no expected increase in future non-use benefits to society from improvements in ecosystem function. Adoption of Alternatives 2 or 3 would not result in reduced administrative costs.	It is expected that Alternative 1 would result in higher net economic benefits to society compared to the other two alternatives. Unlike Alternatives 2 and 3, Alternative 1 would ultimately reduce administrative costs associated with testing and approval of new BRDs. Alternatives 2 and 3 would not allow for the possible increase in future indirect economic benefits as described if Alternative 1 is adopted.

Table 1. Continued

Action 2. Amend the Bycatch Reduction Device (BRD) Framework to adjust the criteria for certification of new BRDs.			
Alternatives	**Positive impacts**	**Negative impacts**	**Net impacts**
Alternative 1. (Preferred). For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the total weight of finfish by at least: Subalternative a. 22% Subalternative b. 30% **(Preferred)** **Alternative 2.** No action. For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish and Spanish mackerel by 50% or demonstrate a 40% reduction in numbers of weakfish and Spanish mackerel. **Alternative 3.** Remove Spanish mackerel as a target species from the BRD certification criteria. Thus, for a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish by 50% or demonstrate a 40% reduction in the numbers of weakfish.	Alternatives 1, 2 and 3 would have no direct economic effects on the shrimp harvesting sector. Future indirect economic benefits could accrue to participants in other fisheries if Alternative 1 results in the testing and certification of more efficient BRDs in a timely manner. Compared to Alternative 2, Alternative 1 may reduce the costs of testing BRDs since researchers would not have to locate areas where weakfish and/or Spanish mackerel are present. There could be some cost savings if Alternative 3 is chosen since researchers would only have to locate areas where weakfish are encountered and not both species at the same time. Alternative 3 may not result in reduced costs to the same extent as Alternative 1.	Alternatives 1, 2 and 3 would have no direct economic effects on the shrimp harvesting sector. Alternatives 2 and 3 would not provide the expected future indirect benefits, as described in Section 4.2.2.3, to participants in other fisheries. Additionally, there would be no expected increase in future non-use benefits to society from improvements in ecosystem functions. The possible research costs savings from Alternative 1 would not be realized if either Alternative 2 or 3 is adopted. Compared to Alternative 2, Alternative 3 is expected to result in lower research costs since Spanish mackerel would not have to be encountered on BRD testing trials.	It is expected that Alternative 1 would result in higher net economic benefits to society compared to the other two alternatives. Alternatives 2 and 3 would not allow for the possible increase in future indirect economic benefits, as described, if Alternative 1 is adopted. Unlike alternative 2, Alternatives 1 and 3 would likely reduce research costs associated with testing of new BRDs. However, it is expected that Alternative 1 would reduce research costs to a greater extent than Alternative 3.

Table 1. Continued

Action 3. Establish a method to monitor and assess bycatch in the South Atlantic rock shrimp and penaeid shrimp fisheries.			
Alternatives	**Positive Impacts**	**Negative impacts**	**Net impacts**
Alternative 1 (Preferred). Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits. **Alternative 2.** No action. Utilize existing information to estimate and characterize bycatch. **Alternative 3.** Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. **Alternative 4.** Require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.	There would be no time costs to the industry if Alternative 2 is chosen. Also, Alternative 2 would not create the additional administrative costs as specified for Alternatives 1, 3 and 4. By providing more accurate data on bycatch, Alternatives 1, 3 and 4 would yield future indirect economic benefits. These benefits would result from better informed management decisions and expected effects would accrue to participants in fisheries for species that appear in the shrimp trawl bycatch.	There would be agency costs from carrying out an observer program if Alternative 1, 3 or 4 is implemented. Observer coverage for the first phase of Alternative 1 and Alternative 3 would cost $160,000 per year. The agency costs for implementing Alternative 3 or the final phase of Alternative 1 could range from $0.7 million to $1.8 million in a given year. In addition, the choice of either Alternative 1, 3 or 4 could impose time costs for completing paper logbooks. If a paper logbook is required there would be administrative costs for production and postage ($11 per logbook) and processing cost ($100 per vessel annually). For the fishery as a whole, the average annual opportunity cost would be approximately $32,186 (10% reporting) to $321,862 (100% reporting). Alternative 2 would not provide the indirect benefits described from improved and more current data on shrimp trawl bycatch.	It is expected that if Alternative 1, 3 or 4 is chosen, and the cost to the industry is minimal, there would be increased net economic benefits to society.

Table 1. Continued

Action 4. Minimize bycatch in the rock shrimp fishery to the extent practicable.			
Alternatives	**Positive impacts**	**Negative Impacts**	**Net impacts**
Alternative 1 (Preferred). Require a NOAA Fisheries-approved BRD be utilized on all rock shrimp trips in the South Atlantic. **Alternative 2.** No action. Do not adopt additional measures to reduce bycatch in the rock shrimp fishery. **Alternative 3.** Implement a seasonal closure in the rock shrimp fishery. Subalternative a. Fall (September, October, November) Subalternative b. Winter (December, January, February) Subalternative c. Summer (June, July, August)	Alternatives 1 and 3 would yield indirect economic benefits to other fishery participants and possibly increase non-use benefits from a reduction in rock shrimp bycatch. These benefits would accrue as a result of increased population sizes of species currently taken as bycatch as described in Section 4.2.4.1. These benefits are expected to be higher for Alternative 3 compared to Alternative 1. Use of a BRD may increase vessel revenues if sorting time is reduced and product quality is enhanced. Alternative 2 would not result in lower additional industry costs or lower revenue as described for Alternatives 1 and 3.	Based on the expected loss not to exceed 3% of the shrimp catch per trip from the use of BRDs, future estimated reduction in revenue for the rock shrimp industry is expected to be $59,417 per year for Alternative 1. For this alternative the average expected reduction per vessel would be $1,382 annually (0.6% of the average revenue of an affected vessel). It is assumed that these vessels would not have to purchase BRDs in order to comply with this requirement. There would be a lost opportunity for increased indirect economic benefits to society as a result of bycatch reduction if Alternative 2 was chosen. Alternative 3 would reduce overall gross annual revenue for the rock shrimp industry by $466,149 (1%), $3,812,659 (11%) or $2,665,167 (8%) for a closure during winter, summer and fall months respectively.	It is reasonable to suppose that Alternative 1 would result in positive net economic benefits. The cost of this measure is not substantial and the benefits from adopting this precautionary approach, until additional information becomes available, is expected to exceed this cost. On that basis, Alternative 2 would not be expected to generate positive net economic benefits. Alternative 3 would have serious negative consequences for the industry and the high cost for reducing bycatch from a seasonal closure may be greater than the expected benefits from protecting the spot population.

Table 1. Continued

Action 5. Consider the requirement for a federal penaeid shrimp permit in order for a shrimp trawler to fish for or possess penaeid shrimp in the South Atlantic EEZ.			
Alternatives	**Positive impacts**	**Negative impacts**	**Net impacts**
Alternative 1 (Preferred). For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application. **Alternative 2.** No action. A federal permit would not be required to fish for or possess penaeid shrimp in the South Atlantic EEZ. **Alternative 3.** For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application. **Alternative 4.** For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to applicants who have the necessary state commercial permits to land and sell shrimp.	Through the requirement for permits, Alternatives 1, 3 and 4 would allow for more efficient and accurate identification of vessels in the penaeid shrimp fishery. Future economic benefits would accrue to the industry from better management based on data collected from the known universe of participants and better enforcement of fishing regulations. Because of the requirement that an eligible applicant needs to have the necessary state license(s)/ permit(s) to land and sell shrimp, Alternative 4 may result in fewer latent permits in the fishery compared to Alternatives 3 and 1. Choosing Alternative 2 would not impose a cost (permit fee) on vessel owners that fish for shrimp in the South Atlantic EEZ. Also, there would be no increase in administrative costs from issuing permits and maintaining a permits database.	Alternatives 1, 3 and 4 would require the purchase of a permit. This cost is $50 per vessel application ($20 per vessel if the vessel owner holds another federal permit issued by the SERO). Also, the opportunity cost (time spent completing the application) is estimated at $5. The industry cost for Alternatives 1, 3 and 4 could range from $27,600 to $94,900 annually. There would be some increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms. Alternative 2 would not allow for the efficient and accurate identification of vessels in the shrimp fishery. Thus, the indirect economic benefits from better data collection would not be realized. Compared to Alternative 1, Alternatives 3 and 4 may not achieve the same level of compliance with the permit requirement because their exemptions present loopholes for law enforcement. Thus, there would be reduced indirect benefits from improved data collection if Alternative 3 or 4 is implemented instead of Alternative 1.	If Alternative 1, 3 or 4 is chosen it is expected that the economic benefits of improved data collection and more effective enforcement would outweigh the cost of the permit fee. As a result Alternative 2 may result in forgone net economic benefits.

Table 1. Continued

Action 6. Revise, establish and/or retain status determination criteria for penaeid shrimp stocks			
Alternatives	**Positive impacts**	**Negative impacts**	**Net impacts**
Alternative 1 (Preferred). Using the established MSY and OY values, revise or establish overfishing and overfished definitions for penaeid shrimp based on an MSY control rule. Overfishing (MFMT) for all penaeid species is a fishing mortality rate that diminishes the stock below the designated MSY stock abundance (B_{MSY}) for two consecutive years and MSST is established with two thresholds: (a) if the stock diminishes to ½ MSY abundance (½ B_{MSY}) in one year, or (b) if the stock is diminished below MSY abundance (B_{MSY}) for two consecutive years. In addition, white shrimp would be considered overfished when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. A proxy for B_{MSY} would be established for each species using CPUE information from SEAMAP-SA data as the lowest values in the 1990-2003 time period that produced catches meeting MSY the following year. **Alternative 2. No action.** Retain the current status determination criteria definitions for penaeid shrimp. **Alternative 3.** Revise or establish consistent overfishing and overfished definitions for penaeid shrimp based on the established MSY and OY catch values. Overfishing (MFMT) for brown and pink shrimp would be defined as a fishing mortality rate that led to annual landings larger than two standard deviations above MSY for two consecutive years, and the overfished threshold (MSST) for brown, pink and white shrimp would be defined as annual landings smaller than two standard deviations below MSY for two consecutive years. Overfishing (MFMT) for white shrimp is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures.	There are no direct economic effects associated with Alternatives 1, 2 and 3.	There are no direct economic effects associated with Alternatives 1, 2 and 3. Indirect negative economic effects could arise if the Council takes restrictive action in response to an overfishing or overfished determination. Should either situation arise, at this time, it is not possible to speculate on the relative magnitude of these effects as the Shrimp Review Advisory Panel would need to make a final determination on whether management action is required and if so the geographic extent and duration of such action.	There are no direct effects from these measures. At this time it is unclear as to the magnitude or duration of any action that may be taken as a result of an overfished or overfishing determination.

Table 1. Continued

Action 7. Revise, establish and/or retain status determination criteria for rock shrimp.			
Alternatives	**Positive impacts**	**Negative impacts**	**Net impacts**
Alternative 1 (Preferred). Establish stock status determination criteria consistent with those of penaeid shrimp, where MSY/OY for rock shrimp is the mean total landings for the South Atlantic during 1986 through 2000 (4,912,927 pounds heads on), where overfishing (MFMT) for rock shrimp would be a fishing mortality rate that led to annual landings larger than two standard deviations (9,774,848 pounds heads on) above MSY (4,912,927 + 9,774,848 = 14,687,775 pounds heads on) for two consecutive years, and MSST would be parent stock size less than ½ (Bmsy) for two consecutive years. **Alternative 2.** No action. Retain the current status determination criteria definitions for rock shrimp. **Alternative 3.** Using the established 6,829,449 pounds (heads on) MSY/OY values, overfishing (MFMT) for rock shrimp would be landings in excess of MSY for two consecutive years and overfished (MSST) would be landings below ½ MSY (3,464,274 pounds heads on) for two consecutive years.	There are no direct economic effects associated with Alternatives 1, 2 and 3. If the Council were to take restrictive action in response to an overfished or overfishing determination it is unclear whether the fishery would benefit from a larger population to be harvested in the future.	There are no direct economic effects associated with Alternatives 1, 2 and 3. There are no restrictive actions associated with Alternative 2. If Alternative 1 or 3 is chosen indirect negative economic effects could arise if the Council takes restrictive action in response to an overfishing or overfished determination. Should either situation arise, at this time, it is not possible to speculate on the relative magnitude of these effects as the Shrimp Review Advisory Panel would need to make a final determination on whether management action is required and if so the geographic extent and duration of such action.	There are no direct effects from these measures. There may be indirect effects associated with Alternatives 1 and 3. These effects would be dependent on future management actions.

The economic effects from the proposed alternatives as presented in the preceding table will not exceed $100 million. It is unlikely that given the expected magnitude of these impacts that there would be an adverse affect on the economy, a sector of the economy, productivity, competition, jobs or communities.

In addition, these proposed alternatives are not likely to have an adverse effect on the environment, public health or safety or state, local or tribal governments. Furthermore, the proposed measure will not create a serious inconsistency or otherwise interfere with an action taken or planned by another agency, will not materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof.

As outlined in Section 3.2.1 commercial harvesters in the South Atlantic shrimp fishery need to purchase state permits or licenses to land and sell shrimp in South Atlantic states. Some of these vessel owners may have also acquired a Gulf of Mexico shrimp permit. In addition, there are many commercial fisheries in the South Atlantic that are federally permitted. For these reasons a permit requirement is not expected to raise novel legal or policy issues. The other measures considered in this amendment are also not expected to raise novel legal or policy issues. Thus, this proposed rule is not significant under E.O. 12866.

SOCIAL IMPACT ASSESSMENT/FISHERY IMPACT STATEMENT

This integrated document contains all elements of the Final Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Initial Regulatory Flexibility Analysis (IRFA), Regulatory Impact Review (RIR), Social Impact Assessment (SIA)/Fishery Impact Statement (FIS) and Biological Assessment (BA). A table of contents for the SIA/FIS 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-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). 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 Council on Environmental Quality’s (CEQ 1997) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, a clarification of the terms “human environment” expanded 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 Magnuson-Stevens Act, fishery management plans (FMPs) must “...achieve and maintain, on a continuing basis, the optimum yield from each fishery” [Magnuson-Stevens Act Section 2 (b) (4)]. Recent amendments to the Magnuson-Stevens Act 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 through the inclusion of a fishery impact statement [Magnuson-Stevens Act Section 303 (a) (9)]. Most recently, with the addition of National Standard 8, conservation and management measures must now, consistent with conservation requirements, take into account the importance of fishery resources to fishing communities to provide for their sustained participation and minimize adverse economic impacts upon those communities to the extent practicable [Magnuson-Stevens Act Section 301 (a) (8)]. 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 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, included under this interpretation are cultural impacts that may involve changes in values and beliefs which affect people’s way of identifying themselves within their occupation, communities and society in general. Social impact analyses help determine the 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 input 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, qualitative data can be used to provide a rough estimate of some impacts. In addition, when there is a body of empirical findings available from the social science literature, it needs to be summarized and referenced in the analyses.

In attempting to assess the social impacts of the proposed amendment it must be noted that data available for these analyses still do not represent a comprehensive overview of the fishery; therefore, analyses do not include all social impacts. What information was available pertains primarily to the commercial harvesting sector and packing houses in the South Atlantic shrimp fishery. These data are records of shrimp landings in the four states of the region and further analyses extrapolated to the communities that might be impacted. Other accounts of the shrimp fishery in the South Atlantic are relatively dated, being compiled almost 25 years ago. Two other studies used were conducted and published in the past five years, however, they are specific to North Carolina. Thus, social impacts on non-commercial harvesters, the processing sector, the consumer, fishing communities and society as a whole are not fully addressed due to data limitations. The fishery impact statement consists of the description of the commercial fishery and the social impacts associated with the proposed actions. Data to define or determine impacts upon fishing communities are still limited.

Table 2. Social impact (SIA/FIS) summary.

<table>
<tr><th>ACTION</th><th>SOCIAL IMPACTS</th></tr>
<tr><td colspan="2">Action 1. Amend the Bycatch Reduction Device (BRD) Framework to adjust Council authority in regard to modifications of the BRD testing protocol.</td></tr>
<tr><td>Alternative 1 (Preferred). Modify the BRD framework procedure to remove the authority and procedural requirements of the Council to modify the BRD Testing protocol and transfer to NOAA Fisheries the authority to make appropriate revisions to the Protocol.</td><td rowspan="3">There are no direct social impacts for fishermen or communities deriving from this action. However, each alternative is associated with indirect social impacts. Alternative 1, the preferred alternative, would have the most positive impacts of the three proposed alternatives in that it promotes timeliness, efficiency and responsiveness to changes in the fishery and technological innovations. Hence, it follows the principle of adaptive management. Alternative 2, No Action, leaves the process in the Council timeline, which can be slow, with some regulatory changes taking more than a year from scoping to implementation. This lengthy process would work to the detriment of the fishermen and the researchers, ultimately having biological impacts on the ecosystem, and thus returning negative feedbacks to the fishery in general (e.g., potential lowered catch of finfish in fisheries other than shrimp). Alternative 3 is similar to the No Action alternative, but NOAA Fisheries would be responsible for the statistical testing methodology of BRDs. This alternative, like Alternative 2, offers no significant benefit of timeliness or expediency to innovations coming from the industry or research organizations.</td></tr>
<tr><td>Alternative 2. No action. The BRD Testing Protocol would remain in the BRD framework under the authority of the Council.</td></tr>
<tr><td>Alternative 3. The Council would retain authority for the BRD framework to modify the BRD Testing Protocol, but would remove the statistical testing methodology established in the Protocol Manual, and transfer authority to establish appropriate statistical testing methodologies to NOAA Fisheries.</td></tr>
<tr><td colspan="2">Action 2. Amend the Bycatch Reduction Device (BRD) Framework to adjust the criteria for certification of new BRDs.</td></tr>
<tr><td>Alternative 1 (Preferred). For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the total weight of finfish by at least:
Subalternative a. 22%
Subalternative b. 30% (Preferred)</td><td rowspan="3">As with Action 1, there will be no direct social impacts, negative or positive, resulting from Action 2. Any impacts from this action will be indirect. Alternative 1, the preferred alternative, is more adaptive in that it recognizes the current societal and scientific trend of managing fisheries based on an ecosystem approach, not a species-specific approach. As for Alternative 1a or Alternative 1b, the approval of one or the other threshold will not have any notable social impacts, direct or otherwise. The No Action Alternative is not adaptive and creates an unnecessary burden on researchers and BRD developers by maintaining difficult testing standards. This can be considered to be a negative, indirect social impact. Similar results and impacts come from Alternative 3, which removes one indicator species from the testing protocol, but leaves the other – weakfish. Because neither weakfish nor Spanish mackerel is classified as overfished, focusing bycatch reduction on only one or two species denies the importance of a functioning ecosystem to healthy fisheries. Hence Alternative 3 would also have an indirect negative impact on the fishery in general.</td></tr>
<tr><td>Alternative 2. No action. For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish and Spanish mackerel by 50% or demonstrate a 40% reduction in numbers of weakfish and Spanish mackerel.</td></tr>
<tr><td>Alternative 3. Remove Spanish mackerel as a target species from the BRD certification criteria. Thus, for a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish by 50% or demonstrate a 40% reduction in the numbers of weakfish.</td></tr>
</table>

Table 2. Social impact (SIA/FIS) summary continued.

Action 3. Establish a method to monitor and assess bycatch in the South Atlantic rock shrimp and penaeid shrimp fisheries.	
Alternative 1 (Preferred). Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits. **Alternative 2.** No action. Utilize existing information to estimate and characterize bycatch. **Alternative 3.** Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. **Alternative 4.** Require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.	The ACCSP Release, Discard and Protected Species Module provides the best method for assessing bycatch from the penaeid and rock shrimp fisheries. However, as funding for the program is currently insufficient, the SAFMC has over the short-term combined the ACCSP Module with the best existing practices for assessing bycatch in order to address the problem of bycatch in the most expeditious and efficient manner possible. While each practice (observer programs, logbooks, state programs/data collection, special projects and federal permit program) has certain potential positive and negative impacts associated with it, this potpourri of protocols will offer a wealth of information and the opportunity for data triangulation. For example, while working towards full implementation of the ACCSP Module, Alternative 1 would include an at-sea observer program and collection of release/discard data through interviews with fishermen in port. While observer programs are an intrusive data collection system, a majority of fishermen interviewed in the past four years (Kitner, personal communication 2004) have expressed a desire to have observers on their boats. While this alternative is the most efficient in terms of dealing with the realities of funding for research and other management related initiatives, there is a potential for problems with data-sharing, data compatibility and continuity in research programs that may impair assessment efforts (as with Alternative 4). While Alternative 1 may have the most potential short-term social impacts, these impacts would be mitigated by properly administered outreach and education programs for the scientists and fishermen. Alternative 2, No Action, would not cause immediate social impacts but poses potential future negative impacts to the shrimp fishery over time. Because no new information would be collected, and management decisions would be based on information that might no longer be applicable to the fishery, more restrictive regulations to reduce bycatch mortality may need to be introduced, imposing a social cost. Alternative 3 could be adopted, but there is no assurance that it would be adequately funded and would thus potentially have an outcome very similar to Alternative 2, No Action. Alternative 4 offers an array of solutions to monitor and assess bycatch but may have the negative impact of being a patchwork of programs. As such, there is a potential for problems with data-sharing, data compatibility and continuity in research programs that may impair assessment efforts.

Table 2. Social impact (SIA/FIS) summary continued.

Action 4. Minimize bycatch in the rock shrimp fishery to the extent practicable.	
Alternative 1 (Preferred). Require a NOAA Fisheries-approved BRD be utilized on all rock shrimp trips in the South Atlantic.	In comparing the alternatives for Action 4, the preferred Alternative 1 is seen as the least onerous of the three proposed alternatives. While Alternative 2 may seem the alternative to pose the fewest negative social impacts, the impacts to agency and management personnel plus fishermen would come in the form of potential lawsuits and fishery closures. Alternative 3 would cause the most hardship for fishermen, as all the proposed closure months (Alternative 3 a, b, and c) exhibit relatively high landings for rock shrimp.
Alternative 2. No action. Do not adopt additional measures to reduce bycatch in the rock shrimp fishery.	
Alternative 3. Implement a seasonal closure in the rock shrimp fishery: Subalternative a. Fall (September, October, November) Subalternative b. Winter (December, January, February) Subalternative c. Summer (June, July, August)	

Table 2. Social impact (SIA/FIS) summary continued.

Action 5. Consider the requirement for a federal penaeid shrimp permit in order for a shrimp trawler to fish for or possess penaeid shrimp in the South Atlantic EEZ.	
Alternative 1 (Preferred). For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.	Implementing a federal shrimp permit system has far more positive impacts than negative ones. As it is open to anyone to obtain a permit, there are no exclusionary negative social impacts. Compared to the no action (Alternative 2), a permit system would ease data collection and benefit the shrimp fishery in many ways. Leaving the situation as it is (No Action) would not benefit the fishery and is not consistent with managers being good stewards of the fishery. Alternative 3 is slightly less restrictive than the preferred Alternative 1 or Alternative 4, but may pose problems for enforcement. Alternative 4 is slightly more restrictive than Alternative 3 by excluding those shrimpers who may not hold state licenses.
Alternative 2. No action. A federal permit would not be required to fish for or possess penaeid shrimp in the South Atlantic EEZ.	
Alternative 3. For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.	
Alternative 4. For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to applicants who have the necessary state commercial permits to land and sell shrimp.	

Table 2. Social impact (SIA/FIS) summary continued.

Action 6. Revise, establish and/or retain status determination criteria for penaeid shrimp stocks.	
Alternative 1. (Preferred) Using the established MSY and OY values, revise or establish overfishing and overfished definitions for penaeid shrimp based on an MSY control rule. Overfishing (MFMT) for all penaeid species is a fishing mortality rate that diminishes the stock below the designated MSY stock abundance (B_{MSY}) for two consecutive years and MSST is established with two thresholds: (a) if the stock diminishes to ½ MSY abundance (½ B_{MSY}) in one year, or (b) if the stock is diminished below MSY abundance (B_{MSY}) for two consecutive years. In addition, white shrimp would be considered overfished when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. A proxy for B_{MSY} would be established for each species using CPUE information from SEAMAP-SA data as the lowest values in the 1990-2003 time period that produced catches meeting MSY the following year.	Specifying the overfished and overfishing definitions does not directly affect resource use and, therefore has no direct effects on existing fisheries and communities. Direct effects associated with resource use would only accrue to subsequent management action in response to an evaluation of the fishery with regards to these benchmarks. With no direct change in the use of the resource by individuals or communities, there would be no behavioral changes by these individuals or communities and, therefore, no indirect affects attributed to such change. These definitions are statutory requirements of an FMP, and their establishment would provide public satisfaction by recognizing that the Council is effectively managing the resource. Alternatives 1, 2 and 3 may cause indirect impacts on the fishermen and their communities should it be determined that lower allowable catch levels are required to meet more conservative definitions of the SFA Parameters.
Alternative 2. No action. Retain the current status determination criteria definitions for penaeid shrimp.	
Alternative 3. Revise or establish consistent overfishing and overfished definitions for penaeid shrimp based on the established MSY and OY catch values. Overfishing (MFMT) for brown and pink shrimp would be defined as a fishing mortality rate that led to annual landings larger than two standard deviations above MSY for two consecutive years, and the overfished threshold (MSST) for brown, pink and white shrimp would be defined as annual landings smaller than two standard deviations below MSY for two consecutive years. Overfishing (MFMT) for white shrimp is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures.	

Table 2. Social impact (SIA/FIS) summary continued.

Action 7. Revise, establish and/or retain status determination criteria for rock shrimp.	
Alternative 1 (Preferred). Establish stock status determination criteria consistent with those of penaeid shrimp, where MSY/OY for rock shrimp is the mean total landings for the South Atlantic during 1986 through 2000 (4,912,927 pounds heads on), where overfishing (MFMT) for rock shrimp would be a fishing mortality rate that led to annual landings larger than two standard deviations (9,774,848 pounds heads on) above MSY (4,912,927 + 9,774,848 = 14,687,775 pounds heads on) for two consecutive years, and MSST would be parent stock size less than ½ (Bmsy) for two consecutive years.	Specifying the overfished and overfishing definitions does not directly affect resource use and, therefore has no direct effects on existing fisheries and communities. Direct effects associated with resource use would only accrue to subsequent management action in response to an evaluation of the fishery with regards to these benchmarks. With no direct change in the use of the resource by individuals or communities, there would be no behavioral changes by these individuals or communities and, therefore, no indirect affects attributed to such change. These definitions are statutory requirements of an FMP, and their establishment would provide public satisfaction by recognizing that the Council is effectively managing the resource. Alternatives 1 and 3 may cause indirect impacts on the fishermen and their communities should it be determined that lower allowable catch levels are required to meet more conservative definitions of the SFA Parameters.
Alternative 2. No action. Retain the current status determination criteria definitions for rock shrimp.	
Alternative 3. Using the established 6,829,449 pounds (heads on) MSY/OY values, overfishing (MFMT) for rock shrimp would be landings in excess of MSY for two consecutive years and overfished (MSST) would be landings below ½ MSY (3,464,274 pounds heads on) for two consecutive years.	

SOCIAL IMPACT ASSESSMENT DATA NEEDS

As explained in Section 3 Affected Environment, shrimping is the common denominator of almost all of the still existing fishing communities in the South Atlantic. However, there has never been a systematic survey of shrimpers or their communities in this region. No baseline of activity or culture exists and changes have been occurring rapidly along the southeastern coasts of the United States. If the permitting measure proposed in this amendment were implemented, then researchers would have a universe from which they could begin inquiries. Recognizing that defining and understanding the social and economic characteristics of a fishery is critical to good management of the fishery, more comprehensive work needs to be done on the shrimp fishery. While some sociocultural studies of the shrimp industry have been carried out in the past 10 years (e.g., Durrenberger 1996, Maril 1995, Maiolo 2004), they do not have specific applicability to the South Atlantic shrimp fishery. Nor have the community and social dimensions of the shrimp fishery been studied recently by NOAA Fisheries and state fishery agencies; the last studies of this sort were conducted over twenty years ago. Alternatives in this amendment, if implemented, will provide the basis to remedy that neglect.

Complete profiles are needed for fishing communities in the South Atlantic. These profiles are being developed but, at the present time, their usefulness is limited. Much of the ongoing research is piecemeal due to the lack of funds and personnel. Furthermore, the fishing communities' dependence upon fishing and fishery resources needs to be established. To achieve these goals, data need to be gathered in three or more ways.

First, in order to establish both baseline data and to contextualize the information already gathered by survey methods, there is a great need for in-depth, ethnographic study of the different fishing sectors or subcultures. Second, existing literature on social/cultural analyses of fisheries and other sources in social evaluation research need to be identified and synthesized to offer a comparative perspective and guide the SIAs. Third, socio-economic data need to be collected on a continuing basis for the commercial and recreational sectors, including the for-hire sector. Social and economic data collection can be accomplished through logbooks for the commercial sector, observer data in the commercial and for-hire sector and dock surveys for all sectors.

The following is a guideline to the types of data needed:

1. Demographic information may include but is not necessarily limited to: population; age; gender; ethnic/race; education; language; marital status; children (age & gender); residence; household size; household income (fishing/non-fishing); occupational skills; and association with vessels and firms (role & status).

2. Social structure information may include but is not necessarily limited to: historical participation; description of work patterns; kinship unit, size and structure; organization and affiliation; patterns of communication and cooperation; competition and conflict; spousal and household processes; and communication and integration.

3. Cultural information (from the perspective of the respondent) may include but is not necessarily limited to: occupational motivation and satisfaction; attitudes and perceptions concerning management; constituent views of their personal future of fishing; psycho-social well-being; and cultural traditions related to fishing (identity and meaning).

4. Fishing community information might include but is not necessarily limited to: identifying communities; dependence upon fishery resources (this includes recreational use); identifying businesses related to that dependence; and determining the number of employees within these businesses and their status.

This list of data needs is neither exhaustive nor all-inclusive, and should be revised periodically to better reflect on-going and future research efforts.

PROTECTED SPECIES BIOLOGICAL ASSESSMENT

This integrated document contains all elements of the Final Plan Amendment, Final Supplemental Environmental Impact Statement (FSEIS), Initial Regulatory Flexibility Analysis (IRFA), Regulatory Impact Review (RIR), Social Impact Assessment (SIA)/Fishery Impact Statement (FIS) and Biological Assessment (BA) of impacts to protected species. The table of contents for the BA is provided separately to aid reviewers in referencing corresponding sections of the Amendment.

Introduction

Section 7(a)(1) of the Endangered Species Act (ESA) of 1973, as amended, requires all federal agencies to use their authorities to conduct conservation programs for listed threatened and endangered species. Section 7(a)(2) requires that federal agencies, in consultation with NOAA Fisheries or the Fish and Wildlife Service, must ensure that any activity they authorize, fund or carry out is not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of designated critical habitat. To facilitate compliance with Section 7(a)(2), the Council has prepared a biological assessment to evaluate the likely effects of the proposed action on endangered and threatened species and any designated critical habitat occurring within the area of the proposed action(s) [Section 7(c)]. For consultation purposes, the biological assessment aids NOAA Fisheries' Division of Protected Resources in determining what further action (informal/formal consultation) is required. Consultations are concluded informally when proposed actions "may affect but are not likely to adversely affect" endangered or threatened species or "not likely to adversely modify" designated critical habitat. Formal consultations are required when proposed actions "may affect" and are "likely to adversely affect" endangered or threatened species or "adversely modify" designated critical habitat. In that case, NOAA Fisheries prepares a biological opinion to determine whether activities may jeopardize the continued existence of any listed species or critical habitat. If a jeopardy opinion is issued, the opinion will contain reasonable and prudent alternatives to the proposed action to reduce impacts and avoid jeopardy to listed species.

Actions 1 and 2 to modify the framework procedures of the FMP would not have direct or indirect impacts on protected resources. There are no direct impacts on protected resources from Actions 3, 4, or 5 to reduce finfish bycatch in the rock shrimp fishery and establish bycatch reporting and permit requirements in the shrimp fishery. However, beneficial indirect impacts may occur through better identification of participants in the fishery and from a better estimation of protected species interactions. There are no direct impacts on protected resources from Actions 6 and 7 to establish or revise stock status criteria for the various shrimp species. Therefore, the proposed actions are not likely to adversely affect any endangered or threatened species or their critical habitat. NOAA Fisheries will conduct a Section 7 consultation on the actions proposed in this amendment when the amendment is submitted for review by the Secretary of Commerce.

1.0 Introduction

1.1 Background

The South Atlantic Fishery Management Council (the Council), in cooperation with the National Marine Fisheries Service (NOAA Fisheries), is responsible for the management of brown, pink, white and rock shrimp off the coast of the southeastern United States. Fishery management plans (FMPs) and FMP amendments are developed in accordance with the Magnuson-Stevens Fishery Conservation and Management Act as amended by the Sustainable Fisheries Act (SFA) (16 U.S.C. 1801 et seq.) (Magnuson-Stevens Act). Section 301(a) of the Magnuson-Stevens Act contains 10 national standards for fishery conservation and management, with which FMPs and FMP amendments prepared by the fishery management councils and the Secretary of Commerce must comply. The proposed actions contained within this amendment to the FMP for the Shrimp Fishery of the South Atlantic Region (Shrimp FMP) focus on advancing the Council's and NOAA Fisheries' compliance with National Standards 1 (prevent overfishing while achieving optimum yield) and 9 (minimize bycatch or mortality from bycatch, where bycatch is defined as the incidental capture of non-target fish and other marine animals).

National Standard 1 directs the Councils, in conjunction with NOAA Fisheries, to end overfishing where it is occurring and rebuild overfished stocks. Where the stock is designated as undergoing overfishing, plans must be implemented to reduce fishing pressure. In cases where stocks are overfished, the Councils and NOAA Fisheries must implement a rebuilding plan. To fulfill this congressional mandate, fishery managers must first determine the status of the species under management. The Magnuson-Stevens Act requires that each FMP define reference points in the form of maximum sustainable yield (MSY) and optimum yield (OY), and specify objective and measurable criteria for identifying when the fishery is overfished and/or undergoing overfishing. Status determination criteria are defined by 50 CFR 600.310 to include a minimum stock size threshold (MSST) and a maximum fishing mortality threshold (MFMT). Together, these four parameters (MSY, OY, MSST and MFMT) are intended to provide fishery managers with the tools to measure the status and performance of each fishery in the fishery management unit. These parameters are difficult to apply to shrimp stocks because they are short-lived (essentially annual crops) and because the year-class strength of shrimp populations is influenced primarily by environmental factors rather than by catch rates. Thus, regulation of fishing effort has not been demonstrated to affect the long-term sustainability of these populations unless the spawning stock has been reduced below a minimum threshold level by environmental conditions. The Magnuson-Stevens Act does not provide specific guidance on how to define management reference points that recognize the influence of environmental factors on population trends.

National Standard 9 of the Magnuson-Stevens Act states that conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. To address National Standard 9, the Magnuson-Stevens Act requires, at Section 303(a)(11), that all FMPs establish a standardized reporting methodology to assess the amount and type of bycatch in a fishery, and include conservation and management measures that minimize bycatch and minimize the mortality of bycatch that cannot be avoided. To address issues related to the management of bycatch in the nation's fisheries, NOAA Fisheries published a National Bycatch Strategy (68 FR 40202, March 11, 2003). The strategy seeks to develop a standardized reporting methodology and undertake education and outreach efforts, while assessing progress towards the national bycatch goal. As part of the national strategy, the

Southeast Region of the U.S. has identified methods to better quantify and reduce bycatch through a FY04 and FY05 Bycatch Implementation Plan (NOAA Fisheries 2004).

1.2 Purpose and need for action

The Council has identified several issues in the shrimp fishery that need to be addressed to effectively manage and conserve the fishery and the resource. Actions proposed in this amendment, if implemented, would provide more efficient methods by which to meet the objectives of the Shrimp FMP. In addressing the identified issues, the Council has outlined the following purposes and underlying needs for the actions proposed within this amendment.

1) Amend the Bycatch Reduction Device (BRD) Framework to allow for timely changes to the Protocol. Amendment 2 established the BRD Testing Protocol, which outlines the procedures by which an experimental BRD is to be tested for its ability to reduce bycatch in a shrimp trawl. The Protocol outlines several rather rigorous procedures intended to reduce the variability and uncertainty in the data that would arise from the requirement for only a 30-tow sample size. In application, several field trials of experimental BRDs were not completed successfully (e.g., 30 successful comparative tows were not completed) because these procedural requirements could not be met. Inability to complete a field trial on potentially effective BRDs because of logistical constraints has substantial negative consequences for conservation. Further development of particularly productive BRDs may cease and BRD efficiency might never rise above the current level. This contradicts the Council’s stated intent to encourage innovative developments to improve BRDs.

These issues were identified at a 1999 shrimp fishery stakeholders’ workshop sponsored by the Gulf and South Atlantic Fisheries Foundation, Inc. Recommendations stemming from that workshop were made available to the Council for their consideration. Based on this information, as well as additional public input regarding the Protocol, the Council began consideration of alternative procedures that address and alleviate impediments to testing and certifying new BRDs candidates.

NOAA Fisheries presented a revised draft of the Protocol to the Council at its November 2000 meeting for review and comment. A final draft, incorporating Council comments and concerns, was provided by NOAA Fisheries to the Council in April 2001 (Appendix B). The alternative procedures maintain the statistical confidence that BRDs will meet the established bycatch reduction criteria and achieve the Council’s goals of bycatch reduction.

Nevertheless, to amend the Protocol the Council must develop a regulatory amendment. This process requires review by the Shrimp Advisory Panel (Shrimp AP), the Shrimp Committee, a public comment period on the regulatory amendment and final approval by the Council. The regulatory amendment is then submitted to NOAA Fisheries for implementation through proposed and final rule. By contrast, NOAA Fisheries has the authority to modify the BRD Protocol established for the Gulf of Mexico shrimp fishery through proposed and final rule, after consultation with the Gulf of Mexico Fishery Management Council, which provides for more timely modifications.

The Council recognizes the need to similarly provide for timely modifications of its Protocol. If the South Atlantic Council similarly transferred authority for the Protocol to NOAA Fisheries, modifications to the procedures also could be accomplished, after consultation with the Council, through proposed and final rule. Providing NOAA Fisheries the authority to modify the Protocol, would facilitate more timely changes should they be deemed necessary. Additionally, providing authority to NOAA Fisheries for both the South Atlantic and Gulf of Mexico Protocols would facilitate the timely implementation of compatible modifications to both Protocols as necessary.

Transferring the authority to modify the BRD testing protocol to NOAA Fisheries would require removal of Section A(1) of the "Modification of BRD testing protocol and BRD certification criteria and requirements" section of the framework. This transference of authority could limit input from the BRD Advisory Panel (BRD AP) and Shrimp Committee and Council in regard to proposed changes. The BRD AP expressed concerns that future changes might not reflect industry concerns. This situation can be avoided as long as NOAA Fisheries consults the Council prior to making any changes.

2) More effectively address bycatch reduction by adjusting the Council's criteria for certification of new BRDs. Amendment 2 established criteria by which experimental BRDs would be certified for use in the South Atlantic penaeid shrimp fishery. A BRD would be certified if it was determined to reduce bycatch mortality of juvenile Spanish mackerel and weakfish by a minimum of 50% or demonstrate a 40% reduction in numbers of Spanish mackerel and weakfish. When these criteria were established both species were considered overfished, and the implementation of a requirement for the use of BRDs in the shrimp fishery was intended to help rebuild both species. Spanish mackerel now is completely recovered and weakfish is no longer overfished (see discussions in Section 3.1.11 and 4.2.2). In addition, sampling for these species in particular has proved to be impractical to researchers. It is difficult to encounter Spanish mackerel and weakfish simultaneously while testing BRDs.

To better address the requirements of National Standard 9, the Council is considering changing the certification criteria to a general finfish reduction requirement. This would support the Council's efforts to achieve an ecosystem approach in fisheries management.

3) Establish a method to regularly monitor and assess bycatch in the South Atlantic penaeid and rock shrimp fisheries. The first step in reducing and minimizing bycatch is to characterize the magnitude and species composition of animals that are discarded. The U.S. Congress, fully aware of this fact, established Section 303(a)(11) of the Magnuson-Stevens Act that states that any FMP that is prepared by any Council, or by the Secretary of Commerce, with respect to any fishery, shall "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery...". To support this mandate, the National Standard Guidelines call for development of a database for each fishery in order to house bycatch and bycatch mortality information (63 FR 24212).

To accomplish the legislative goals and mission of NOAA Fisheries, the Council has recognized the need to establish a standard bycatch reporting methodology for the shrimp fishery. NOAA Fisheries defines a standard bycatch reporting methodology as a description of both the data collection and analyses that is used to estimate bycatch in a fishery. Development of a standardized reporting methodology will ensure the collection and distribution of timely, reliable and standardized bycatch data to the public and policy decision-makers. Currently there is no such methodology fully implemented for the southeast Atlantic shrimp fishery. During the 1990s there were a number of ad hoc studies to estimate bycatch in the South Atlantic. One of these studies, conducted during February 1993 to September 1994, provided a comprehensive characterization study of the fishery. However, the Council is seeking to implement a long-term, standardized monitoring and assessment program as part of this shrimp amendment.

4) Reduce the amount of bycatch in the rock shrimp fishery. At-sea observations of 177 tows (all with BRDs) conducted from September 2001 through December 2002 on a total of six rock shrimp trips off the Florida east coast revealed significant quantities of bycatch. Finfish comprised 54% of the catch by weight and 32% of the catch by numbers, while rock shrimp comprised 10% and 13% by number and weight respectively. Weight extrapolations from the species composition samples are contained in Table 1-1.

Table 1-1. Weight extrapolations from the species composition samples for 2001 and 2002: all areas, seasons and depths from the at-sea observation of 177 tows on six rock shrimp trips (NOAA Fisheries 2003c).

Species	**Weight (kg)**	**Percent weight**
Dusky flounder, *Syacium papillosum*	2761	13
Iridescent swimming crab, *Portunus gibbesii*	2167	10
Rock shrimp, *Sicyonia brevirostris*	2066	10
Inshore lizardfish, *Synodus foetens*	1917	9
Longspine swimming crab, *Portunus spinicarpus*	1621	8
Spot, *Leiostomus xanthurus*	1338	6
Blotched swimming crab, *Portunus spinimanus*	1011	5
Brown shrimp, *Farfantepenaeus aztecus*	778.6	4
Red goatfish, *Mullus auratus*	490.6	2
All other species combined	7090.3	33

Mortality of discards (i.e., bycatch) in both commercial and recreational fisheries has been a cause for great concern among resource managers and the public. Ecologically, we are only beginning to understand the impact of discard mortality in disrupting food chains and altering population dynamics. Economically, the removal of commercially important species as bycatch may equate to the elimination of potential revenue for commercial and recreational fishing. Little is known about the status of those finfish (e.g., dusky flounder, inshore lizardfish, spot, red goatfish) and invertebrate (e.g., iridescent swimming crab, longspine swimming crab, blotched swimming crab) species that are present in rock shrimp trawl bycatch in the greatest numbers. None of these species have undergone (or are likely to undergo) formal stock assessments because most, with the exception of spot, are not targeted in commercial or recreational fisheries. Data are inadequate to conduct a formal, coast-wide assessment of spot. However, fishery managers believe that a combination of BRD and minimum size limit requirements would be sufficient to protect this stock until a spot assessment can be completed (ASMFC 2004d).

In today's society, bycatch concerns extend to non-exploitable species. There is a need to address the bycatch issue in the rock shrimp fishery. This would better address the requirements of National Standard 9 and support the Council's efforts to achieve an ecosystem approach in fisheries management. However, proposed actions must take into consideration the fact that the rock shrimp observer study was carried out during an atypical rock shrimp season where rock shrimp harvest was especially low compared to previous years (Section 3.2.3.1). Thus, these findings should be considered preliminary (Section 3.1.9).

5) Provide an accurate and efficient method to identify and quantify vessels that fish in federal waters for penaeid shrimp species. Fishery managers, in completing the analyses required to gauge the impacts of management actions on the human environment, must rely upon the information contained in databases maintained by the four South Atlantic states and the U.S. Coast Guard. Each of the four South Atlantic states requires a commercial fishing license to harvest penaeid shrimp in state waters. The type of information collected typically includes owner, captain, vessel name, vessel length and vessel registration number. In addition, the U.S. Coast Guard maintains a nation-wide vessel identification system (VIS) as required by the Ship Mortgage Act of 1988 (46 U.S.C. 911-984). The information collected includes the owner's name, address, the date and location of vessel construction and the manner in which the owner took title to a vessel. The purpose of the VIS is to aid law enforcement in the identification and recovery of stolen vessels, deter vessel theft and assist in deterring and discovering security-interest and insurance theft.

The information collected through state license programs and Coast Guard VIS is inadequate to complete the analysis required to totally satisfy Magnuson-Stevens Act and other federal mandates. In describing the basic elements to be contained in an FMP, Section 303(a) of the Magnuson-Stevens Act lists, among other items, the number of vessels involved in the fishery. Also, the required elements to complete the economic analysis required by the Regulatory Flexibility Act of 1980 (5 U.S.C. 601-612) include information on incorporation, revenue profiles by vessel size and capacity and revenue from and participation in other fisheries. Other crucial information lacking includes whether or not the vessel is utilized for a fishery other than the shrimp fishery and whether the shrimping effort is in state waters, federal waters or both.

The VIS falls short of applicability towards fishery management for several reasons. Firstly, the system does not collect information from the full universe of vessels. The Coast Guard is only required to document vessels with volumes of 5 net tons or more (generally, this equates to vessels greater than 25 feet). In terms of recreational vessels, the Coast Guard typically (though not required) includes vessels of 5 net tons or more in the VIS (GAO 2002). Secondly, the VIS is unable to handle data reliability issues and detailed data requests from the states (GAO 2002).

In light of the current data systems and federal mandates, the Council has recognized that establishment of a commercial vessel permit for fishery participants in federal waters is a prerequisite for a comprehensive data collection program. A permit system would provide the mechanism to obtain accurate numbers on shrimping effort in the South Atlantic EEZ. This information would be used in biological, economic and social assessments of the resource and fishery participants crucial to sound management.

6) Comply with the Sustainable Fisheries Act through designation of status determination criteria (minimum stock size threshold and maximum fishing mortality threshold), or proxies thereof as necessary, for white, brown, pink and rock shrimp. The Magnuson-Stevens Act requires that each FMP define reference points in the form of maximum sustainable yield (MSY) and optimum yield (OY), and specify objective and measurable criteria for identifying when the fishery is overfished and/or undergoing overfishing. Status determination criteria are defined by 50 CFR 600.310 to include a minimum stock size threshold (MSST) and a maximum fishing mortality threshold (MFMT). Together, these four parameters (MSY, OY, MSST and MFMT) are intended to provide fishery managers with the tools to measure the status and performance of each fishery in the fishery management unit. By evaluating stock biomass (B) and fishing mortality rate (F) in relation to MSY, OY, MSST and MFMT, fishery managers can determine the status of a fishery at any given time and assess whether management measures are achieving established goals.

The Council addressed the Magnuson-Stevens Act requirements through a 1998 comprehensive amendment to the shrimp FMP that addressed SFA definitions. For the penaeid and rock shrimp, the Council chose the “no action” alternative in Shrimp FMP Amendment 4, based on the conclusion that established definitions were consistent with the best available scientific information. The Council took this action because shrimp are annual crops that fluctuate considerably from year to year depending primarily on environmental factors. The regulations implementing these measures were effective December 2, 1999. Although the 1998 SFA amendment maintained the current definitions for shrimp, not all criteria were specifically defined. The stock status criteria are incomplete and, thus, do not totally fulfill the relevant requirements of the Magnuson-Stevens Act and the national standard guidelines.

1.3 History of shrimp management in the South Atlantic

The **Fishery Management Plan/EIS** for the Shrimp Fishery of the South Atlantic Region (SAFMC 1993) provided 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 to eliminate fishing mortality on over-wintering white shrimp following severe winter cold kills. In addition it also established 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 can 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 penaeid species is allowed provided that the nets are in an un-fishable condition which is defined as stowed below deck. The plan provided an exemption for the royal red and rock shrimp fisheries to allow the rock shrimp fishery to be prosecuted with minimal disruption during a closure of federal waters for protection of white shrimp.

The Shrimp FMP (SAFMC 1993) defined MSY as the mean total landings for the southeast region:

White shrimp – 14.5 million pounds
Brown shrimp – 9.2 million pounds
Pink shrimp – 1.8 million pounds

Optimum Yield (OY) for the white shrimp fishery was defined as the amount of harvest that could be taken by U.S. fishermen without reducing the spawning stock below the level necessary to ensure adequate reproduction. This level has been estimated only for the central coast of South Carolina, and only in terms of subsequent fall production (assumed to represent recruitment).

The Shrimp FMP established the overfishing criterion for white shrimp as “overfishing is indicated when the overwintering white shrimp population within a state’s waters declines by 80% or more following severe winter weather resulting in prolonged cold water temperatures.” Regulations implementing the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region (SAFMC 1993) were published October 27, 1993 and became effective on November 26, 1993.

Amendment 1/EA to the shrimp fishery management plan (SAFMC 1996a) addressed measures pertaining to the rock shrimp fishery in the South Atlantic EEZ. In this amendment rock shrimp was added to the management unit. Trawling for rock shrimp was prohibited east of 80° W. longitude between 27° 30’ N. latitude and 28° 30’ N. latitude in depths less than 100 fathoms to limit the impact of the rock shrimp fishery on essential bottom fish habitat, including the fragile coral species existing in the *Oculina* Bank Habitat Area of Particular Concern. This prohibition enhanced existing federal regulations for coral and snapper grouper by protecting essential live/hard bottom habitat including *Oculina* coral and the *Oculina* Bank HAPC from trawl related damage. To address the need for better data, NOAA Fisheries was directed to require dealers to submit reports to accurately account for harvest of rock shrimp in the South Atlantic. Amendment 1 established OY for the rock shrimp fishery as MSY in the South Atlantic EEZ. MSY 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. This amendment established MSY for rock shrimp as the mean total landings for the southeast region. Through this amendment, an overfishing threshold was established for rock shrimp. The rock shrimp resource was considered overfished when the annual landings exceeded the value which is two standard deviations above mean landings 1986-1994. This level was set at 6,829,449 pounds based on the more accurate state data. Shrimp Amendment 1 (SAFMC 1996a) was sent to NOAA Fisheries for formal review and implementation on January 17, 1996. Regulations implementing the actions in Amendment 1 became effective on October 9, 1996 (closure) and November 1, 1996 (remaining measures).

Shrimp Amendment 2/SEIS (SAFMC 1996b) added pink shrimp to the management unit, defined overfishing and OY for brown and pink shrimp, required the use of certified BRDs in all penaeid shrimp trawls in the South Atlantic EEZ (the large mesh extended funnel and the fisheye) and established a framework for BRD certification specifying BRD certification criteria and testing protocol. OY for the brown and pink shrimp fisheries in the South Atlantic EEZ was defined as the amount of harvest that can be taken by U.S. fishermen 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]. When annual landings fall below this level, the resource is considered overfished. The amendment was sent to NOAA Fisheries for formal review and implementation on April 30, 1996. The Amendment was approved on February 24, 1997. Regulations implementing the actions in Amendment 2 became effective on April 21, 1997.

Shrimp Amendment 3/EIS was included in the Council’s Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region (SAFMC 1998a), which addressed the Habitat requirements of the Magnuson-Stevens Act, as amended in 1996. Under Shrimp Amendment 3, Essential Fish Habitat for the South Atlantic shrimp resource was defined as follows [Note: Detailed information is presented in the Council’s Habitat Plan (SAFMC 1998b)]:

Penaeid shrimp: inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity and all interconnecting water bodies as described in the Habitat Plan (SAFMC 1998b). Inshore nursery areas include tidal freshwater (palustrine), estuarine and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and inter-tidal non-vegetated flats. This applies from North Carolina through the Florida Keys.

Rock shrimp: offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 34 and 55 meters. This applies for all areas from

North Carolina through the Florida Keys. Essential fish habitat includes the shelf current systems near Cape Canaveral, Florida, which provide major transport mechanisms affecting planktonic larval rock shrimp. These currents keep larvae on the Florida shelf and may transport them inshore in spring. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse rock shrimp larvae.

Shrimp Amendment 3 also established Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPC) for penaeid shrimp in the South Atlantic. Areas that meet the criteria for EFH-HAPCs for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp and state-identified overwintering areas. The Comprehensive Amendment was approved in June 1999; no regulations were required to make the designations of EFH and EFH-HAPCs effective. Regulations were implemented as part of this amendment, under the FMP for Corral, Coral Reefs, and Live Hard Bottom Habitats of the South Atlantic Region (Coral FMP) (see below).

In addition, Shrimp Amendment 3 called for implementation of a voluntary Vessel Monitoring System (VMS) in the rock shrimp fishery. The voluntary pilot program was intended to provide information concerning the future use of transponders in the rock shrimp fishery. This voluntary program was not implemented because of logistical issues associated with the evolving VMS technologies at the time.

The Council's Comprehensive Habitat Amendment (including Shrimp Amendment 3) was sent to NOAA Fisheries for formal review and implementation on October 9, 1998. The Amendment was approved on June 3, 1999. Regulations implementing these actions were published on June 14, 2000 and became effective on July 14, 2000.

Coral Amendment 4/EIS to the Coral FMP, included in the Comprehensive SFA Amendment (SAFMC 1998c) expanded the *Oculina* Bank Habitat Area of Particular Concern (HAPC) to an area bounded to the west by 80°W. Longitude, to the north by 28°30'N. Latitude, to the south by 27°30'N. latitude and to the east by the 100 fathom (600 feet) depth contour. Amendment 4 expanded the *Oculina* Bank HAPC to include the area closed to rock shrimp harvest. The Draft Calico Scallop FMP proposes to close this area to calico scallop harvest. The expanded *Oculina* Bank HAPC is 60 nautical miles long by about 5 nautical miles wide although the width tracks the 100 fathom (600 foot) depth contour rather than a longitude line. Within the expanded *Oculina* Bank HAPC area the following regulations apply:

1. Fishing with a bottom longline, bottom trawl, dredge, pot or trap is prohibited.
2. A fishing vessel may not anchor, use an anchor and chain or use a grapple and chain.

Amendment 4 to the Coral FMP (SAFMC 1998c) also established two Satellite *Oculina* HAPCs: Satellite *Oculina* HAPC #1 bounded on the north by 28°30'N. Latitude, on the south by 28°29'N. Latitude, on the east by 80°W. Longitude and on the west by 80°3'W. Longitude; and Satellite *Oculina* HAPC #2 is bounded on the north by 28°17'N. Latitude, on the south by 28°16'N. Latitude, on the east by 80°W. Longitude and on the west by 80°3'W. Longitude.

It is the Council's intent to prohibit the possession of calico scallops and rock shrimp within these areas to enhance enforceability of the prohibition of harvest and the prohibition on use of bottom-tending gear in these areas.

Within the two Satellite *Oculina* Bank HAPCs, the following regulations apply:

1. Fishing with a bottom longline, bottom trawl, dredge, pot or trap is prohibited.
2. A fishing vessel may not anchor, use an anchor and chain or use a grapple and chain.

Shrimp Amendment 4/EA was included in the Council's Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and Other Required Provisions in Fishery Management Plans of the South Atlantic Region (SAFMC 1998c), which addressed the Sustainable Fisheries Act requirements of the Magnuson-Stevens Act, as amended in 1996. Shrimp Amendment 4 included reporting requirements as specified in the Atlantic Coastal Cooperative Statistics Program (ACCSP). It was established that the Council staff would work with NOAA General Counsel to determine the appropriate procedure to remove all the varied data reporting requirements in individual FMPs and reference one comprehensive data reporting document. The Shrimp FMP was also amended to include available information on fishing communities (detailed discussion in the SFA Comprehensive Amendment; SAFMC 1998c). In addition, Amendment 4 designated biological reference points and status determination criteria (Table 1-2). The Council approved MSY for rock shrimp as 6,829,449 pounds, OY for rock shrimp as equal to MSY and the overfished definition for rock shrimp as two standard deviations above mean landings for the period 1986-1994.

The Council's Comprehensive SFA Amendment (including Shrimp Amendment 4) was sent to NOAA Fisheries for formal review and implementation on October 7, 1998. The final rule was published on November 2, 1999 and regulations became effective on December 2, 1999.

Table 1-2. Biological reference points (BRP) and status determination criteria (SDC) for the four shrimp species in the fishery management unit as designated by the Council's 1998 Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and Other Required Provisions in Fishery Management Plans of the South Atlantic Region.

BRP/SDC	Shrimp species	Designation
MSY	White	14.5 million pounds.
	Brown	9.2 million pounds
	Pink Rock	1.8 million pounds 6,829,449 pounds
OY	White	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.
	Brown Pink Rock	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 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp]. 6,829,449 pounds
Overfishing and Overfished Level	White	Overfishing is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. (Note: This overfishing definition actually describes the overfished status rather than overfishing.) No overfished definition.
	Brown Pink Rock	Brown and pink shrimp are overfished when the 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]. No overfishing definitions for either species. (Note: It is assumed that overfishing is occurring when the overfished threshold is met.) Overfished is mean landings + 2 SDs (6,829,449) – no overfishing definition established (Note: It is assumed that overfishing is occurring when the overfished threshold is met).

Amendment 5/EIS to the Shrimp Plan was developed to address issues in the rock shrimp fishery (SAFMC, 2002). Amendment 5 established a rock shrimp limited access program, required a vessel operator's permit, established a minimum mesh size for the tail bag of a rock shrimp trawl (at least 40 meshes of 1 and 7/8 inch stretched mesh above the 2 inch rings) and required use of an approved vessel monitoring system in the limited access rock shrimp fishery. Amendment 5 was sent for formal Secretary of Commerce review on February 25, 2002. The amendment was approved on October 23, 2002 and final regulations implementing the actions in Amendment 5 were published on February 18, 2003 and became effective on the dates as indicated in the following paragraphs:

> **Operator permits - effective May 16, 2003:** "For a person to be an operator of a vessel fishing for rock shrimp in the South Atlantic EEZ or possessing rock shrimp in or from the South Atlantic EEZ, or to be an operator of a vessel that has a valid permit for South Atlantic rock shrimp, such person must have and carry on board a valid operator permit and one other form of personal identification that includes a picture (driver's license, passport, etc.). At least one

person with a valid operator's permit for the South Atlantic rock shrimp fishery must be aboard while the vessel is at sea or offloading."

Limited access endorsement - effective July 15, 2003: "For a person aboard a vessel to fish for or possess rock shrimp in the South Atlantic EEZ off Georgia or off Florida, a limited access endorsement for South Atlantic rock shrimp must be issued to the vessel and must be on board. A vessel is eligible for an initial limited access endorsement if the owner owned a vessel with a Federal permit for South Atlantic rock shrimp on or before December 31, 2000 and landed at least 15,000 pounds of South Atlantic rock shrimp in any one of the calendar years 1996 through 2000 from a vessel he/she owned."

VMS - effective October 14, 2003: Vessels that were issued a limited access endorsement for South Atlantic rock shrimp must have a NOAA Fisheries-approved, operating VMS on board when on a trip in the South Atlantic. An operating VMS includes an operating mobile transmitting unit on the vessel and a functioning communication link between the unit and NOAA Fisheries as provided by a NOAA Fisheries-approved communication service provider.

Control Date: At the December 2003 Council meeting, the Council set a control date of December 10, 2003 for the penaeid shrimp fishery operating in the South Atlantic EEZ. Publication of this control date (69 FR 10189; March 4, 2004) puts the industry on notice that the Council may develop a limited access program in the future. Should this occur there is no guarantee that vessels entering the fishery after this date will qualify for a limited access endorsement.

1.4 Objectives of the shrimp fishery management plan

Objectives identified in the Shrimp FMP and subsequent amendments are as follows:

1. Eliminate fishing mortality on over-wintering white shrimp following severe winter cold kills.

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

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

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

5. 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.

6. 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.

7. Provide a mechanism to manage rock shrimp under the fishery management plan for the shrimp fishery in the South Atlantic region.

8. Minimize impacts of the rock shrimp fishery on coral, coral reefs and live/hard bottom habitat in the South Atlantic region.

9. Implement permit and reporting requirements needed to ensure necessary data are provided by the rock shrimp industry.

10. Manage the resource to provide for higher sustainable net benefits by taking the first step in reducing the current overcapacity in the rock shrimp fishery.

11. Remove latent permits from the rock shrimp fishery and restrict future entrants so as not to exacerbate the overcapacity problem in the future.

12. Protect the interest of traditional user groups in the rock shrimp fishery. Traditional users also tend to be more familiar with management regulations pertaining to their fishery as opposed to new entrants who enter a fishery and participate infrequently.

13. Decrease fishing mortality on unmarketable small/juvenile rock shrimp with the goal of increasing future yield in the rock shrimp industry from reduced discards of small shrimp.

14. Improve enforcement of current fishery management regulations, particularly with regard to illegal fishing in the *Oculina* Bank HAPC, by requiring vessel monitoring systems on rock shrimp vessels.

15. Protect the interests of vessel owners who are not operators and increase compliance with management regulations by the requirement for operator permits for rock shrimp vessels.

2.0 Alternatives

This environmental impact statement explores the differences among a number of management alternatives for seven proposed changes to the Shrimp Fishery Management Plan (FMP). Alternatives are developed to show ways of meeting the purpose and need while addressing a range of issues. For Amendment 6 to the Shrimp FMP, alternatives were received and developed through interdisciplinary team meetings, Council meetings, written public comments, scoping meetings and meetings of the Shrimp, Rock Shrimp and Shrimp Bycatch Reduction Device (BRD) Ad Hoc Advisory Panels. The Council employs a process that screens all alternatives to a management action conceived during scoping to identify a reasonable range for detailed analysis. Appendix A (separate document) contains the alternatives that were eliminated from further study for each of the seven proposed actions and the reason for their elimination.

The Council decided to consolidate the requirements of the Magnuson-Stevens Act, Regulatory Flexibility Act, the National Environmental Policy Act, and the other applicable laws into an integrated document. For that reason, the evaluation of alternatives and discussion about the effects on the environment is presented in **Section 4.0. Environmental Consequences**. This includes a detailed comparison between alternatives explaining the Council's choice in the selection of the preferred alternative. **Section 2.0. Alternatives** summarizes that discussion. The Council and NOAA Fisheries concluded this meets NEPA's regulatory requirements.

2.1 Action 1. Amend the Bycatch Reduction Device (BRD) Framework to adjust Council authority in regard to modifications of the BRD testing protocol.

Alternative 1 (Preferred). Modify the BRD framework procedure to remove the authority and procedural requirements of the Council to modify the BRD Testing protocol and transfer to NOAA Fisheries the authority to make appropriate revisions to the Protocol.

Alternative 2. No action. The BRD Testing Protocol would remain in the BRD framework under the authority of the Council.

Alternative 3. The Council would retain authority for the BRD framework to modify the BRD Testing Protocol, but would remove the statistical testing methodology established in the Protocol Manual, and transfer authority to establish appropriate statistical testing methodologies to NOAA Fisheries.

Amendment 2 established a requirement for the use of NMFS-certified BRDs in the penaeid shrimp fishery operating in the South Atlantic EEZ, and a framework procedure whereby the Council could modify the certification criteria and the BRD testing procedures. The framework discusses two issues: (1) certification procedures including establishment of bycatch reduction criteria, and (2) a means to modify: [a] the BRD testing protocol and [b] the BRD certification criteria. The Council is now considering modifications to the framework that would remove its authority to modify the BRD testing protocol.

Biologically, Alternative 1 would have beneficial, indirect impacts through the facilitation of the evaluation and certification of potentially more efficient BRDs. The ecological effects of bycatch reduction are outlined in Section 4.2.4 of this amendment. Both Alternatives 2 and 3 would have adverse, indirect impacts by impeding the certification of BRDs that may be more efficient in reducing bycatch. Economically, Alternative 1 would have beneficial, indirect impacts to fishery participants if new BRDs result in the increased escapement of nontargeted finfish species from shrimp nets. The continued delay in the certification of more efficient BRDs, as would occur in Alternatives 2 and 3, could equate to lost beneficial, indirect impacts to the shrimping industry (the industry). Alternative 1 would allow procedures as prescribed in the Protocol to be modified through the publication of a proposed and final rule. As this could be done in less than one year, there would be reduced administrative costs compared to Alternative 2 and 3 since there would be no need to prepare an amendment and incur affiliated costs (e.g., staff time, Council meetings and document preparation). Both Alternatives 2 and 3 would require the Protocol to be modified through framework action in an amendment. As the completion of an amendment would most likely require at least a year, administrative costs (e.g., staff time, Council meetings and document preparation) would be higher for Alternatives 2 and 3 than Alternative 1. However, revisions to the BRD sampling procedures as outlined in Alternative 3 would create a data set that would need to be appropriately analyzed by the statistical procedures established by NOAA Fisheries. This process would require a concurrent revision to their statistical procedures through a separate proposed and final rule, thus resulting in increased administrative time and costs compared to Alternative 1. In terms of social impacts, the facilitation of the process that would occur as a result of Alternative 1 would certify more efficient BRDs and result in beneficial, indirect impacts to fishery participants and society as a whole. In addition, a timely and more efficient system could equate to an increase in the public's confidence in the fishery management process in the South Atlantic. The opportunity for increased bycatch reduction would be delayed if Alternative 2 or 3 were implemented. Also, the continued lengthy process would work to the detriment of fishermen and researchers, ultimately having adverse, indirect impacts on the ecosystem. Table 2-1 summarizes and compares the impacts of all the alternatives.

Table 2-1. A summarized comparison of the impacts between the alternatives for Action 1. The impacts are designated as adverse, beneficial, direct and indirect as appropriate.

	Alternatives		
Impacts	**Alternative 1. (Preferred)**. Modify the BRD framework procedure to remove the authority and procedural requirements of the Council to modify the BRD Testing protocol and transfer to NOAA Fisheries the authority to make appropriate revisions to the Protocol.	**Alternative 2.** No action. The BRD Testing Protocol would remain in the BRD framework under the authority of the Council.	**Alternative 3.** The Council would retain authority for the BRD framework to modify the BRD Testing Protocol, but would remove the statistical testing methodology established in the Protocol Manual, and transfer authority to establish appropriate statistical testing methodologies to NOAA Fisheries.
Biological	Beneficial, indirect impacts to the ecosystem.	Adverse, indirect impacts to the ecosystem	Adverse, indirect impacts to the ecosystem.
Economic	Beneficial, indirect impacts to the shrimping industry (the industry). The research and administrative costs will be lower than Alternatives 2.	Lost opportunity for beneficial, indirect impacts to the industry. Administrative costs would be greater than Alternative 1 and 3.	Beneficial, indirect impacts to the industry. It is expected that administrative costs are greater than Alternative 1, but less than Alternative 2.
Social	Beneficial, indirect impacts to fishery participants and society as a whole.	Adverse indirect impacts to the ecosystem, fishermen and researchers.	Adverse, indirect impacts to the ecosystem.

2.2 Action 2. Amend the Bycatch Reduction Device (BRD) Framework to adjust the criteria for certification of new BRDs.

Alternative 1. (Preferred). For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the total weight of finfish by at least:

Subalternative a. 22%
Subalternative b. 30% **(Preferred)**

Alternative 2. No action. For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish and Spanish mackerel by 50% or demonstrate a 40% reduction in numbers of weakfish and Spanish mackerel.

Alternative 3. Remove Spanish mackerel as a target species from the BRD certification criteria. Thus, for a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish by 50% or demonstrate a 40% reduction in the numbers of weakfish.

Biologically, Alternative 1 would allow the certification of a wider variety of BRDs thus equating to beneficial, indirect impacts. Subalternative 1b would ultimately provide a higher overall reduction in bycatch compared to Subalternative 1a. Choosing Subalternative 1a could lead to the certification of less effective BRDs than the ones currently approved for use in this fishery. Alternatives 2 and 3 would not promote the development of productive BRD concepts. As a result, BRD efficiency may never rise above the current level. The ecological effects of bycatch reduction, in general, are outlined in Section 4.2.4 of this amendment. In terms of economic impacts, Alternative 1 could result in improved efficiency in bycatch of species other than weakfish and Spanish mackerel, equating to beneficial, indirect impacts to participants in other fisheries. Also, Alternative 1 may reduce the costs of testing BRDs since researchers would not have to locate areas where weakfish and/or Spanish mackerel are present; Alternative 2 would miss this opportunity, and Alternative 3 would still require researchers to test during periods of high weakfish abundance, which may not represent actual fishing conditions. Subalternative 1b would lead to greater beneficial, indirect impacts compared to Subalternative 1a as there would be increased compatibility as the Gulf of Mexico Fishery Management Council chose a 30% overall finfish reduction criteria to certify BRDs for use in the Eastern Gulf of Mexico. In terms of social impacts, Alternative 1 would result in an evolution from a species-specific approach to an ecosystem approach to management, which will have a better reception among scientists and the public, equating to beneficial, indirect impacts. There is no difference in the social impacts between Subalternatives 1a and 1b. Alternatives 2 and 3 would create adverse, indirect social impacts to researchers and BRD developers by setting unreasonable testing standards. In addition, by gauging the efficiency of BRDs according to how much one species is excluded, the Council loses an opportunity to move towards an ecosystem approach to fisheries management. Table 2-2 summarizes and compares the impacts of all the alternatives.

Table 2-2. A summarized comparison of the impacts between the alternatives for Action 2. The impacts are designated as adverse, beneficial, indirect and direct as appropriate.

	Alternatives		
Impacts	**Alternative 1 (Preferred).** For a new BRD to be certified, it be must statistically demonstrated that such a device can reduce the total weight of finfish by at least: Subalternative a. 22% Subalternative b. 30% **(Preferred)**	**Alternative 2.** No action. For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish and Spanish mackerel by 50% or demonstrate a 40% reduction in numbers of weakfish and Spanish mackerel.	**Alternative 3.** Remove Spanish mackerel as a target species from the BRD certification criteria. Thus, for a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish by 50% or demonstrate a 40% reduction in the numbers of weakfish.
Biological	Beneficial, indirect impacts. Subalternative 1b would provide a greater degree of beneficial, indirect impacts than Subalternative 1a, or Alternative 2.	Loss of opportunity for beneficial, indirect impacts. Alternative 1a would have less biological benefits than maintaining status quo.	Loss of opportunity for beneficial, indirect impacts.
Economic	Beneficial, indirect impacts. It is likely that research costs would be lower than the status quo (Alternative 2) or Alternative 3.	Loss of opportunity for beneficial, indirect impacts. It is likely that research costs would be higher than Alternatives 1 and 3.	Loss of opportunity for beneficial, indirect impacts. It is likely that research costs would be higher than Alternative 1 but lower than Alternative 3.
Social	Beneficial, indirect impacts. There is no difference in the social impacts between Subalternative 1a and 1b.	Adverse, indirect impact to researchers and BRD developers.	Adverse, indirect social impacts to researchers and BRD developers.

2.3 Action 3. Establish a method to monitor and assess bycatch in the South Atlantic rock shrimp and penaeid shrimp fisheries.

The alternatives for Action 3 outline the methods to monitor and assess bycatch (Table 2-3). Alternative 3 relies more on the utilization of at-sea observing of trips on shrimp vessels. The first phase of Alternative 1 and Alternative 4 require a lower level of at-sea observer reporting, used in conjunction with logbook reporting by the industry.

Alternative 1 (Preferred). Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.

Alternative 2. No action. Utilize existing information to estimate and characterize bycatch.

Alternative 3. Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology.

Alternative 4. Require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.

Alternatives 1, 3, and 4 would provide beneficial, indirect biological impacts through, among other things, enhancement of the quality of data provided for stock assessments and better estimation of interactions with protected species (the reader is to refer to Section 4.2.3.1 for a complete list of these impacts). Alternative 2, by not initiating new data collection efforts and long-term monitoring of bycatch, would represent a lost opportunity to create beneficial, indirect impacts. Economically, the cost of logbook reporting via paper outlined in Alternatives 1, 3, and 4 would cost the industry an estimated \$12.50 per hour per vessel. The estimated public burden costs associated with vessel logbooks would be \$11.00 per logbook and \$100 per vessel annually. Establishing a system based on relatively high levels of observer coverage would be very expensive (~\$1,000 per day). Logbook programs are more useful in providing estimates of total effort by area and season that can then be combined with observer data to estimate total bycatch. This is especially true in the shrimp fishery where bycatch of some species can be very high and not easily quantified in a logbook. It will not be possible to estimate a statistically valid number of fishermen needed to participate in logbook and observer program until the universe of participants is identified and preliminary data are analyzed. However, the minimum observer level (when combined with effort data) will be substantially less than what is proposed in Alternatives 1 and 3 with the ACCSP discard module. In terms of social impacts, Alternatives 1, 3, and 4 could potentially lead to better data that would allow for less onerous restrictions on the fishery and beneficial impacts. Alternative 2 would represent a lost opportunity to achieve the same beneficial impacts. Table 2-4 summarizes and compares the impacts of all the alternatives.

Table 2-3. The elements that would be utilized in the monitoring program to collect bycatch information under the three alternatives.

Elements of a bycatch reporting program	Alternatives			
	Alternative 1 (Preferred). Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard, and Protected Species Module as the prferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits..	**Alternative 2.** No action. Utilize existing information to estimate and characterize bycatch.	**Alternative 3.** Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology.	**Alternative 4.** Require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits**.**
At-sea observer coverage	Yes. This alternative would require that 20% of the total funds distributed annually for at-sea observers on shrimp vessels trips in South Atlantic and Gulf of Mexico waters would be allocated to the South Atlantic. Using 2003 funding level for estimation purposes, a total of **160 days at sea per year** would be allocated to the South Atlantic in the future. The expected cost would be $160,000 annually. Once the ACCSP bycatch module is implemented and assuming observers would be required on **730 to 1,826 trips per year,** overall estimated cost could range between $0.7 and $1.8 million in a given year.	Yes. Currently, most funds are allocated for bycatch studies in the Gulf of Mexico.	Yes. To meet the ACCSP standard, at-sea observers would be required on at least 2-5% of total trips. For high priority fisheries, the standard recommends the target sampling level be set at 5% of total trips or at a level that achieves a 20-30% proportional standard error (pse). Assuming observers would be required on **730 to 1,826 trips per year**, overall estimated cost could range between $0.7 and $1.8 million in a given year.	Yes. This alternative would require that 20% of the total funds distributed annually for at-sea observers on shrimp vessels trips in South Atlantic and Gulf of Mexico waters would be allocated to the South Atlantic. Using 2003 funding level for estimation purposes, a total of **160 days at sea per year** would be allocated to the South Atlantic in the future (Section 4.2.3.1). The expected cost would be $160,000 annually.
Paper logbooks	Yes. A statistically valid number of shrimp vessels operating in the South Atlantic EEZ would be required to participate. The number (universe) of participants in the fishery, obtained through a federal permit program, would be used to calculate the number by region that would be statistically valid.	None.	May be used.	Yes. A statistically valid number of shrimp vessels operating in the South Atlantic EEZ would be required to participate. The number (universe) of participants in the fishery, obtained through a federal permit program, would be used to calculate the number by region that would be statistically valid.
Electronic logbooks	Yes. A subset of shrimp vessels may participate.	None.	May be used.	Yes. A subset of shrimp vessels may participate.
Utilize bycatch information collected in conjunction with grant-funded programs	Yes.	Yes.	Yes.	Yes.
Outreach/ Training	Yes once the ACCSP Bycatch Module is implemented.	None.	Yes for at-sea observers and fishermen.	Yes once the ACCSP Bycatch Module is implemented.
Port sampling	Yes once the ACCSP Bycatch Module is implemented.	None.	Yes.	None.

Table 2-4. A summarized comparison of the impacts between the alternatives for Action 3. The impacts are designated as adverse, beneficial, indirect and direct as appropriate.

	Alternatives			
Impacts	**Alternative 1 (Preferred).** Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.	**Alternative 2.** No action. Utilize existing information to estimate and characterize bycatch.	**Alternative 3.** Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology.	**Alternative 4.** Require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.
Biological	Beneficial, indirect impacts to the ecosystem.	Loss of opportunity for beneficial, indirect impacts.	Beneficial, indirect impacts to the ecosystem.	Beneficial, indirect impacts to the ecosystem.
Economic	Some adverse direct impacts to the industry and public as a result of the logbook requirement. Observers on 160 days would cost the agency $160,000 per year for the first phase of this program. Once the ACCSP module is implemented agency costs could vary from $730,000 to $1,826,000 in a given year.	No administrative impacts or adverse impacts from the logbook requirement.	Some adverse direct impacts to the industry and public as a result of the logbook requirement. The agency costs of observers on 2-5% of all trips could cost from $730,000 to $1,826,000 in a given year.	Some adverse direct impacts to the industry and public as a result of the logbook requirement. Observers on 160 days would cost the agency $160,000 per year.
Social	Potential, beneficial, indirect impacts Adverse, direct impacts to the industry as a result of the paper logbook requirement.	Potential, adverse, indirect impacts to the industry.	Potential, beneficial, indirect impacts.	Potential, beneficial, indirect impacts. Adverse, direct impacts to the industry as a result of the paper logbook requirement.

2.4 Action 4. Minimize bycatch in the rock shrimp fishery to the extent practicable

Alternative 1 (Preferred). Require a NOAA Fisheries-approved BRD be utilized on all rock shrimp trips in the South Atlantic.

Alternative 2. No action. Do not adopt additional measures to reduce bycatch in the rock shrimp fishery.

Alternative 3. Implement a seasonal closure in the rock shrimp fishery:

Subalternative a. Fall (September, October, November)
Subalternative b. Winter (December, January, February)
Subalternative c. Summer (June, July, August)

Alternatives 1 and 3 would decrease bycatch in the rock shrimp fishery. The ecological effects of bycatch reduction, in general, are outlined in Section 4.2.4 of this amendment. Because BRDs are required in the penaeid shrimp fishery, and many rock shrimp trips also take penaeid shrimp, over the past 3 years, between 14-128 rock shrimp trips would have been required to use BRDs. However, the bycatch reduction capability of currently approved BRDs in the rock shrimp fishery is unknown. Alternative 2 would not result in bycatch reduction from rock shrimp tows from current levels. There would be bycatch reduction from those vessels that keep their penaeid shrimp catch in excess of 1% of their total catch, and thus are required to use BRDs. The only source for bycatch information to define the current levels is from a 2001-2002 pilot study (Appendix C). Alternative 3 would result in higher levels of bycatch reduction than Alternative 1. The rock shrimp pilot study contains the extrapolated species composition by year and season from at-sea observation of rock shrimp trawls in the South Atlantic from September 2001 through December 2002. The highest level of incidental finfish and crustacean catch rates were observed during the winter months. As there would be a reduction of trawl gear in the water, this alternative could provide further protection for smalltooth sawfish (listed as endangered under the ESA) and species of sea turtles found in the area (all are endangered except loggerhead that is threatened).

Alternative 1 would have adverse, direct, economic effects to the industry. Future estimated reduction in revenue for the rock shrimp industry is expected to be $59,417 (the calculations of future expected revenue loss assume a 3% shrimp loss per trip from the use of BRDs). As the average reduction per vessel would be expected to be $1,382 annually (0.6% of the average revenue of an affected vessel), economic impacts to the industry would be considered minimal. However, there would be beneficial, indirect, economic impacts to society as a result of bycatch reduction. Alternative 2 would not result in additional industry costs to lower revenue as described in Alternatives 1 and 3. However, there would be a lost opportunity for beneficial, indirect, economic impacts to society as a result of bycatch reduction. Alternative 3 would reduce overall gross revenue per vessel per year in the industry by $5,901 (1%), $42,363 (11%) and $28,969 (8%) during winter, summer and fall months respectively. Given the economic climate of the industry, this alternative would equate to substantial economic consequences on fishery participants and force some vessel owners to exit the industry.

In terms of social impacts, there would be an expected initial resistance to the measures in Alternative 1. However, the resistance would probably transfer to acceptance as a result of increased tow efficiency and reduced crew sorting time. Alternative 2 would avoid the hardships associated with Alternative 3.

However, social impacts may arise from potential closures and fishery closures if bycatch is not reduced. Alternative 3 would cause the most hardships to the industry and most likely force some participants to leave the industry. Table 2-5 summarizes and compares the impacts of all the alternatives.

Table 2-5. A summarized comparison of the impacts between the alternatives for Action 4. The impacts are designated as adverse, beneficial, indirect and direct as appropriate.

Impacts	Alternatives		
	Alternative 1 (Preferred). Require a NOAA Fisheries-approved BRD be utilized on all rock shrimp trips in the South Atlantic.	**Alternative 2.** No action. Do not adopt additional measures to reduce bycatch in the rock shrimp fishery.	**Alternative 3.** Implement a seasonal closure in the rock shrimp fishery: Subalternative a. Fall (September, October, November) Subalternative b. Winter (December, January, February) Subalternative c. Summer (June, July, August)
Biological	Beneficial, direct impacts. Greater impacts than Alternative 2 but less than Alternative 3	Loss of opportunity for beneficial, direct impacts	Beneficial, direct impacts. Greater impacts than Alternatives 2 and 3
Economic	Minimal, adverse, direct impact to the rock shrimp industry. Beneficial, indirect economic benefits to society	Avoidance of the adverse, direct impacts to the industry as described in Alternatives 1 and 3. A lost opportunity for beneficial, indirect impacts to society	Substantial, adverse, direct and cumulative impacts to participants in the rock shrimp fishery. Beneficial, indirect economic benefits to society
Social	An expected initial resistance may transfer to acceptance as a result of increased tow efficiency and reduced crew sorting time.	This alternative would avoid the hardships associated with Alternative 3. However, social impacts may arise from closures to the fishery if bycatch is not reduced.	Adverse, direct impacts to the industry.

2.5 Action 5. Consider the requirement for a federal penaeid shrimp permit in order for a shrimp trawler to fish for or possess penaeid shrimp in the South Atlantic EEZ

Alternative 1 (Preferred). For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.

Alternative 2. No action. A federal permit would not be required to fish for or possess penaeid shrimp in the South Atlantic EEZ.

Alternative 3. For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.

Alternative 4. For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to applicants who have the necessary state commercial permits to land and sell shrimp.

Alternatives 1, 3 and 4, if tied to observer and catch/effort reporting programs, would result in beneficial, indirect impacts from the increased assessment of bycatch in the shrimp fishery (including protected resources interactions). Alternative 2, by preventing the development of a system to efficiently identify participants for future analyses and communication, would not achieve the same benefits. The annual permit fee designated by Alternative 1, 3 and 4 would be $50. However, if the vessel owner holds another NOAA Fisheries Southeast permit, the cost of this additional new permit would be only $20. The opportunity cost (time spent completing the application) is estimated at $5 per vessel annually. However, under Alternative 3, applicants would have to submit a copy of their state commercial permits (taking another 0.33 hours for retrieval and copying of that permit). Therefore, the opportunity cost would increase under Alternative 3 to a total of 0.66 hours (i.e., a total of $10 per application). The cost would equate to a minimal, adverse, direct impact to the industry. However, Alternatives 1, 3 and 4 would have a beneficial, indirect impact to the industry from better management based on data collected from the known universe of participants and better enforcement of fishing regulations. Alternative 2 would not have temporal or monetary costs to owners of vessels associated with the purchase for a vessel permit. However, the industry would lose the opportunity to obtain beneficial, indirect impacts from improved management and enforcement of fishing regulations. Alternatives 1, 3 and 4 would benefit the industry through improved communication. For example, 1) shrimpers could be contacted in the case of proposed changes in regulations; 2) information collected by a permit system could be used by shrimpers to form constituencies; and 3) scientists, port agents and law enforcement would be able to better contact fishermen for research and outreach. The continued delay in the collection of valuable information for management of the shrimp resource, which would occur if Alternative 2 is chosen, would continue to the detriment of the managers, shrimpers and society as a whole. There would be administrative costs associated with Alternatives 1 and 3 for the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms. These costs would not be incurred if Alternative 2 is chosen. Table 2-6 summarizes and compares the impacts of all the alternatives.

Table 2-6. A summarized comparison of the impacts between the alternatives for Action 5. The impacts are designated as adverse, beneficial, indirect and direct as appropriate.

	Alternatives			
Impacts	**Alternative 1 (Preferred).** For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.	**Alternative 2.** No action. A federal permit would not be required to fish for or possess penaeid shrimp in the South Atlantic EEZ.	**Alternative 3.** For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ, and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.	**Alternative 4.** For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ, and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to applicants who have the necessary state commercial permits to land and sell shrimp.
Biological	Beneficial, indirect impacts to the ecosystem.	Loss of opportunity for beneficial, indirect impacts.	Beneficial, indirect impacts to the ecosystem.	Beneficial, indirect impacts to the ecosystem.
Economic	Minimal, adverse, direct impacts to the industry as a result of the application fee and time costs from completing an application. Beneficial, indirect impacts to the industry from an improved management system. There would be an increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms.	Avoidance of minimal, adverse direct impact to the industry as a result of the application fee. Industry would lose the opportunity to obtain beneficial, indirect impacts from better management and enforcement of fishing regulations. This alternative would not result in administrative costs or costs to the industry.	Minimal, adverse, direct impacts to the industry as a result of the application fee and time costs from completing an application. Beneficial, indirect impacts to the industry from an improved management system. There would be an increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms.	Minimal, adverse, direct impacts to the industry as a result of the application fee and time costs from completing an application. Beneficial, indirect impacts to the industry from an improved management system. There would be an increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms.
Social	Beneficial, indirect impacts to permit holder through improved communication.	The continued delay in the collection of valuable information for the management of the shrimp resource would continue to be lost to the detriment of the managers, shrimpers and society as a whole.	Beneficial, indirect impacts to permit holder through improved communication.	Beneficial, indirect impacts to permit holder through improved communication.

2.6 Action 6. Revise, establish and/or retain status determination criteria for penaeid shrimp stocks.

Alternative 1. (Preferred) Using the established MSY and OY values, revise or establish overfishing and overfished definitions for penaeid shrimp based on an MSY control rule. Overfishing (MFMT) for all penaeid species is a fishing mortality rate that diminishes the stock below the designated MSY stock abundance (B_{MSY}) for two consecutive years and MSST is established with two thresholds: (a) if the stock diminishes to ½ MSY abundance (½ B_{MSY}) in one year, or (b) if the stock is diminished below MSY abundance (B_{MSY}) for two consecutive years. In addition, white shrimp would be considered overfished when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures.

A proxy for B_{MSY} would be established for each species using CPUE information from SEAMAP-SA data as the lowest values in the 1990-2003 time period that produced catches meeting MSY the following year.
Brown shrimp = 2.000 individuals per hectare
Pink shrimp = 0.461 individuals per hectare
White shrimp = 5.868 individuals per hectare.

Alternative 2. No action. Retain the current status determination criteria definitions for penaeid shrimp. These values are shown in Table 2-7.

Table 2-7. The current status determination criteria definitions for penaeid shrimp.

BRP/SDC	**Shrimp species**	**Designation**
MSY	White	14.5 million pounds.
	Brown	9.2 million pounds.
	Pink	1.8 million pounds.
OY	White	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.
	Brown Pink	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 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp].
Overfishing and Overfished Level	White	Overfishing is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. (Note: This overfishing definition actually describes the overfished status rather than overfishing.) No overfished definition.
	Brown Pink	Brown and pink shrimp are overfished when the 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]. No overfishing definitions for either species. (Note: It is assumed that overfishing is occurring when the overfished threshold is met.)

Alternative 3. Revise or establish consistent overfishing and overfished definitions for penaeid shrimp based on the established MSY and OY catch values. Overfishing (MFMT) for brown and pink shrimp

would be defined as a fishing mortality rate that led to annual landings larger than two standard deviations above MSY for two consecutive years, and the overfished threshold (MSST) for brown, pink, and white shrimp would be defined as annual landings smaller than two standard deviations below MSY for two consecutive years.

Brown shrimp:	MSST = 3.0 MP	MSY = 9.2 MP	MFMT = 15.5 MP.
Pink shrimp:	MSST = 0.3 MP	MSY = 1.8 MP	MFMT = 3.3 MP.
White shrimp:	MSST = 6.5 MP	MSY = 14.5 MP	

Overfishing (MFMT) for white shrimp is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures.

There are no direct effects associated with Alternatives 1, 2 and 3. If Alternative 1, 2 or 3 is chosen indirect negative short-term economic and social effects could arise if the Council takes restrictive action in response to an overfishing or overfished determination. Should either situation arise, at this time, it is not possible to speculate on the relative magnitude of these impacts. In all cases, if an overfished and/or overfishing determination is reached the Advisory Panel would need to make a final determination on whether management action is required and if so the geographic extent and duration of such action. Alternatives 1, 2 and 3 may also have beneficial, indirect impacts to protected resources, particularly if future management actions tied to these limits results in a decrease in fishing effort. Impacts of all the alternatives are summarized and compared in Table 2-8.

Table 2-8. A summarized comparison of the impacts between the alternatives for Action 6.

Impacts	**Alternatives**		
	Alternative 1 (Preferred).	**Alternative 2.** No action.	**Alternative 3.**
Biological	Possible, beneficial, indirect impacts to the shrimp resource. The impact of fishing on subsequent year class is unknown.	Possible, adverse, indirect impacts to the shrimp resource. The impact of fishing on subsequent year class is unknown.	Possible, beneficial, indirect impacts to the shrimp resource. The impact of fishing on subsequent year class is unknown.
Economic	Possible, adverse impacts to the industry through any restrictions on fishing effort.	Adverse impacts to the shrimp resource could equate to impacts to the industry.	Possible, adverse impacts to the industry through any restrictions on fishing effort.
Social	Possible, adverse impacts to the industry through any restrictions on fishing effort. Beneficial impacts as there may be public satisfaction by recognizing that the Council is effectively managing the resource.	Adverse impacts to the shrimp resource could equate to impacts to the industry.	Possible, adverse impacts to the industry through any restrictions on fishing effort. Beneficial impacts as there may be public satisfaction by recognizing that the Council is effectively managing the resource.

2.7 Action 7. Revise, establish and/or retain status determination criteria for rock shrimp stocks.

Alternative 1 (Preferred). Establish stock status determination criteria consistent with those of penaeid shrimp, where MSY/OY for rock shrimp is the mean total landings for the South Atlantic during 1986 through 2000 (4,912,927 pounds heads on), where overfishing (MFMT) for rock shrimp would be a fishing mortality rate that led to annual landings larger than two standard deviations (9,774,848 pounds heads on) above MSY (4,912,927 + 9,774,848 = 14,687,775 pounds heads on) for two consecutive years, and MSST would be parent stock size less than ½ (Bmsy) for two consecutive years.

Alternative 2. No Action. Retain the current status determination criteria definitions for rock shrimp. These values are shown in Table 2-9.

Table 2-9. The current status determination criteria definitions for rock shrimp.

BRP/SDC	Shrimp species	Designation
MSY	Rock	6,829,449 pounds
OY	Rock	OY is MSY, which is 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.
Overfishing and Overfished Level	Rock	Rock shrimp are overfished when the annual landings exceed the value which is two standard deviations above mean landings 1986-1994 This level, based on the more accurate state data, is 6,829,449 pounds. No overfishing definition. (Note: It is assumed that overfishing is occurring when the overfished threshold is met.)

Alternative 3. Using the established 6,829,449 pounds (heads on) MSY/OY values, overfishing (MFMT) for rock shrimp would be landings in excess of MSY for two consecutive years and overfished (MSST) would be landings below ½ MSY (3,464,274 pounds heads on) for two consecutive years.

There are no direct effects associated with Alternatives 1, 2, and 3. Under any of the alternatives indirect negative short-term economic and social effects could arise if the Council takes restrictive action in response to an overfishing or overfished determination. Should either overfishing or an overfished situation arise, at this time, it is not possible to speculate on the relative magnitude of these impacts. If an overfished and/or overfishing determination is reached the Shrimp Review Advisory Panel would need to make a final determination on whether management action is required and if so the geographic extent and duration of such action. The alternatives may also have beneficial, indirect impacts to protected resources, particularly if future management actions tied to these limits results in a decrease in fishing effort. Impacts of all the alternatives are summarized and compated in Table 2-10.

Table 2-10. A summarized comparison of the impacts between the alternatives for Action 7.

Impacts	Alternatives		
	Alternative 1. (Preferred).	**Alternative 2.** No action.	**Alternative 3.**
Biological	Possible, beneficial, indirect impacts to the shrimp resource. The impact of fishing on subsequent year class is unknown.	Possible, adverse, indirect impacts to the shrimp resource. The impact of fishing on subsequent year class is unknown.	Possible, beneficial, indirect impacts to the shrimp resource. The impact of fishing on subsequent year class is unknown.
Economic	Possible, adverse impacts to the industry through any restrictions on fishing effort.	Adverse impacts to the shrimp resource could equate to impacts to the industry.	Possible, adverse impacts to the industry through any restrictions on fishing effort.
Social	Possible, adverse impacts to the industry through any restrictions on fishing effort. Beneficial impacts as there may be public satisfaction by recognizing that the Council is effectively managing the resource.	Adverse impacts to the shrimp resource could equate to impacts to the industry.	Possible, adverse impacts to the industry through any restrictions on fishing effort. Beneficial impacts as there may be public satisfaction by recognizing that the Council is effectively managing the resource.

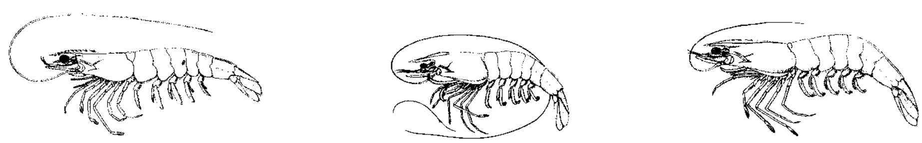
3.0 Affected Environment

3.1 Ecological and habitat characterization of the managed species

3.1.1 Description and distribution

Much of the information in this section is taken from the synoptic reviews on the biology of the various shrimp species by Bielsa *et al.* (1983), Lassuy (1983), Muncy (1984) and Larson *et al.* (1989). Additional source references are cited in these synopses. 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, *Litopenaeus setiferus*, the brown shrimp, *Farfantepenaeus aztecus* and the pink shrimp, *Farfantepenaeus duorarum*. The rock shrimp, *Sicyonia brevirostris* (family Sicyoniidae) and the royal red shrimp, *Pleoticus robustus* (family Solenoceridae) occur in deeper water than the three penaeid species and are of lesser importance to the fishery (SAFMC 1996b).

Common names for *Litopenaeus setiferus* (Figure 3.1-1) include white shrimp, gray shrimp, lake shrimp, green shrimp, green-tailed shrimp, blue tailed shrimp, rainbow shrimp, Daytona shrimp, common shrimp and southern shrimp. *F. aztecus* (Figure 3.1-1) is known as brown shrimp, brownie, green lake shrimp, red shrimp, redtail shrimp, golden shrimp, native shrimp and also the summer shrimp in North Carolina. Common names for *F. duorarum* (Figure 3.1-1) include pink shrimp, spotted shrimp, hopper, pink spotted shrimp, brown spotted shrimp, grooved shrimp, green shrimp, pink night shrimp, red shrimp, skipper and pushed shrimp.



Pink shrimp White shrimp Brown shrimp

Figure 3.1-1. Illustrations of white, brown and pink shrimp.

Rock shrimp (Figure 3.1-2) are very different in appearance from the three species of penaeid shrimp. Rock shrimp can be easily separated from these species by their thick, rigid, stony exoskeleton.

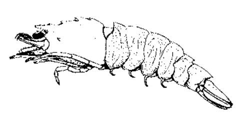


Figure 3.1-2. Illustration of rock shrimp.

The affected environment, including a description of the shrimp fishery in the South Atlantic region, is presented in detail in the original shrimp plan (SAFMC 1993). A description of Council concerns and recommendations on protecting shrimp habitat is also included in the original Shrimp FMP (SAFMC 1993).

Juvenile and adult penaeid shrimp 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 shrimp, mysids, copepods, isopods, amphipods, ostracods, mollusks, foraminiferans, chironomid larvae and various types of organic debris (SAFMC 1996a).

Juvenile and adult rock shrimp are bottom feeders. Stomach contents analyses indicated that rock shrimp primarily feed on small bivalve mollusks and decapod crustaceans (Cobb *et al.* 1973). Kennedy *et al.* (1977) found the relative abundance of particular crustaceans and mollusks in the stomach contents of rock shrimp corresponded to their availability in the surrounding benthic habitat, suggesting opportunistic, not selective, feeding by rock shrimp.

Shrimp are preyed on by a wide variety of species at virtually all stages in their life history. Postlarvae are prey for sheepshead minnows, water boatmen and insect larvae. Grass shrimp, killifishes and blue crabs prey on young penaeid shrimp. Also, a wide variety of finfish are known to prey heavily on juvenile and adult penaeid shrimp (SAFMC 1996b).

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 is more common off South Carolina, Georgia and northeast Florida. White shrimp are generally concentrated on the continental shelf where water depths are 89 ft (27 m) or less, although occasionally they are found much deeper (up to 270 ft) (SAFMC 1996b).

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. Although brown shrimp 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 areas where water depth is as great as 361 ft (110 m), but they are most abundant in areas where the water depth is less than 180 ft (55 m) (SAFMC 1996b).

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 occur in sufficient abundance to be of major commercial significance only in North Carolina and the Florida Keys. Pink shrimp are most abundant in areas where water depth is 36-121 ft (11-37 m) although in some areas they may be abundant where water depth is as much as 213 ft (65 m) (SAFMC 1996b).

Rock shrimp are distributed worldwide in tropical and temperate waters. In the southeastern United States, the rock shrimp fishery is based entirely on the rock shrimp (*Sicyonia brevisrostris*). The center of abundance occurs off northeast Florida south to Jupiter Inlet (SAFMC 1996a). Small quantities of rock shrimp are also found off North Carolina, South Carolina, and Georgia (SAFMC 2002). Rock shrimp occur in deeper waters than the associated three *Penaeid* shrimp species. The largest concentrations are found in areas where water depth is between 111 and 180 ft (34 and 55 m) deep (SAFMC 1998a & b).

3.1.2 Reproduction

All three species of penaeid shrimp and rock shrimp are dioecious (separate sexes). White shrimp attain sexual maturity at about 5.3-5.5 in (35-140 mm) total length (TL). Brown shrimp also reach sexual maturity at about 5.5 in TL (140 mm), whereas pink shrimp reach sexual maturity at about 3.3 in TL (85 mm). Female rock shrimp attain sexual maturity at about 0.7 in (17 mm) carapace length (CL), and all males are mature by 0.9 in (24 mm) CL. Fecundity for all penaeid species ranges from 500,000 to 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 (SAFMC 1996b).

Off 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 20-80 ft (6.1-24.4 m). In South Carolina, most spawning occurs within about four miles of the coast. Spawning is correlated with bottom water temperatures of 62.6 to 84.2° F (17° to 29°C) although spawning generally occurs between 71.6 and 84.2° F (22° and 29°C). White shrimp begin spawning during April off Florida and Georgia, and late April or May off South Carolina. Spawning may continue into September or October (SAFMC 1996b).

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 45 ft (13.7 m) deep and the greatest percentage of ripe females were at 150 ft (45.7 m). 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 (SAFMC 1996b).

Pink shrimp apparently spawn at depths of 12 to 52 ft (3.7 to 15.8 m). Off eastern Florida, peak spawning activity probably occurs during the summer. In North Carolina, roe-bearing females are found as early as May, and by June, most pink shrimp are sexually mature (SAFMC 1996b).

Rock shrimp, as with most shrimp species, are highly fecund. Fecundity most probably, as with penaeids, increases with size. The spawning season for rock shrimp is variable with peak spawning beginning between November and January and lasting 3 months (Kennedy *et al.* 1977).

3.1.3 Development, growth, abundance and movement patterns

All three penaeid species have 11 larval stages 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. Postlarval sizes are similar for white and pink shrimp ranging from approximately 0.1-0.5 in (2.9 to 12 mm) TL; brown shrimp are usually larger (SAFMC 1996b).

For rock shrimp the development from egg to postlarvae takes approximately one month. Subsequently, the development from postlarvae to the smallest mode of recruits takes two to three months. The major transport mechanism affecting planktonic larval rock shrimp is the shelf current systems near Cape Canaveral, Florida (Bumpus 1973). These currents keep larvae on the Florida Shelf and may transport them inshore during spring. Recruitment to the area offshore of Cape Canaveral occurs between April and August with two or more influxes of recruits entering within one season (Kennedy *et al.* 1977).

The mechanisms that transport penaeid shrimp postlarvae from distant spawning areas to inside estuaries are not well known. Shoreward countercurrents north of Cape Canaveral have been suggested as a mechanism for transport of pink shrimp postlarvae from spawning areas to nursery areas along the northeast Florida coast. Movement of white shrimp postlarvae into the estuary is most likely a result of nearshore tidal currents as white shrimp spawn relatively close to shore. Brown shrimp may overwinter in offshore waters and migrate into estuaries the following spring. The inshore phase of the penaeid life cycle is perhaps the most critical because this is a period of rapid growth. These estuarine nursery areas, dominated by the marsh grass, *Spartina alterniflora*, provide abundant food, suitable substrate, and shelter from predators for postlarval shrimp. In the South Atlantic, 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 (white shrimp are uncommon in this northern area).

Large white shrimp begin emigrating out of the estuary to the commercial fishing areas in mid-summer. 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 4.7 in TL (120 mm). This movement to offshore waters may be caused by cold weather, storms, high tides and/or large influxes of fresh water, but size is the principal determinant (SAFMC 1996b).

Brown shrimp first enter the commercial fishery in North Carolina in June at about 4 in TL (100 mm). Movement of brown shrimp appears to take place primarily at night with peak movement at, or shortly after dusk. In the South Atlantic, juvenile and adult brown shrimp are rarely affected by severe winter weather because most surviving shrimp have moved offshore prior to the onset of cold weather (SAFMC 1996b).

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. Recruitment to the area offshore of Cape Canaveral begins in April and May and again during October and November (SAFMC 1996b).

Smaller white and pink shrimp may remain in the estuary during winter and are termed overwintering stocks (SAFMC 1996b). Harsh winter conditions such as cold water temperatures and rainfall can affect the survival of overwintering stocks and subsequent year-class strength. Pink shrimp bury deeply in the substrate with the onset of cold weather and are protected to some extent from winter mortalities. 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. Pink 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 (SAFMC 1996b).

The shrimp species of the southeastern United States occupy similar habitats with the greatest differences being in optimal substrate and salinity. Apparently all three penaeid species can tolerate a wide range of habitat conditions; however, there appear to be optimal conditions that result in the highest growth rates and greatest survival. Rock shrimp grow about 0.08 – 0.1 in (2 - 3 mm) CL per month as juveniles and 0.02 in (0.5 - 0.6 mm) CL per month as adults (Kennedy *et al.* 1977). By contrast, adolescent penaeid shrimp species grow rapidly. White shrimp grow from 0.04 – 0.09 in (1.0-2.3 mm) per day, brown shrimp grow 0.02 – 0.1 in (0.5-2.5 mm) per day and pink shrimp grow 0.01 – 0.07 in (0.25-1.7 mm) per day (Tables 1 and 2 in SAFMC 1993). Rates of growth for rock shrimp and the penaeid shrimp species are variable and depend on factors such as season, water temperature, shrimp density, size and sex. Salinity is a factor determining growth rate in white and brown shrimp. Although field studies indicate that juvenile white shrimp prefer low salinities, laboratory studies have revealed that they tolerate a wide range of salinities; they have been successfully reared at salinities of 18 to 34 ppt (Perez-Farfante 1969). Nevertheless, McKenzie and Whitaker (1981) cited several studies in which fast growth was reported for white shrimp at lower salinities of 7 to 15 ppt. The lowest salinity in which white shrimp were recorded in the northern Gulf of Mexico was 0.42 ppt (Perez-Farfante 1969). High salinities appear to inhibit growth in white shrimp, but for brown shrimp, salinities in excess of 10 ppt seem to enhance growth rate. However, Zein-Eldin and Aldrich (1965) and Zein-Eldin and Griffith (1970) found that salinity did not affect the growth of postlarval shrimp. Relatedly, during years of low densities, the average size of white shrimp is generally larger.

Apparently white shrimp have a greater tolerance to low salinity than brown shrimp (McFarland and Lee 1963). Gunter *et al.* (1964) found that juvenile white shrimp were most abundant where salinities were less than 10 ppt whereas brown shrimp juveniles were more abundant where salinities were between 10.0 and 19.9 ppt. However, Truesdale (1970) concluded that salinity, per se, had no effect on white shrimp postlarval distribution and abundance in Trinity Bay, Texas except during periods of high river discharge. Gunter (1961) attributes the predominance of white shrimp in

Louisiana to the lower estuarine salinities. Conversely, brown shrimp dominate in the waters around the much drier Texas, where river discharge rates are much lower. Parker (1970) reported brown shrimp in areas where bottom salinity ranged from 0.9 to 36.5 ppt. Gaidry and White (1973) found that commercial catches of brown shrimp were poor in those years when salinities were less than 15 ppt at the time postlarvae were present in the estuaries.

Water temperature directly or indirectly influences white shrimp spawning, growth, habitat selection, osmoregulation, movement, migration and mortality (Muncy 1984). Spring water temperature increases trigger spawning, and rapid water temperature declines in fall portend the end of spawning (Lindner and Anderson 1956). Growth is fastest in summer and slowest or negligible in winter. Water temperatures below 68°F (20°C) inhibit growth of juvenile shrimp (Etzold and Christmas 1977) and growth is virtually nil at 61°F (16°C) (St. Amant and Lindner 1966). Growth rates increase rapidly as temperatures increase above 68°F (20°C). Increased water temperatures affects molting rate (Perez-Farfante 1969). Good correlation between heating-degree-days and catch/effort ratio for penaeid shrimp was similar to correlations of yield-per-hectare versus latitude (Turner 1977). Temperature and food supply limited the growth of white shrimp postlarvae more than did salinity differences between 2 and 35 ppt (Zein-Eldin 1964). Freshwater inflow may affect coastal water temperatures, which in turn affect the growth rates (White and Boudreaux 1977) and migration of white shrimp (Shipman 1983b). White shrimp are more tolerant of high temperatures and less tolerant of low temperatures than either brown or pink shrimp (Etzold and Christmas 1977). Temperature also affects brown and pink shrimp growth rates, with rates as high as 0.13 in (3.3 mm) per day recorded when temperature exceeded 77° F (25° C) but less than 0.04 in (1.0 mm) per day when water temperature was below 68° F (20° C). Gaidry and White (1973) stated that years of low commercial landings of brown shrimp were associated with prolonged estuarine temperatures of less than 68°F (20° C) at the time of postlarval immigration into the estuary. Aldrich *et al.* (1968) demonstrated in laboratory experiments that brown shrimp postlarvae burrowed in the sediment when water temperature was reduced to 54°-62°F (12°-16.5°C).

Pink shrimp in Florida Bay were found to grow 0.14 in (3.5 mm) CL in winter and only 0.07 in (1.9 mm) CL in spring. In North Carolina, maximum pink shrimp growth rates were recorded in summer (Tables 1 and 2 in SAFMC 1993).

Juvenile shrimp appear to be most abundant at the *Spartina* grass-water interface. This “estuarine edge” is the most productive zone in many estuaries. Because there is a minimum of wind generated turbulence and stabilization of sediments, rich bands of organic material are found along the edges of marshes (Odum 1970). Furthermore, Odum (1970) found the percentages of organic detritus in sediments along the shore in the Everglades estuary are several times greater than a few meters offshore. Mock (1967) examined two estuarine habitats, one natural and one altered by bulkheading. He found a 2 ft (0.6 m) band of rich organic material along the natural shore and very little organic material along the bulkheaded shore. White shrimp were 12.5 times and brown shrimp 2.5 times more numerous in the natural area as in the altered area. Loesch (1965) found that juvenile white shrimp in Mobile Bay were most abundant nearshore in water less than 2 ft (0.6 m) deep containing large amounts of organic detritus. Brown shrimp were congregated in water 2-3 ft (0.6 to 0.9 m) deep where there was attached vegetation.

Along the Florida Atlantic coast, the predominant substrate inside of the 656 ft (200 m) depth contour is fine to medium sand with small patches of silt and clay (Milliman 1972). 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 and are active at night. White shrimp do not bury with the regularity of pink shrimp or brown shrimp (SAFMC 1996b). These temporal and spatial shifts by brown shrimp, white shrimp, and pink shrimp help reduce direct interspecific competition especially for certain substrates (Lassuy 1983). Staggered seasonal recruitment of brown and white shrimp into the South Atlantic estuaries would also reduce competition (Baisden 1983).

Kennedy *et al.* (1977), characterized rock shrimp habitat and compiled a list of crustacean and molluscan taxa associated with rock shrimp benthic habitat. The bottom habitat on which rock shrimp thrive is limited and thus limits the depth distribution of these shrimp. Cobb *et al.* (1973) found the inshore distribution of rock shrimp to be associated with terrigenous and biogenic sand substrates and only sporadically on mud. Rock shrimp also utilize hard bottom and coral, more specifically *Oculina*, habitat areas. This was confirmed with research trawls capturing large amounts of rock shrimp in and around the *Oculina* Bank HAPC prior to its designation.

3.1.4 Population dynamics

Population size of brown, pink, white and rock shrimp is believed to be primarily regulated by environmental conditions and available habitat. Penaeid (brown, pink and white) shrimp have an annual life cycle, where adults spawn offshore and the larvae are transported to coastal estuaries. Recruitment to the estuaries and eventually to the fishing grounds is extremely dependent on fluctuations of environmental conditions within estuaries. Poor recruitment to the fishery may occur because of excessively cold winters or heavy rains that reduce salinities and cause high mortality of post-larvae. Conversely, high recruitment to the fishery may occur when environmental conditions are favorable for postlarval development. Effort in the penaeid fishery has been relatively stable over the last 20 years; therefore, catches in any given year may show large fluctuations depending on the magnitude of successful recruitment of young shrimp as they emigrate from the estuaries to offshore waters. Rock shrimp, with a similar life span, occur in deeper waters than the associated three penaeid shrimp species, but their annual abundance is also environmentally controlled.

Although shrimp trawling certainly reduces population size over the course of a season, the impact of fishing on subsequent year-class strength is unknown. Natural mortality rates are very high, and coupled with fishing mortality, most of the year class may be removed by the end of a season. Because annual variation in catch is presumed to be due to a combination of prevailing environmental conditions, fishing effort, price and relative abundance of shrimp (SAFMC 1996b), 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. Nevertheless, due to high fecundity and migratory behavior, the three penaeid species are capable of rebounding from very low population sizes in one year to large population sizes in the next, provided environmental conditions are favorable (SAFMC 1996b).

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. For white and brown shrimp, salt marsh habitat is especially important as juvenile nursery areas. Inshore seagrass beds are important nursery areas for juvenile pink shrimp. The quality and availability of these habitat areas to the juvenile penaeid shrimp species is critical to overall shrimp production (SAFMC 1996b).

During years when inshore overwintering white shrimp stocks are greatly reduced due to cold water temperature or heavy rain, management action may accelerate recovery of the stocks and increase fall production by protecting 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 for white shrimp, 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 (SAFMC 1996b).

3.1.5 Biological reference points and status determination criteria

The following discussion describes what biological reference points and status determination criteria are and how they are determined based on guidance found in the Magnuson-Stevens Act and in guidelines for interpretation of National Standard 1. All U.S. fisheries must comply with these mandates.

The Magnuson-Stevens Act requires that each FMP define reference points in the form of maximum sustainable yield (MSY) and optimum yield (OY), and specify objective and measurable criteria for identifying when a fishery is overfished or undergoing overfishing. Status determination criteria are defined by 50 CFR 600.310 to include a minimum stock size threshold (MSST), i.e., the overfished criterion, and a maximum fishing mortality threshold (MFMT), i.e, the overfishing criterion. Together, these four parameters (MSY, OY, MSST and MFMT) are intended to provide fishery managers with the tools to measure fishery status and performance. By evaluating stock biomass (B) and fishing mortality (F) in relation to MSY, OY, MSST and MFMT, fishery managers can determine the status of a fishery at any given time and assess whether management measures are achieving established goals.
The primary goal of federal fishery management, as described in National Standard 1 of the Magnuson-Stevens Act, is to conserve and manage U.S. fisheries to "...prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the United States fishing industry" (Magnuson-Stevens Act§301(a)(1)). OY is defined as the amount of fish that "will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational

opportunities, and taking into account the protection of marine ecosystems...” (Magnuson-Stevens Act §3(28)).

While economic and social factors are to be considered in defining the OY for each fishery, OY may not be defined as an amount of fish that would compromise a stock’s ability to produce MSY – or the largest long-term average catch that can be taken continuously (sustained) from a stock under prevailing ecological and environmental conditions. OY must prevent overfishing, and in the case of an overfished fishery, OY must provide for “rebuilding to a level consistent with producing MSY in such a fishery” (50 CFR 600.10).

Fishery managers use the parameters MSST and MFMT to monitor the current level of biomass (B_{CURR}) and rate of fishing mortality (F_{CURR}) in a fishery in relation to B_{MSY} and F_{MSY}. MSST represents the threshold biomass level below which a stock would not be expected to be capable of rebuilding to B_{MSY} within ten years if exploited at MFMT. A stock with a biomass below the MSST (e.g., B_{CURR} < MSST) would be considered overfished. Once this designation is made, a rebuilding plan is required to rebuild the stock to B_{MSY}. MFMT represents the maximum level of fishing mortality that a stock can withstand while still producing MSY on a continuing basis. A fishery experiencing a fishing mortality rate that exceeds the MFMT (e.g., F_{CURR} > MFMT) would be considered undergoing overfishing.

Establishing appropriate definitions for MSY, OY, the overfishing threshold and the overfished condition for the shrimp stocks will provide guidance to the Council as to what management measures, if any, may be needed to optimize yield with its associated social, economic and ecological benefits. The Council currently has established stock status criteria related to MSY and OY for all four managed shrimp stocks; overfished definitions exist for three stocks and an overfishing fishing definition exists for one stock.

3.1.5.1 Established targets and thresholds for rock shrimp

Maximum Sustainable Yield

Because rock shrimp live only 20 to 22 months, landings fluctuate considerably from year to year depending primarily on environmental factors. Although there is a good historical time series of catch data, the associated effort data were not considered adequate to calculate a biologically realistic value for MSY. Nevertheless, two standard deviations above the mean total landings was considered to be a reasonable proxy for MSY (SAFMC 1996a). The MSY proxy for rock shrimp, based on the state data from 1986 to 1994, is 6,829,449 pounds heads on (SAFMC 1996a).

Optimum Yield

OY is equal to MSY. The intent is to allow 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. This is appropriate for an annual crop like rock shrimp when recruitment is dependent on environmental conditions rather than female biomass. A relatively small number of mature shrimp can provide sufficient recruits for the subsequent year’s production (SAFMC 1996a).

Overfished Definition

The South Atlantic rock shrimp resource is overfished when annual landings exceed a value two standard deviations above mean landings during 1986 to 1994 (mean=3,451,132 lb., s.d. =1,689,159), or 6,829,449 pounds heads on (SAFMC 1996a). In other words, the stock would be overfished if landings exceeded MSY. The status of rock shrimp stocks in the South Atlantic are not considered overfished at this time. High fecundity enables rock shrimp to rebound from a very low population size in one year to a high population size in the next when environmental conditions are favorable (SAFMC 1996a).

Overfishing Definition

There is no designation of overfishing for rock shrimp. The overfished definition, which is based on landings (and fishing effort) in excess of average catch is, in essence, an overfishing definition.

3.1.5.2 Established targets and thresholds for white shrimp

Maximum Sustainable Yield

The existing definition of MSY established by the original Shrimp Plan was calculated as mean total landings for the South Atlantic during 1957 to 1991 adjusted for recreational landings. In calculating total landings, an additional ten percent (an estimate made by state shrimp biologists) was added to the commercial catch to account for recreational landings that were unreported. There were other adjustments based on more accurate recreational landings information when the shrimp baiting permit went into effect in South Carolina. Using this methodology, MSY is estimated to be 14.5 million pounds for white shrimp (SAFMC 1993).

Optimum Yield

OY 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. This level has been estimated only for the central coastal area of South Carolina, and only in terms of subsequent fall production (assumed to represent recruitment). Therefore, in actual application, OY for the white shrimp fishery is the amount of harvest that can be taken by the U.S. fishery during the fishing season which may vary from year to year based on both state regulations and regulations promulgated pursuant to the Shrimp FMP (i.e., closures due to cold kills) (SAFMC 1993).

Overfished Definition
The Council has not established an overfished definition for white shrimp. Nevertheless, the overfishing definition, indicating when population sizes have declined below a minimum threshold would also represent an overfished definition.

Overfishing Definition
Overfishing is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter weather resulting in prolonged cold water temperatures. If the abundance declines by 80%, 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. 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 (SAFMC 1993).

3.1.5.3 Established targets and thresholds for brown shrimp

Maximum Sustainable Yield
The existing definition of MSY established by the original Shrimp Plan was calculated as the mean total landings for the South Atlantic during 1957 to 1991 adjusted for recreational landings. In calculating total landings, an additional ten percent (an estimate provided by state shrimp biologists) was added to the commercial catch to account for recreational landings that are unreported. Using this methodology, MSY was estimated to be 9.2 million pounds for brown shrimp (SAFMC 1993).

Optimum Yield
OY for brown shrimp was defined in Amendment 2 to the Shrimp Plan as the amount of harvest that can be taken by U.S. fishermen without annual landings falling two standard deviations below the mean landings during 1957 through 1993 for three consecutive years (SAFMC 1996b). This value is 2,946,157 pounds (heads on).

Overfished Definition
The South Atlantic brown shrimp resource is considered to be overfished when annual landings fall below two standard deviations below mean landings for the period 1957 to 1993 for three consecutive years (2,946,157 pounds (heads on)). If annual landings fall below two standard deviations of the 1957 to 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. The brown shrimp stocks in the South Atlantic are not considered overfished at this time. Annual production appears to be most influenced by late winter and early spring environmental conditions as has been observed in the Gulf of Mexico (SAFMC 1996b).

Overfishing Definition

The Council has not established an overfishing definition for brown shrimp. If landings fall below the overfished threshold, it can be assumed that overfishing is also occurring.

3.1.5.4 Established targets and thresholds for pink shrimp

Maximum Sustainable Yield
The existing definition of MSY established by the original Shrimp Plan was calculated as mean total landings for the South Atlantic during 1957 to 1991 adjusted for recreational landings. In calculating total landings, an additional ten percent (an estimate provided by state shrimp biologists) was added to the commercial catch to account for recreational landings that are unreported. Using this methodology, MSY was estimated to be 1.8 million pounds for pink shrimp (SAFMC 1993).

Optimum Yield
OY for pink shrimp was defined as the amount of harvest that can be taken by U.S. fishermen without annual landings falling two standard deviations below the mean landings during 1957 through 1993 for three consecutive years. This value is 286,293 pounds (heads on) for pink shrimp (SAFMC 1996b).

Overfished Definition
The South Atlantic pink shrimp resource is overfished when annual landings fall below two standard deviations below mean landings during 1957 to 1993 for three consecutive years (286,293 pounds (heads on)). If annual landings fall below two standard deviations of the 1957 to 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 (SAFMC 1996b).

There are indications that pink shrimp abundance may be reduced by prolonged cold water conditions. However, unlike with white shrimp, there does not appear to be a biological justification for closing the fishery following cold kills. It is believed that overwintering shrimp that are not harvested before reaching the ocean may simply be lost to the fishery. Further, being at the northern end of their range, larvae produced by overwintering North Carolina pink shrimp may be carried north by prevailing currents and lost to the system (SAFMC 1993).

Overfishing Definition
The Council has not established an overfishing definition for pink shrimp. If landings fall below the overfished threshold, it can be assumed that overfishing is also occurring.

3.1.6 Methodology for calculating biomass based stock status determination criteria

Control rules are prescribed fishing strategies (e.g., formulas or graphic representations of formulas) that specify allowable catch levels, usually as a function of population size, or stock biomass, of the targeted species. Control rules can take many forms and they can generally be described in terms of their shape and tuning. The shape of a control rule describes how catch levels change as a function of biomass, for example gradually declining with a shrinking stock or dropping steeply if a stock drops below a certain threshold. The tuning of a control rule describes how much fishing it is designed to allow and can vary from a tuning that achieves maximum sustainable yields to much lower values.

NOAA Fisheries has recommended that, at a minimum, management of a stock be described using four management reference points—MSY, OY, MFMT and MSST—each of which plays a distinct role in shaping the control rules by which that stock is managed. MSY represents the largest average catch level that can be sustained over the long-term, and establishes the tuning of the MFMT, which is the threshold criterion that sets the upper limit on catches. If catches exceed this threshold, the fishery would be experiencing overfishing. OY represents the target catch level for the fishery over the long-term and should therefore be embodied in the tuning of a target control rule if it is established. Finally, the MSST represents a threshold below which concern needs to be raised over the stock and its management. If a stock drops below this level, a rebuilding plan will be required. In some cases the existing control rules might be sufficient to rebuild a stock in a reasonable timeframe. In others, more restrictive measures may be required.

For the South Atlantic shrimp fishery, only historical catch records and limited effort information is available. Current data gaps preclude the estimation of B_{MSY}. Furthermore, because of high fluctuations in annual recruitment and landings, F_{MSY}, or even F_{CURR}, cannot be estimated. This limited information makes it difficult to use standard procedures to establish an overfishing threshold based on F_{MSY}. Nevertheless, the Council has stated, in previous portions of the FMP, that although estimates of population size are not available, effort in the fishery is known to be high and the fishery may be fishing at near-maximum levels. Therefore, it can be assumed to be operating at or near B_{MSY} and F_{MSY}. Based on that assumption, the Council has established targets and thresholds using annual landings as an indication of relative abundance (health) of the parent stock.

The limitation to this approach, especially for species such as shrimp, which live for only one year, is its total dependence on catch, without accounting for external factors such as economic or social conditions that might influence the overall annual landings of a particular species. It is possible that the fishery might not target a species to the extent possible during a given year, and low landings could result from a lack of effort instead of a reduced stock size. Similarly, a stock might undergo a poor recruitment year, but still be relatively healthy, but reduced catch rates combined with economic or social factors might inhibit fishery effort on that stock, and annual landings would decline. Conversely, because of good prices or exceptionally good recruitment, landings might be exceptionally high during a given year, or two-year period. In either situation, the Council would want to further evaluate all the conditions before making a determination regarding the status of the stock, which could delay effective remedial action.

The National Standard Guidelines (50 CFR 600.310[c][2][i]) identify alternatives for establishing MSY to include removal of a constant catch each year that allows the stock size to remain above an identified lower level, or to allow a constant level of parent stock escapement each year. For penaeid (brown, pink, and white) shrimp stocks, it is appropriate to establish an MSY control rule based on maintaining a constant level of escapement each year that will produce sufficient recruits to maintain harvest at historical levels. This approach would relate MSY in terms of catch to a quantifiable level of escapement in each stock, where a proxy for B_{MSY} is established as the minimum parent stock size known to have produced MSY the following year. MFMT, as a fishing mortality that drives the stock below B_{MSY} in a given year when exceeded, would define overfishing. MSST, or the overfished level, would represent a biomass level lower than $0.5*B_{MSY}$ (i.e., one-half the parent stock size or other proxy). In other words, this would be an MSY control rule that relied on constant escapement of B_{MSY}.

In accordance with the Technical Guidelines (Restrepo *et al.* 1998), CPUE data can be used as a proxy for biomass-based parameters including B_{MSY} and current biomass. Until those data become available from the fishery, CPUE-based abundance estimates from fishery-independent Southeast Area Monitoring and Assessment Program - South Atlantic (SEAMAP-SA) data can serve as a proxy to indicate parent stock (escapement).

The SEAMAP-SA Shallow Water Trawl Survey is funded by NOAA Fisheries and conducted by the South Carolina Department of Natural Resources - Marine Resources Division (SCDNR-MRD). This survey provides long-term, fishery-independent data on seasonal abundance and biomass of all finfish, elasmobranchs, decapod and stomatopod crustaceans, sea turtles, horseshoe crabs and cephalopods that are accessible by high-rise trawls (Appendix E). Samples are taken by trawl from Cape Hatteras, North Carolina to Cape Canaveral, Florida. Cruises are conducted in spring (early April - mid-May), summer (mid-July - early August) and fall (October - mid-November). Stations are randomly selected from a pool of stations within each stratum. Strata are delineated by the 4 m depth contour inshore and the 10 m depth contour offshore. The R/V Lady Lisa, a 75-ft (23-m) wooden-hulled, double-rigged, St. Augustine shrimp trawler owned and operated by SCDNR is used to tow paired 75-ft (22.9-m) mongoose-type Falcon trawl nets without TEDs or BRDs. The body of the trawl is constructed of #15 twine with 1.875-in (47.6-mm) stretch mesh. The cod end of the net is constructed of #30 twine with 1.625-in (41.3-mm) stretch mesh and is protected by chafing gear of #84 twine with 4-in (10-cm) stretch “scallop” mesh. A 300 ft (91.4-m) three-lead bridle is attached to each of a pair of wooden chain doors that measure 10 ft x 40 in (3.0-m x 1.0-m) and to a tongue centered on the head-rope. The 86-ft (26.3-m) head-rope, excluding the tongue, has one large (60-cm) Norwegian “polyball” float attached top center of the net between the end of the tongue and the tongue bridle cable and two 9-in (22.3-cm) PVC foam floats located one-quarter of the distance from each end of the net webbing. Trawls are towed for twenty minutes, excluding wire-out and haul-back time, exclusively during daylight hours (1 hour after sunrise to 1 hour before sunset). Contents of each net are sorted separately to species, and total biomass and number of individuals are recorded for all species of finfish, elasmobranchs, decapod and stomatopod crustaceans, cephalopods, sea turtles, xiphosurans and cannonball jellies. The South Atlantic Bight is separated into six regions for data analysis. Data from the paired trawls are pooled for analysis to form a standard unit of effort (tow). The coefficient of variation (CV), expressed as a proportion, is used to compare relative amounts of variation in abundance among years and among species. Density estimates, expressed as number of individuals or kilograms per hectare (ha), are standardized by dividing the mean catch per tow by the mean area (ha) swept by the combined trawls. Mean area swept by a net is calculated by multiplying the width of the net opening (13.5 m), as determined by Stender and Barans (1994), by the distance (m) trawled and dividing the product by 10,000 m^2/ha (SEAMAP 2002).

Current (1990-2002) SEAMAP data indicate that the average escapement results in annual abundance estimates ranging from 1.975 to 10.277 shrimp per hectare for brown shrimp, 0.211 to 1.728 shrimp per hectare for pink shrimp and 5.665 to 34.799 shrimp per hectare for white shrimp (Table 3.1-1).

Table 3.1-1. Annual CPUE (nos/ha) estimates derived from the SEAMAP Shallow water Trawl Survey.

Year	Brown Shrimp	Pink Shrimp	White Shrimp
1990	4.022	0.568	9.028
1991	2.469	0.873	12.880
1992	2.000	0.511	5.868
1993	5.899	0.673	5.665
1994	5.568	0.594	10.606
1995	3.104	1.728	17.535
1996	10.277	0.461	12.913
1997	2.275	0.948	7.447
1998	1.975	0.853	18.256
1999	2.972	0.450	34.799
2000	7.697	0.211	13.060
2001	8.637	0.502	10.454
2002	3.347	0.867	9.186
2003	9.640	0.418	7.372

Because of their high sensitivity to certain environmental factors, South Atlantic shrimp show extreme fluctuations in population size. Annual sampling of shrimp from the southeast region indicate that density per hectare have varied by a factor of 5 to 10 and can more than double from one year to the next (Table 3.1-1).

For stocks such as rock shrimp, where no similar data set exists, information from which to establish stock status determination criteria are limited to measures of catch. Nevertheless, with the development of a permitting system and reporting requirements associated with the permit, better information will be collected on the effort and catch in this fishery. Data should be reviewed periodically to determine if better inferences can be drawn to address B_{MSY}. Additionally, any time that annual catch levels trigger one of the selected thresholds, new effort should be made to infer B_{MSY} or a reasonable proxy.

The current stock status determination criteria for rock shrimp were calculated from catch estimates as reported in Amendment 1 of the Shrimp Plan (SAFMC 1996a) during the period 1984-1996 (Table 3.1-2). Similarly, the current stock status determination criteria for white, brown and pink shrimp were calculated from landings information. The data used to generate these parameters are presented in Table 3.1-3. These landings statistics were compiled in the original plan and Amendment 2 to the South Atlantic Shrimp Plan (SAFMC 1993 and SAFMC 1996b).

Table 3.1-2. Landings data used to calculate the current MSY value for rock shrimp in the South Atlantic.

Year	Landings
1986	2,514,895
1987	3,223,692
1988	1,933,097
1989	3,964,942
1990	3,507,955
1991	1,330,919
1992	2,572,727
1993	5,297,197
1994	6,714,761

Note: Data for the period 1986 to 1994 are taken from Shrimp Amendment 1 (SAFMC 1996a).

Table 3.1-3. Landings data used to calculate the current MSY values for the penaeid species in the South Atlantic.

Year	White Shrimp	Brown Shrimp	Pink Shrimp
1957	14,712,461	9,740,164	2,157,243
1958	11,092,893	9,189,603	823,467
1959	12,823,217	9,434,893	2,061,216
1960	18,788,016	9,038,236	1,226,496
1961	14,033,378	2,495,614	1,747,822
1962	12,133,840	11,532,694	2,246,510
1963	7,268,926	7,646,291	554,339
1964	8,119,217	7,089,616	1,948,048
1965	16,304,005	8,126,345	1,687,237
1966	9,162,164	11,604,450	531,230
1967	10,902,104	7,978,838	1,579,998
1968	16,945,887	5,919,510	1,337,930
1969	16,914,732	8,570,168	1,698,021
1970	12,491,819	7,133,124	860,584
1971	18,810,304	9,764,458	1,914,656
1972	16,635,560	7,725,422	788,277
1973	18,241,500	4,502,900	1,518,395
1974	13,375,345	11,088,656	2,118,261
1975	15,910,990	6,713,349	2,015,874
1976	14,370,316	9,651,432	1,815,048
1977	4,961,115	10,605,268	801,227
1978	8,913,478	6,601,646	561,297
1979	17,014,249	6,643,381	1,775,764
1980	14,255,717	13,368,442	1,573,926
1981	8,367,526	4,372,667	871,121
1982	10,517,276	8,915,451	1,749,785
1983	12,404,793	6,711,871	2,699,625
1984	4,088,105	7,209,256	1,391,292
1985	7,727,811	16,318,704	1,438,953
1986	10,968,861	8,702,924	2,101,628
1987	13,086,952	3,024,169	3,139,447
1988	10,909,691	8,143,448	2,929,585
1989	13,851,605	9,231,743	3,393,081
1990	12,613,723	8,734,294	1,651,188
1991	18,272,539	10,680,481	2,699,144

3.1.7 Essential fish habitat and essential fish habitat-habitat areas of particular concern

For penaeid shrimp, Essential Fish Habitat (EFH) includes inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity, and all interconnecting water bodies as described in the Habitat Plan (SAFMC 1998b). Inshore nursery areas include tidal freshwater (palustrine), estuarine, and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine, and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and intertidal non-vegetated flats. This applies from North Carolina through the Florida Keys.

Areas that meet the criteria for Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs) for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp (for example, in North Carolina this would include all Primary Nursery Areas and all Secondary Nursery Areas) and state-identified overwintering areas.

Estuarine tidal creeks and salt marshes that serve as nursery grounds are perhaps the most important habitats occupied by penaeid shrimp. The major factor controlling shrimp growth and production is the availability of nursery habitat. Remaining wetland habitat must be protected if present production levels are to be maintained. In addition, impacted habitats must be restored if future production is to be increased. Other areas of specific concern are the barrier islands as these land masses are vital to the maintenance of estuarine conditions needed by shrimp during their juvenile stage. Passes between barrier islands into estuaries allow the mixing of sea water and fresh water which is of prime importance to estuarine productivity.

In North Carolina, EFH-HAPCs include estuarine shoreline habitats as juvenile shrimp congregate in these areas. Seagrass beds, prevalent in the sounds and bays of North Carolina and Florida, are particularly critical areas. Core Sound and eastern Pamlico Sound have approximately 200,000 acres of seagrass beds making North Carolina second only to Florida in abundance of this type of habitat (Department of Commerce 1988b). In subtropical and tropical regions shrimp postlarvae recruit into seagrass beds from distant offshore spawning grounds (Fonseca *et al.* 1992).

South Carolina and Georgia lack substantial amounts of seagrass beds. Here, the nursery habitat of shrimp is the high marsh areas that offer shell hash and mud bottoms. In addition, there is seasonal movement out of the marsh into deep holes and creek channels adjoining the marsh system during winter. Therefore, the area of particular concern for early growth and development encompasses the entire estuarine system from the lower salinity portions of the river systems through the inlet mouths.

For rock shrimp, Essential Fish Habitat consists of offshore terrigenous and biogenic sand bottom habitats ranging in depth from 59 to 597 ft (18 to 182 m) with highest concentrations occurring in areas between 111 and 180 ft (34 and 55 m) deep. This applies for all areas from North Carolina through the Florida Keys. Essential Fish Habitat includes the shelf current systems near Cape

Canaveral, Florida, which provide major transport mechanisms affecting planktonic larval rock shrimp. These currents keep larvae on the Florida Shelf and may transport them inshore in spring. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse rock shrimp larvae.

No EFH-HAPCs have been identified for rock shrimp; however, deep water habitat (e.g. the rock shrimp closed area/expanded *Oculina* Bank HAPC) may serve as nursery habitat and protect the stock by providing a refuge for rock shrimp. Refer to Appendix D for a more detailed account of EFH and EFH-HAPCs for other fisheries in the South Atlantic.

3.1.8 Description of bycatch in the penaeid shrimp fishery prior to the use of BRDs

The discarded bycatch of fish and invertebrates in the penaeid shrimp trawl fishery is highly variable according to season and area. The following information reflects bycatch levels and composition in the penaeid shrimp fishery prior to the requirement for use of bycatch reduction devices (BRDs). It has been documented that federally approved BRDs reduce overall finfish bycatch by approximately 30% in the South Atlantic. These devices also reduce the numbers of weakfish and Spanish mackerel in the catch by 40% (refer to the Section 3.1.10).

Results of initial studies to document bycatch in the penaeid shrimp fishery were described in Amendment 2 to the South Atlantic Shrimp Fishery Management Plan (SAFMC 1996b). Previous determinations of the ratio of finfish (lb) to shrimp (lb heads on) in North Carolina indicated that the daytime ratios were consistently higher than the nighttime ratios due to larger shrimp catches rather than lower finfish catches.

The first integrated bycatch program was part of the congressionally mandated Bycatch Research Program from February 1992 through December 1996. This program was carried out to characterize the entire southeast shrimp fishery prosecuted in both the Gulf and South Atlantic region. To ensure the integrity and validity of the results, the following research protocols were followed:

1. A voluntary observer program using trained observers was undertaken. The program included vessel insurance and compensation for cooperating vessels.
2. Using a stratified sampling approach indexed to shrimping effort, NOAA Fisheries and other cooperating institutions deployed observers throughout the fleet to document bycatch during normal fishing operations using standard data collection methods.
3. All data were entered into a common database managed by NOAA Fisheries' 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.

For characterization sampling, the entire catch of each trawl was sampled, and all species quantified. For BRD evaluations, a select group of finfishes and other species were quantified, with the remainder of the catch grouped into general categories. Therefore, both bycatch characterization sampling and BRD evaluation data were use to determine general categories of bycatch. Sampling was stratified based on shrimp effort, and given that the South Atlantic shrimp fishery accounts for approximately 10-15 % of the total U.S. shrimp production, the sampling effort was limited for some temporal and spatial strata. Nevertheless, the sampling that occurred provided a sufficient basis for NOAA Fisheries to characterize the fishery in the South Atlantic region. During that program, observers logged a total of 920 sea days documenting bycatch in the South Atlantic shrimp fishery. The majority of the effort was expended during 1992 through 1994.

In response to this federally mandated research program, NOAA Fisheries began cooperative work with the shrimp industry through the Gulf and South Atlantic Fisheries Foundation. The cooperative bycatch research program studied bycatch and gear options in shrimp trawl fisheries throughout the southeast region. The study estimated the catch rate for shrimp and bycatch in the South Atlantic penaeid shrimp fishery.

The South Atlantic observer program included 920 sea days of sampling effort from February 1992 through December 1996. These sea days were accomplished during 604 trips, varying in length from 1 to 54 days (Nance 1998). The results of the program are detailed in Nance (1998) and Nance *et al.* (1997), and presented in Tables 3.1-4 and 3.1-5. In summary, the study indicated that about 27 kg (59.5 lb) of organisms per hour are taken during trawling operations, and that the finfish to shrimp ratio for the South Atlantic shrimp fishery was 2.83 to 1 by weight and 2.35 to 1 by number. Finfish comprised the majority (51%) of the catch by weight, followed by non-commercial invertebrates (31%), and commercial shrimp species (18%), including brown shrimp, white shrimp, pink shrimp, seabobs, sugar/blood shrimp and rock shrimp. Finfish represented about 54% of the 1,450 organisms taken per hour during normal trawling operations. Non-commercial invertebrates and commercial shrimp species each comprised about 23% of the catch by number (Nance *et al.* 1997).

Shrimp trawl catch per hour changed seasonally, being lowest during the first trimester of the year (ca. 12 kg/hr [26.5 lb/hr]), while the summer and post-summer seasons had very similar catch rates at around 28-30 kg per hour (Table 3.1-4). Finfish catch rates always comprised more than 44% of the catch, while shrimp catch rates were approximately 15% to 18% in the summer and post-summer periods, respectively, but 37% in the pre-summer season. Finfish catch by weight for the entire shrimp fishery was highest between May and August. The highest catch rate of finfish by number occurred in September through December, with nearly 1,800 individual finfish caught per hour. Shrimp catches were higher then too, resulting in a finfish to shrimp ratio of only 2.59 individual finfish to 1 shrimp.

Similarly, shrimp trawl catch per hour differed by latitude as well. By weight, the northern area (>34^{o}N) had the highest overall catch rates (37 kg/hr [81.6 lb/hr]), while areas to the south of 34^{o}N had catch rates at around 25 kg/hr (55.1 lb/hr) (Nance *et al.* 1997).

Table 3.1-4. Average percent composition of shrimp trawl catch by season in the South Atlantic (NOAA Fisheries 1998).

Catch	**Weight**	**Weight**	**Weight**	**Number**	**Number**	**Number**
Time period	Jan-April	May-Aug	Sept-Dec	Jan-April	May-Aug	Sept-Dec
Finfish	44%	58%	44%	65%	58%	44%
Shrimp	37%	15%	18%	11%	26%	17%
Crustaceans	9%	14%	14%	21%	14%	9%
Invertebrates	9%	13%	25%	3%	3%	30%
Total catch (per hr)	12 kg 26.5 lb	30 kg 66.1 lb	28 kg 61.7 lb	850	1350	1800
Finfish:Shrimp ratio	1.19 to 1	3.87 to 1	2.44 to 1	5.91 to 1	2.23 to 1	2.59 to 1

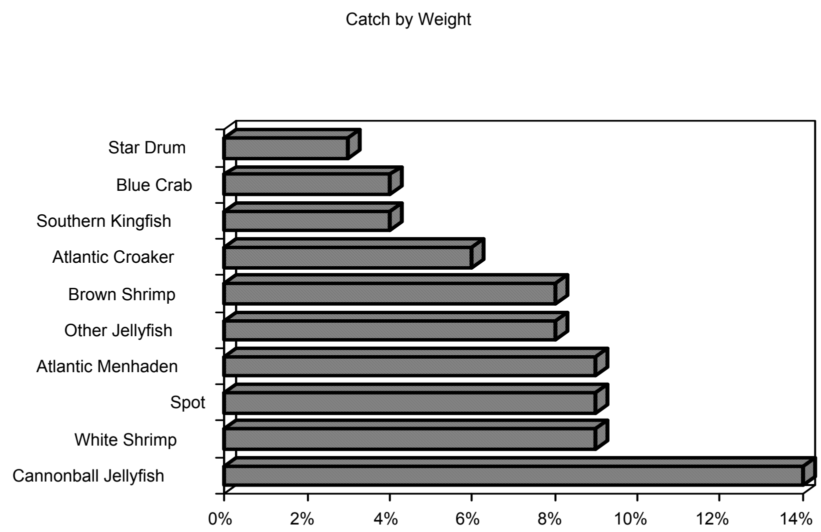
Additional information collected during the Bycatch Program was presented in Amendment 2 to the Shrimp FMP. When looking at catch according to depth of the fishing effort across all shrimp fisheries, the highest bycatch of finfish came from vessels fishing in 60 ft (18.3 m) or greater depths, with 56% of the catch being finfish and 18% shrimp or a ratio of 3.1 finfish caught for each shrimp caught (Table 3.1-5).

Table 3.1-5. Percent average hourly shrimp trawl catch by area and depth (Data Source: NOAA Fisheries 1995).

Area	**Finfish**	**Shrimp**	**Crustaceans**	**Invertebrates**	**Total Catch (number)**	**Finfish to Shrimp**
South Atlantic						
< 18.3 m (60 ft)	46%	29%	11%	14%	1229	1.6 to 1
> 18.3 m (60 ft)	56%	18%	21%	5%	726	3.1 to 1
Florida						
< 18.3 m (60 ft)	37%	30%	27%	6%	1207	1.2 to 1
> 18.3 m (60 ft)	43%	29%	23%	4%	802	1.5 to 1

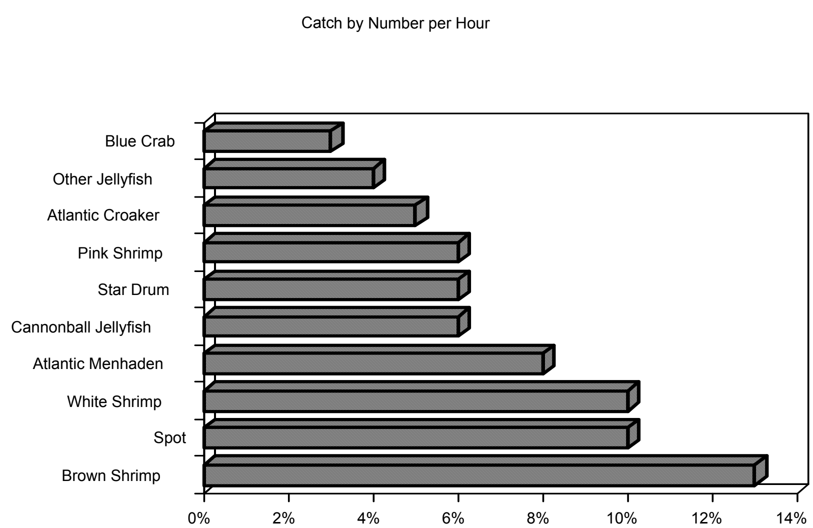
* 393 sea days, 63 trips and 679 tows

When summarizing catch of the South Atlantic shrimp fleet by species, cannonball jellyfish constituted 14% of the catch by weight and brown shrimp made up 8% of the catch by weight and 13% of the catch by number (Figures 3.1-3 and 3.1-4). White shrimp constituted 9% of the catch by weight and 10% of the catch by number. The highest catch of an individual finfish species was spot, which accounted for 9% of the catch by weight and 10% by number (Figures 3.1-3 and 3.1-4).



*393 sea days, 63 trips, and 679 tows

Figure 3.1-3. Top ten species caught in South Atlantic shrimp trawls by weight (Data Source: SAFMC 1996a).



*393 sea days, 63 trips, and 679 tows

Figure 3.1-4. Top ten species caught in South Atlantic shrimp trawls by number (Data Source: SAFMC 1996a).

3.1.9 Description of bycatch in the rock shrimp fishery

The data on bycatch from trips that target rock shrimp are somewhat limited. Previously, comments received from industry representatives at scoping meetings and public hearings for Amendment 1 to the Shrimp Plan indicated that trips targeting rock shrimp north of Cape Canaveral contain very little bycatch. Industry representatives also stated that beyond 120 ft (36.6 m), 90% of the catch is rock shrimp; therefore, it can be assumed that the remaining catch is bycatch (SAFMC 1996a). There was an early attempt to characterize the catch composition of rock shrimp trips in the South Atlantic. One rock shrimp bycatch characterization observer trip was completed between January 26 and February 4, 1995 (SAFMC 1996a).

From industry accounts, as the rock shrimp fishery developed and vessels began fishing earlier in the year, in June and July versus August or September, discards of unmarketable juvenile rock shrimp increased. Members of the South Atlantic Rock Shrimp Advisory Panel recommended gear modifications that were implemented in Amendment 5 to the South Atlantic Shrimp Plan to address this problem (SAFMC 2002).

The most recent information on bycatch in this fishery comes from a preliminary report of a NOAA Fisheries observer study conducted during the period September 2001 through December 2002 (Appendix C). Nine rock shrimp trips were observed from September 2001 through December 2002. Six trips occurred off the east coast of Florida, two trips operated in the Gulf of Mexico and off the east coast of Florida and one trip targeted Gulf of Mexico waters exclusively.

A total of 177 tows was sampled from eight trips off the east coast of Florida. A total of 233 unique species was collected. There were 37 species of crustacea, 166 fish species, 29 other invertebrate species and 1 category of miscellaneous debris. All of these vessels were using BRDs voluntarily. Therefore, the results of the sampling reflect the catch that was not excluded by BRDs.

The following summarizes the main findings in this report:

1. Rock shrimp comprised 10% of the catch by weight and 13% by number.
2. Extrapolated catch per unit effort (CPUE) for rock shrimp was 3.6 kilograms per hour (approximately 7.9 pounds per hour).
3. Penaeid shrimp comprised 6% of the catch by weight and 4% by number.
4. Finfish comprised 54% of the catch by weight and 32% of the catch by number.
    i. During the summer 2002 (June, July and August) 53% of the catch (by weight) was finfish (65 tows observed).
    ii. During the fall 2002 (September, October and November) 54% of the catch (by weight) was finfish (41 tows observed).
    iii. During the winter 2002 (December, January and February) 64% of the catch (by weight) was finfish (8 tows observed).
    iv. CPUE of finfish was highest in winter 2002 (27.1 kg./hr) followed by fall 2002 (19.8 kgs/hr) and summer 2002 (19.0 kgs/hr).

Weight extrapolations from the species composition samples for both years, all areas, seasons and depths indicate that:

1. Dusky flounder (*Syacium papillosum*) comprised 13% of the total catch.
2. Iridescent swimming crab (*Portunus gibbesii*) comprised 10% of the total catch.
3. Rock shrimp comprised 10% of the total catch.
4. Inshore lizardfish (*Synodus foetens*) comprised 9% of the total catch.
5. Longspine swimming crab (*Portunus spinicarpus*) at 8%.
6. Spot (*Leiostomus xanthurus*) at 6%.
7. Blotched swimming crab (*Portunus spinimanus*) at 5%.
8. Brown shrimp (*Farfantepenaeus aztecus*) at 4%.
9. Red goatfish (*Mullus auratus*) at 2%.
10. All other species combined comprised 33% of the total weight.

Data from one additional trip in 2002 were not included in these results because the data were not computerized at the time the report was prepared. These observed trips were sampled during an atypical rock shrimp season where harvest was especially low compared to previous years (Section 3.2.3.1). Thus, these findings should be considered preliminary and a more realistic evaluation of this fishery is expected from analyses of results at the completion of this observer program.

A different catch composition could be observed during a year when rock shrimp harvest is at a "normal" level. From preliminary data on rock shrimp landings and industry reports it appears that rock shrimp harvests rebounded during 2003 (Section 3.2.3.1). Observer coverage in the rock shrimp fishery extended through 2003. Information from these trips will be analyzed and presented to the Council for future evaluation of the rock shrimp fishery. From preliminary data for the 2003 portion of the observer coverage program, it appears that rock shrimp catch rates were higher and they comprised a larger proportion of the catch compared to the 2002 observer data. For all 125 tows in the 2001/2002 observer program, rock shrimp made up 9.6% of the overall catch. A preliminary examination of the data from the 95 tows observed in 2003 indicated that 21.3% of the total catch was comprised of rock shrimp (Scott-Denton, NOAA Fisheries, Southeast Fisheries Science Center, pers. comm. 2003).

3.1.10 BRD research program

The second part of the congressionally mandated Bycatch Research Program, from 1992 through 1996, involved the development and review of bycatch reduction devices (BRDs). These trawl gear modifications were identified as the most cost-effective and least disruptive way to minimize finfish bycatch in the shrimp fishery. A four-phase development program was successfully used under this program structure to develop several BRD designs that are used in the fishery. Within this framework, the research and development of candidate devices was carried out independently by NOAA Fisheries, Sea Grant, state agencies, universities and industry, drawing on a variety of funding sources, primarily the Saltonstall-Kennedy (S-K) and MARFIN (Marine Fisheries Initiative) grants programs.

From 1992 to 1996, fishery researchers and commercial fishers developed and tested a total of 145 bycatch reduction device (BRD) designs throughout the southeast region. Research conducted by the

Gulf and South Atlantic Fisheries Foundation, Inc. (Foundation), indicated that reductions in general catch and bycatch were 22% or less (Table 3.1-6). Spanish mackerel catch rate was reduced by 0%-83% and weakfish catch rate was reduced by 6%-58% (Tables 3.1-7a, b and c). The State of North Carolina also conducted testing on BRDs and Table 3.1-7b presents a summary of the observed reduction rates for BRDs that were proposed for use in federal waters when Shrimp Amendment 2 was developed (SAFMC 1996b).

Table 3.1-6. Summary of reductions (kg/hr) attributed to BRD designs tested in the South Atlantic during 1993 and 1994 (Sources: Watson, NOAA Fisheries, 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 invertebrates (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_O = CPUE of control net - CPUE of the BRD net = 0.
numbers in ( ) represent sample size

Table 3.1-7a. Reduction rates (kg/hr) for weakfish, shrimp and Spanish mackerel for the large mesh extended funnel BRD tested primarily off Georgia and South Carolina (1995 GSAFDF data); (Data Source: Watson, NOAA Fisheries, 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 3.1-7b. Reduction rates (kg/hr) for weakfish and Spanish mackerel for Florida fisheye and large mesh extended funnel BRDs tested primarily off North Carolina (NCDMF 1992-1994 data) (Data Source: Watson, NOAA Fisheries, 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%	

The fisheye tested by NCDMF off North Carolina reduced weakfish bycatch by 58% with high reductions for other species including spot and Atlantic croaker, which were reduced by more than 50%. The NCDMF tests showed that the fisheye reduced total finfish bycatch by 48% and total biomass by 28% (SAFMC 1996b).

A comparison of reduction rates attributable to various fisheye configurations tested aboard commercial trawlers in North Carolina between 1992 and 1994 indicated that 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 approximately 50% and the 5.5" by 6.5" fisheye reduced weakfish by over 70%. Tests of large mesh extended funnel BRDs were conducted by NCDMF and showed reduction rates of 55% in finfish numbers and 56% in the number of weakfish (SAFMC 1996b).

These evaluations resulted in the approval of 3 BRD designs for use by the South Atlantic penaeid shrimp fishery. Regulations implementing the actions described in Amendment 2 to the FMP were promulgated effective April 21, 1997. The final rule established a requirement, with limited exceptions, for the use of certified BRDs in penaeid (brown, pink and white) shrimp trawls towed in the South Atlantic exclusive economic zone (EEZ).

Table 3.1-7c. Reduction rates (kg/hr) for weakfish, trout and Spanish mackerel for large mesh extended funnel and midsize fisheyes tested primarily off South Carolina and Georgia (1993-1994 NOAA Fisheries and GSAFDF data) (Data Source: Watson, NOAA Fisheries, 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 30-mesh 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 30-mesh position	Reduction rate (kg/hr)	Number	95% Conf.
Weakfish	-7%	26	-
Spanish mackerel	-0%	20	-
Trout	-20%	32	-
Shrimp	-2%	112	-

Midsize fisheye, 45-mesh position	Reduction rate (kg/hr)	Number	95% Conf.
Weakfish	-16%	95	
Spanish mackerel	-0%	30	
Trout	-81%	4	
Shrimp	+3%	160	

Recent re-evaluations of all Gulf of Mexico and South Atlantic datasets generated by NOAA Fisheries and the Foundation were utilized in determining the effectiveness of BRDs for use in the eastern Gulf of Mexico (Amendment 10 to the Gulf of Mexico Shrimp Fishery Management Plan; Table 3.1-8). The BRDs currently certified in the South Atlantic (the fisheye and the expanded mesh) achieve a 30% reduction in overall finfish bycatch (Table 3.1-8).

Table 3.1-8 Reduction rate estimates of various BRDs and one TED for the Gulf of Mexico and South Atlantic (taken from GMFMC Shrimp FMP Amendment 10).

Species	**n**	**Reduction Rate (%)**	**P - Value**	**95% C.I. (%)**
12x5 Fisheye BRD				
Shrimp (wt)	157	4	0.16	--
Total Fish (wt)	141	35	0	30 to 39
12x5 Fisheye BRD in the 2.6 Meter Position				
Shrimp (wt)	105	4	0.17	--
Total Fish (wt)	98	44	0	38 to 49
12x5 Fisheye BRD in the 3.8 Meter Position				
Shrimp (wt)	35	-1*	0.78	--
Total Fish (wt)	35	31	0	24 to 37
Extended Funnel Device				
Shrimp (wt)	299	0	0.74	--
Total Fish (wt)	280	38	0	32 to 44
Jones/Davis BRD				
Shrimp (wt)	33	4	0.07	0 to 9
Total Fish (wt)	31	58	0	53 to 63
Parker TED				
Shrimp (wt)	68	7	0.00	4 to 10
Total Fish (wt)	67	32	0.00	28 to 36

*Negative values represent a nominal increase. Source: NOAA Fisheries (unpublished data).

It has been demonstrated that the use of a turtle excluder device (TED) also reduces finfish bycatch in penaeid shrimp trawls. A number of experimental trials were conducted in Cape Canaveral, Florida, during 1986 to test the bycatch reduction capability of various TED designs and configurations. Based on the results of these trials, the Atlantic States Marine Fisheries Commission Weakfish Management Board granted a 23.9% TED credit for weakfish reduction (GSAFF 1999). However, many of those TEDs were soft (net webbing) TEDs that were never certified for use by NOAA Fisheries. Soft TEDs have much greater bycatch exclusion capability than hard (metal grid) TEDs.

The Foundation tested several hard TEDs during the late 1990s for their bycatch exclusion capabilities. A common TED, the Super Shooter, had 0% reduction in finfish bycatch compared to the catch of a “naked” (no TED) net (GSAFF 1997). NOAA Fisheries has similar data on the results of a variety of hard TEDs and none have demonstrated more than a minimal reduction in finfish catch.

Currently, only one soft TED is certified. Recent changes to the TED regulations (68 FR 8456, February 21, 2003) have greatly modified the shape, size and configuration of hard TEDs. No information is available on the bycatch exclusion capability of these TEDs. However, their configurations would suggest that little bycatch reduction would be expected, except for the mechanical exclusion of large fishes such as sharks and rays.

3.1.11 The bycatch reduction device testing protocol

Amendment 2 also established a Bycatch Reduction Device Testing Protocol (Protocol) for examining the bycatch reduction performance of additional BRD designs. BRDs tested under such a Protocol and determined to reduce bycatch mortality of juvenile Spanish mackerel and weakfish by a minimum of 50%, or demonstrate a 40% reduction in numbers of Spanish mackerel and weakfish, would be certified for use in the South Atlantic EEZ shrimp fishery. Juvenile Spanish mackerel and weakfish were bycatch species in South Atlantic shrimp trawl fisheries, while also being targets of directed commercial and recreational fisheries as adults. Thus, these species were targeted species for bycatch reduction. Both of these species were overfished and undergoing overfishing and fisheries managers were trying to recover these stocks to a “healthy” status. Spanish mackerel is managed by the SAFMC (ASMFC also manages Spanish mackerel) and weakfish is managed by the ASMFC (Appendix F).

Under the current Protocol, state fishery management agencies, universities and other institutions can work with fishermen to develop and evaluate BRDs for certification. If an experimental BRD demonstrates the capability to meet the certification criteria, the information is submitted to NOAA Fisheries’ Southeast Regional Administrator (RA) for consideration of certification. If approved by the RA, NOAA Fisheries will announce in the *Federal Register* the certification of the BRD for use in all South Atlantic EEZ waters.

Currently, Spanish mackerel has recovered from a previous overfished status and is not overfished and is not experiencing overfishing. The 2003 Report of the Mackerel Stock Assessment Panel (MSAP 2003) indicated that F/F_{MSY} (current fishing mortality over a fishing mortality that would achieve MSY) was 0.58, and there was only a 3% chance that overfishing occurred on the Atlantic Spanish mackerel stock in the 2002/2003 fishing year. The median estimate of B_{2000}/B_{MSY} was 1.78; in other words the stock is 1.78 times the size of the stock necessary to produce MSY. There is less than a 1% chance that the stock is overfished.

The 2002 NOAA Fisheries Report to Congress classified weakfish as not overfished and not approaching an overfished condition (NOAA Fisheries 2003a). However, in this report overfishing was undefined. From the perspective of the Atlantic States Marine Fisheries Commission (ASMFC), the most recent assessment for weakfish indicates that the current level of SSB is well above the proposed threshold level of 14,400 mt (31.8 million pounds). Estimates of fishing mortality (the rate fish are being removed by human activity) ranged from a high in 1994 of 2.52 to a low in 2000 of 0.12. Since 1995, estimates of F have been below the Amendment 3 target of 0.50. The 2000 estimate of 0.12 could be an underestimate. Despite this bias, the corrected value would still be below the fishing mortality target of 0.31 and far below the fishing mortality threshold of 0.50

(Amendment 4 to the ISFMP for weakfish). Similarly, the size and age structure has improved. The assessment model results indicate that the proportion of age 6+ fish has increased from 0.3% of the total number of weakfish in 1990 to 6.8% of the total in 2001 (Amendment 4 to the ISFMP for weakfish).

Amendment 4 to the ASMFC Weakfish Plan still contains the 40% reduction criterion for weakfish (Appendix F). The following is taken directly from Amendment 4 to the Weakfish Plan:
“One or more BRDs shall be required in all food shrimp (penaeid) trawl nets with a heardope length exceeding 16 feet and having mesh less than 2.5 in stretched inside measurement (middle to middle knot measurement). All BRDs must be certified, properly installed and demonstrate a 40% reduction by number or 50% reduction of bycatch mortality of weakfish when compared to catch rates in a naked net. States are encouraged to continue research on gear technology and methods that will result in further bycatch reductions.”

An addendum to the weakfish plan would be necessary to remove or change this requirement.

3.1.12 Minimizing bycatch in the shrimp fishery to the extent practicable

The Magnuson-Stevens Act requires the Council to establish a standardized bycatch reporting methodology for federal fisheries and to identify and implement conservation and management measures that, to the extent practicable and in the following order: (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided (16 U.S.C. 1853(a)(11)). The Act defines bycatch as fish that are harvested in a fishery, but that are not sold or kept for personal use. This definition includes economic discards and regulatory discards and excludes fish released alive under a recreational catch-and-release fishery management program (16 U.S.C. 1802(2)). Economic discards are fish that are discarded because they are undesirable to the harvester. This category of discards generally includes certain species, sizes and/or sexes with low or no market value. Regulatory discards are fish that are required by regulation to be discarded such as fish below a minimum size limit, but also include fish that may be retained but not sold.

NOAA Fisheries outlines at 50 CFR 600.350(d)(3)(i) ten factors that should be considered in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable. These are:

1. Population effects for the bycatch species;
2. Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem);
3. Changes in the bycatch of other species of fish and the resulting population and ecosystem effects;
4. Effects on marine mammals and birds;
5. Changes in fishing, processing, disposal and marketing costs;
6. Changes in fishing practices and behavior of fishermen;
7. Changes in research, administration and enforcement costs and management effectiveness;
8. Changes in the economic, social or cultural value of fishing activities and nonconsumptive uses of fishery resources;

9. Changes in the distribution of benefits and costs; and
10. Social effects.

Agency guidance provided at 50 CFR 600.350(d)(3)(ii) suggests the Councils adhere to the precautionary approach outlined in the Food and Agriculture Organization of the United Nations Code of Conduct for Responsible Fisheries (Article 6.5) when faced with uncertainty concerning these ten practicability factors. According to Article 6.5 of the Code, using the absence of adequate scientific information as a reason for postponing or failing to take measures to conserve target species, associated or dependent species, and non-target species and their environment, would not be consistent with a precautionary approach.

The analyses in Sections 3.1.12.1 and 3.1.12.2 consider this guidance in evaluating whether existing regulations minimize bycatch and bycatch mortality to the extent practicable in the South Atlantic penaeid and rock shrimp fisheries, respectively. Section 4.2.4 includes an evaluation of the environmental effects of modifying the current management regime in the rock shrimp fishery to further minimize bycatch and bycatch mortality, following the conclusion that additional action is needed to meet the Magnuson-Stevens Act bycatch mandate in that fishery.

3.1.12.1 Minimize bycatch in the penaeid shrimp fishery to the extent practicable

The South Atlantic penaeid shrimp fishery occurs in an area extending from Fort Pierce, Florida to Pamlico Sound and Ocracoke Inlet, North Carolina. The federal fishery is primarily prosecuted with otter trawl gear (SAFMC 1993). Other gear (e.g., cast nets, haul seines, wing nets, etc.) also is used, but accounts for a minor portion of the annual commercial landings. Trawl gear is predominantly used in federal waters. Management actions implemented by the Council to minimize bycatch in the penaeid shrimp fishery and the effects of those actions on finfish and invertebrates and on sea turtles are described in Sections 3.1.12.1.1 and 3.1.12.1.2, respectively. Section 3.1.12.1.3 contains an evaluation of the effects of these management measures on bycatch and bycatch mortality of finfish using the ten practicability factors provided at 50 CFR 600.350(d)(3)(i).

In summary, technological devices mandated for use in the South Atlantic penaeid shrimp trawl fishery are estimated to reduce finfish bycatch by at least 30% and to reduce sea turtle bycatch by as much as 97%. More data are needed to improve the reliability of information on the current level of finfish bycatch, which generally continues to exceed the catch of shrimp. However, based on a review of the status of the five species of greatest concern in the South Atlantic (weakfish, king mackerel, Spanish mackerel, Atlantic croaker and spot), there is no evidence to indicate that the mortality of finfish caused by the shrimp trawl fleet (with TEDs implemented) is having a significant adverse affect on finfish stocks. This practicability analysis concluded that current management measures minimize bycatch and bycatch mortality to the extent practicable in the penaeid shrimp fishery.
Bycatch in the shrimp trawl fishery could have adverse socioeconomic effects on finfish fisheries that target the same species that are taken as bycatch in the shrimp fishery. But any adverse effects associated with reducing the number of fish available to the directed commercial and recreational

finfish fisheries are likely outweighed by the socioeconomic benefits of the high value shrimp fishery in which some level of bycatch is unavoidable. The revenue generated by the South Atlantic commercial shrimp fishery is the highest in the region relative to other commercial harvesting sectors.

The technology certified by the Council for use in the penaeid shrimp fishery attempts to balance the above described biological, ecological, social and economic tradeoffs by reducing finfish bycatch while minimizing shrimp loss. As a result, current management measures are believed to have minimized finfish bycatch and finfish bycatch mortality to the extent practicable. Researchers continue working to improve the performance and efficiency of bycatch reduction devices.

3.1.12.1.1 Managing finfish and invertebrate bycatch in the penaeid shrimp fishery

The key focus of the Shrimp FMP when it was implemented in 1993 was to provide for concurrent closures of state and federal waters following severe winter weather to eliminate fishing mortality on overwintering white shrimp when necessary to ensure the sustainability of the stock (SAFMC 1993). The Council recognized at the time that mortality in the shrimp trawl fishery had an adverse impact on a number of finfish stocks that are important to commercial and/or recreational fisheries in the South Atlantic, including the weakfish, king mackerel, Spanish mackerel, Atlantic croaker and spot (Nance 1998). But an amendment to the Magnuson-Stevens Act in 1990 specifically prohibited the Council from implementing bycatch reduction measures until January 1, 1994. This prohibition was later extended for three months.

The intent of the 1990 Magnuson-Stevens Act incidental harvest provision was to ensure that bycatch reduction requirements were based on reliable information on the magnitude and composition of bycatch, and that such requirements minimized adverse effects on shrimp fishery participants to the extent practicable. The 1990 Magnuson-Stevens Act amendment authorized a 3-year study of bycatch in the Gulf of Mexico and South Atlantic shrimp trawl fishery to characterize bycatch and to develop gear options that could reduce bycatch with minimum loss of shrimp production. Results of these studies are summarized in Section 3.1.8, 3.1.9 and 3.1.10.

Upon completion of this study, the Council developed Amendment 2 to the Shrimp FMP (SAFMC 1996b). Effective April 1997, Amendment 2 required that shrimp trawl gear operating in federal waters of the South Atlantic use one of three BRDs certified by the Council based on their ability to reduce finfish bycatch while minimizing shrimp loss. These federally approved BRDs include the 12x5 fisheye, the extended funnel BRD and the expanded mesh BRD, which are estimated to achieve a 30% reduction in overall finfish bycatch (Section 3.1.10).

3.1.12.1.2 Managing sea turtle bycatch in the penaeid shrimp fishery

The South Atlantic penaeid shrimp trawl fishery also is regulated to minimize interactions with sea turtles, all species of which are listed as either threatened or endangered under the 1973 ESA. The incidental take and mortality of sea turtles as a result of trawling activities has been documented along the Atlantic Ocean seaboard. Federal regulations under the ESA require most shrimp trawlers operating in the South Atlantic to have a NOAA Fisheries approved turtle excluder device (TED) installed in each net that is rigged for fishing to provide for the escape of sea turtles. To be approved by NOAA Fisheries, a TED design must be shown to be at least 97% effective in excluding sea turtles during experimental TED testing (68 FR 8456; February 21, 2003).

The use of TEDs is believed to have had a significant beneficial impact on the survival and recovery of at least some sea turtle species (68 FR 8456; February 21, 2003). However, information from Epperly and Teas (2002) demonstrated that these devices, as originally designed, were not adequately protecting all species and size classes of turtles. Leatherback sea turtles were too large to escape through the TED openings. According to a biological opinion completed in December 2002, as many as 2.5% of the loggerhead turtles in the Atlantic also were too large to exit through the TEDs (68 FR 8456; February 21, 2003). Consequently, NOAA Fisheries amended regulations in February 2003 to 1) modify the dimensions of approved TEDs so that they are effective at excluding leatherbacks and large sexually mature loggerhead and green turtles, and 2) modify trynet and bait shrimp exemptions to the TED requirements to decrease lethal take of sea turtles.

In the 2002 Biological Opinion, NOAA Fisheries determined that “shrimp trawling in the southeastern United States under the proposed revisions to the sea turtle conservation regulations and as managed by the fishery management plans for shrimp in the South Atlantic and Gulf of Mexico is not likely to jeopardize the continued existence of endangered green, leatherback, hawksbill and Kemp’s ridley sea turtles and threatened loggerhead sea turtles” (NOAA Fisheries 2002). The new rule is expected to decrease shrimp trawl related mortality by 94% for loggerheads and by 96% for leatherbacks (68 FR 8456; February 21, 2003).

3.1.12.1.3 Bycatch practicability analysis

3.1.12.1.3.1 Population effects for the bycatch species

The population effects of bycatch mortality are the same as fishing mortality from directed fishing efforts. If not properly managed and accounted for, either form of mortality could potentially reduce stock biomass to an unsustainable level. One important difference in the effects of the penaeid shrimp trawl fishery and directed fisheries on finfish is that fishes taken in shrimp trawls are generally small and young. Juveniles are more expendable in one respect because they occur in high numbers, and relatively few actually survive to adulthood. But the reproductive potential of a stock can be compromised if fish are not provided sufficient opportunities to reproduce before they are exposed to fishing or bycatch mortality. The risk of stock collapse increases markedly if the fish are subject to fishing or bycatch mortality before they mature (Myers and Mertz 1998).

Early weakfish management plans indicated that bycatch of juvenile weakfish in the shrimp trawl fishery reduced yield per recruit and spawning stock biomass per recruit of the weakfish stock. The amount of weakfish discarded in the shrimp trawl fishery often approached or exceeded directed landings in South Atlantic states (Nance 1998). BRDs have reduced discards of weakfish and other finfish species by at least 30% since that time (see Section 3.1.10). Although some soft TEDs were also documented to reduce finfish bycatch (see Section 3.1.10), most of the current hard TED configurations suggest that they will have little impact on bycatch reduction, except for the mechanical exclusion of large fishes such as sharks and rays.

The current level of bycatch in the penaeid shrimp trawl fishery continues to be substantial despite these advancements in bycatch reduction. However, bycatch mortality is incorporated in assessments of finfish stocks where bycatch estimates are available (e.g., weakfish and sharks) (Nance 1998). Additionally, the sustainability of finfish species taken as bycatch in shrimp trawls does not appear to be threatened by this source of mortality.

The following summarizes available information on the status of the five species of greatest concern in the South Atlantic: weakfish, king mackerel, Spanish mackerel, Atlantic croaker and spot. Two of these five species, Atlantic croaker and spot, represent major components of the total shrimp trawl finfish bycatch. The remaining species are represented in the catch in lesser numbers. All were selected for review by Nance (1998) because of their commercial and recreational importance, and because bycatch mortality has the potential to significantly impact their abundance.

The weakfish stock has moved from an overfished to a recovering condition, as spawning stock biomass and recruitment have increased. Significant declines in fishing mortality are credited for these improvements (ASMFC 2004a). King mackerel and Spanish mackerel are neither overfished nor experiencing overfishing (NOAA Fisheries 2003a). Spanish mackerel stock biomass has more than doubled since the mid-1990s (ASFMC 2004b). The first coast-wide assessment of the Atlantic croaker stock has not yet been completed (ASMFC 2004c). However, the 2001 review of the Atlantic croaker FMP based on a more limited assessment indicates that the population is increasing in size and expanding in age/size structure (Desfosse *et al.* 2001). Data are inadequate to conduct a formal, coast-wide assessment of spot. But the current BRD and minimum size limit requirements are believed to have reduced mortality sufficiently to protect this stock until an assessment can be completed (ASMFC 2004d).

Observed increases in nesting levels of the Kemp’s ridley sea turtles exemplify the significant beneficial impact of TEDs on the survival and recovery of several sea turtle populations. The total annual mortality of Kemp’s ridley turtles has been reduced by 44%-50% since 1990, when TEDs became more widely used in U.S. waters. Once the most critically endangered sea turtle, Kemp’s ridley nesting levels have increased from 700-800 nests per year in the mid-1980s to over 6,000 nests in 2000. Recent modifications to the TED rule designed to better protect larger species of sea turtles are expected to decrease shrimp trawl related mortality by 94%-96% for loggerheads and leatherbacks, respectively (68 FR 8456; February 21, 2003).

3.1.12.1.3.2 Ecological effects due to changes in the bycatch of shrimp (effects on other species in the ecosystem)

There is limited bycatch of shrimp in the shrimp trawl fishery because nearly all shrimp harvested is marketed. Interaction with BRDs and trawl gear could result in some mortality on those shrimp that subsequently escape the devices. However, the BRDs certified by the Council minimize shrimp loss to the extent possible and have not adversely affected the status of shrimp stocks. According to NOAA Fisheries' most recent report to Congress, none of the South Atlantic penaeid shrimp stocks is overfished or experiencing overfishing (NOAA Fisheries 2003a). Consequently, the ecosystem effects of such losses are expected to be minimal.

3.1.12.1.3.3 Changes in the bycatch of other species of fish and invertebrates and the resulting population and ecosystem effects

Reductions in finfish bycatch attributed to the mandated use of BRDs may result in increased predation on shrimp if affected finfish are shrimp predators. Only 14 of 161 fish species examined during NOAA Fisheries' offshore bycatch characterization surveys on commercial vessels from 1992-1996 were identified as predators on penaeid shrimp. These are the Atlantic croaker, sand seatrout, spotted seatrout, silver seatrout, ocellated flounder, inshore lizardfish, bighead searobin, smooth puffer, red snapper, lane snapper, Spanish mackerel, rock sea bass, dwarf sand perch and Atlantic sharpnose shark (Nance 1998).

Predator-prey relationships are largely dependent on the size structure of predator and prey populations. Juvenile fish that could not prey on large shrimp because of their small size may be able to do so if their exclusion from trawl gear allows them to grow larger. However, it is also possible that some fish will reduce their preference for shrimp as they grow larger and their dietary habits change (Nance 1998).

Simulations using an ecosystem-based model of the interactions among shrimp and finfish stocks in the Gulf of Mexico indicate that shrimp stock biomass could increase by 4.7% or decrease by 17% depending on bycatch exclusion rates and assumptions relative to predator selection of shrimp prey (Nance 1998). Predation is the primary cause of the simulated decrease in shrimp stock biomass. A reduction in the amount of nitrogen recycled from discards is a contributing factor. However, nitrogen returned to the ecosystem through discards is minimal in comparison to the large nitrogen input from rivers (Nance 1998).

The possible outcomes simulated by the model are uncertain, as multiple factors that are not well understood will influence the actual response of the ecosystem to changes in shrimp trawl bycatch. Generally, scientific data are inadequate to reliably predict ecosystem effects, particularly with respect to stock size, and interactions between predators and prey, and species, such as bottomfish, sharks, birds and dolphins, which compete with each other for food and other resources (Nance 1998; Cook 2003). Consequently, the ecosystem model is based on a number of assumptions about which scientists are uncertain, including a discard mortality rate of 100%. The limitations of the model are discussed more fully in Nance (1998).

Changes in the bycatch of non-shrimp invertebrates (e.g., crustacea and molluscs) also could have ecosystem effects. These species have ecological functions in addition to serving as prey for other invertebrates and fishes. For example, some species, like barnacles and hydrozoans, condition habitat for other organisms by providing a growing surface or by contributing to the bioturbation of bottom sediments.

3.1.12.1.3.4 Effects on marine mammals and birds

Under Section 118 of the Marine Mammal Protection Act (MMPA), NOAA Fisheries must publish, at least annually, a List of Fisheries (LOF) that places all U.S. commercial fisheries into one of three categories based on the level of incidental serious injury and mortality of marine mammals that occurs in each fishery. The 2003 List of Fisheries classifies the Southeastern U.S. Atlantic Shrimp Trawl fishery as a Category III fishery, meaning that the annual mortality and serious injury of a stock resulting from the fishery is less than or equal to 1% of the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (68 FR 135; July 15, 2003). No changes in this fishery's classification were proposed in the 2004 proposed LOF (69 FR 71; April 13, 2004).

Species of large whales protected by the ESA can be found in or near the area in which the South Atlantic shrimp trawl fishery occurs. The slow speed (1 to 2 knots) at which shrimp trawlers operate while trawling is sufficient to allow both whales and fishing vessels time to avoid a collision. There have been no reported interactions between large whales and shrimp vessels in the South Atlantic. A biological opinion conducted by NOAA Fisheries in December 2002 identified the chances of the South Atlantic shrimp trawl fishery affecting these species as "discountable" and determined they were not likely to be adversely affected (NOAA Fisheries 2002). Discountable effects are defined as effects that are extremely unlikely to occur.

There have been no documented seabird-gear interactions in the South Atlantic penaeid shrimp fishery. This finding is based on more than 117,000 hours of observer coverage while trawling on 1,310 trips completed from February 1992 through December 2003 during 12,749 sea days in the U.S. Gulf of Mexico and southeastern Atlantic. A total of 668 trips (1,475 sea days) occurred off the east coast, and 5 trips (127 sea days) targeted waters off both the east coast and in the Gulf of Mexico (E. Scott-Denton, NOAA Fisheries, personal communication). Seabirds that feed on discards would be expected to be affected by any increases or decreases in the amount of discards produced by the shrimp trawl fishery (Nance 1998; Cook 2003). Discards and offal produced by fishing vessels makes food more easily available to seabirds, and have been linked to population increases in a number of species (Cook 2003).

3.1.12.1.3.5 Changes in fishing, processing, disposal and marketing costs

Penaeid shrimp fishermen have experienced direct costs as a result of the BRD and TED requirements. The cost of a BRD ranges from about $20 for a fisheye design to less than $100 for the large mesh extended funnel (SAFMC 1996b). The cost of outfitting small fishing vessels with BRDs is estimated at $200 (four BRDs at a cost of $50 per BRD). These vessels trawl with two nets. Larger shrimp vessels typically use four nets, and keep a spare set onboard. As a result, these vessels are required to purchase approximately eight BRDs, with a resulting cost of $400. The purchase of these gear modifications is a recurring expense. Currently, the cost of a TED typically used for an offshore, larger vessel runs approximately $320 to $350. For shrimpers whose TED frames were large enough to be compliant with the new rule and only needed to have the opening modified – the cost ran approximately $50. In general, shrimpers will have their TEDs re-worked every year, which if it does not require replacing the TED, will run approximately $100/TED.

The use of BRDs could result in some shrimp loss. But studies suggest that the use of BRDs or similar techniques to reduce finfish capture would not negatively affect shrimp production in the long-term if finfish exhibit even moderate selectivity against shrimp as prey (Nance 1998). The amount of shrimp loss associated with the three BRDs certified for use in the South Atlantic region is expected to be minimal.

The bycatch reduction achieved by BRDs could benefit shrimp fishermen by reducing the time required to cull unwanted species. Reducing culling time could improve the quality of the shrimp processed by decreasing the amount of time it takes to get shrimp into cold storage. The net economic effect of BRDs has not been quantified. But anecdotal information indicates that some fishermen favor using these devices because they increase net revenue per trawling operation (SAFMC 1996b).

3.1.12.1.3.6 Changes in fishing practices and behavior of fishermen

Some fishermen could perceive BRD and TED requirements as unnecessarily restrictive. However, there are few data available to adequately define how the requirements are perceived, and how these perceptions have changed fishing practices and behavior. A survey conducted by Kitner in 1987 to collect information on shrimp fishermen’s response to TEDs found that reactions were more favorable among those who had experience with the devices. The fishermen’s response to the BRD requirement in Shrimp Amendment 2 was similar. Those fishermen most familiar with BRDs appeared to be most accepting of the regulations. However, the Council received relatively few comments in opposition to the regulation overall. This could indicate that the industry was resigned to having to use the new technology. Also, it could indicate that shrimp fishermen understand the value of BRDs.

Bycatch mortality can reduce the availability of finfish to directed fisheries. Finfish taken in shrimp trawls are generally juveniles, and most of these fish would likely be subject to natural mortality before they become available to directed fisheries. However, bycatch mortality can adversely affect the status of stocks taken in directed fisheries by reducing the opportunity for bycatch species to mature and reproduce before they are subject to mortality. Because declining landings have precipitated the imposition of state and federal catch restrictions in some directed fisheries, participants in those fisheries likely perceive the BRD requirement as a regulation that promotes equity in the fisheries (Nance 1998).

3.1.12.1.3.7 Changes in research, administration and enforcement costs and management effectiveness

Research needed to understand the effectiveness of BRDs and TEDs is costly, as are administrative and enforcement efforts needed to implement and enforce these regulations. However, the implementation of these gear modification requirements has improved management effectiveness by decreasing turtle and finfish bycatch in the fishery.

3.1.12.1.3.8 Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources

The combined landings from U.S. shrimp fisheries in 2002 ranked highest in value of all domestic fisheries that year (NOAA Fisheries 2003b). The South Atlantic shrimp fishery generates the most revenue for the commercial harvesting sector in this region. During the last two years for which data are available (2001 and 2002), commercial shrimp landings in the South Atlantic generated an average of $63.56 million annually (Section 3.2.3.1.1).

The U.S. Congress recognized the need to balance the costs of bycatch reduction with the social and economic benefits provided by the shrimp fishery when it mandated the study of shrimp trawl bycatch (and potential gear modifications) through the 1990 reauthorization of the Magnuson-Stevens Act. The resulting cooperative bycatch research program was effective in identifying gear options that could reduce shrimp trawl bycatch with minimum loss of shrimp production.

While BRD and TED requirements certainly present direct costs to participants in the shrimp fishery, they could reduce overall costs by making operations more efficient (Section 3.1.12.1.3.5). Additionally, studies of BRDs suggest that the use of these devices or similar techniques to reduce finfish capture would not negatively affect shrimp production in the long-term if finfish exhibit even moderate selectivity against shrimp as prey (Nance 1998).

Decreases in bycatch mortality attributed to these technologies are believed to have contributed to the survival and recovery of at least some sea turtle populations and finfish stocks (Section 3.1.12.1.3.1). The societal benefits associated with recovering these species are not easily quantified, but are believed to outweigh any short-term costs to penaeid shrimp fishermen related to the required use of bycatch reduction technology.

3.1.12.1.3.9 Changes in the distribution of benefits and costs

Prior to the mandated use of bycatch reduction technology in the penaeid shrimp fishery, there was a general perception that benefits and costs were not equitably distributed between the shrimp trawl fisheries and directed finfish fisheries and between the shrimp trawl fisheries and the broader public. Commercial and recreational fishermen who target finfish taken incidental to the trawl fishery believe that shrimp fishermen should share the burden of regulations needed to sustain declining fish stocks (Nance 1998). And at least some members of the public view bycatch as unnecessary waste. Discarded finfish provide an ecological service in that they are consumed by other marine species. However, the ecological role of discarded finfish would have been different had they been allowed to mature. The mandated use of BRDs and TEDs was intended to address these perceived inequities while maintaining a productive, high value shrimp fishery.

3.1.12.1.3.10 Social effects

There are few data available to adequately define the social effects of BRD and TED requirements. Penaeid shrimp fishermen could be experiencing negative effects related to the costs of installing and using the devices and to feeling overregulated. They also could be experiencing positive effects related to improved efficiency. The concerned public is likely experiencing social benefits related to knowing that the organisms they value for aesthetic and existence reasons are better protected. However, some members of the public could be of the opinion that the reductions in bycatch achieved through BRD and TED requirements are insufficient.

3.1.12.1.3.11 Conclusion

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the South Atlantic penaeid shrimp fisheries based on the findings in Section 3.1.12.1 and using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, technological devices mandated for use in the South Atlantic penaeid shrimp trawl fishery are estimated to reduce finfish bycatch by at least 30% and to reduce sea turtle bycatch by as much as 97%. More data are needed to improve the reliability of information on the current level of finfish bycatch, which generally continues to exceed the catch of shrimp. However, based on a review of the status of the five species of greatest concern in the South Atlantic (weakfish, king mackerel, Spanish mackerel, Atlantic croaker and spot), there is no evidence to indicate that the mortality of finfish caused by the shrimp trawl fleet (with TEDs implemented) is having a significant adverse affect on finfish stocks. Therefore, the Council concluded that current management measures minimize bycatch and bycatch mortality to the extent practicable in the penaeid shrimp fishery.

3.1.12.2 Minimize bycatch in the rock shrimp fishery to the extent practicable

The South Atlantic rock shrimp fishery is concentrated in an area off northeast Florida south to Jupiter Inlet. The fishery is primarily prosecuted by commercial otter trawl gear. Management measures regulating harvest in the fishery include a minimum mesh size restriction, a limited access program and area closures located east of 80°W longitude, between 27°30'N and 28°30'N latitude, in depths less than 100 fathoms. The primary purpose of the area closures is to minimize the impacts of the rock shrimp fishery on essential bottom habitat, including the fragile coral species located in the *Oculina* Bank Habitat Area of Particular Concern (HAPC). These closures are enforced using vessel monitoring systems (VMS) (SAFMC 2002).

3.1.12.2.1 Description of bycatch in the rock shrimp fishery

Section 3.1.9 describes the magnitude and composition of bycatch in the rock shrimp fishery based on a preliminary report of observer coverage of the U.S. Southeastern Atlantic rock shrimp fishery from September 2001 through December 2002 (Appendix C).

In summary, the majority of the total catch throughout the study period was composed of finfish. Weight extrapolations from the species composition samples indicate that dusky flounder is the finfish represented in the greatest number (13% of the total catch), followed by the inshore lizardfish (9% of the total catch), spot (6% of the total catch) and red goatfish (2% of the total catch). Non-shrimp crustaceans generally represented the second largest component of the catch by weight, except in fall 2001, when rock shrimp comprised 22% of the total catch. The iridescent swimming crab is the non-shrimp crustacean represented in the greatest number (10% of the total catch), followed by the longspine swimming crab (8% of the total catch) and the blotched swimming crab (5% of the total catch). The amount of penaeid shrimp in the catch varied by season, and ranged from 3% to 7%. Invertebrates and debris comprised the smallest portion of the total catch, ranging from less than 1% to 4% and from less than 1% to 3%, respectively (NOAA Fisheries 2003c).

These findings could underestimate bycatch in the South Atlantic rock shrimp fishery because all of the observed trawls were equipped with BRDs, and those devices are not required in the fishery at this time. However, BRDs are regularly used in the rock shrimp fishery because they are required if penaeid shrimp comprise more than 1% of the catch. Additionally, these data were recorded during an atypical rock shrimp season defined by relatively low levels of harvest compared to previous years.

Four loggerhead sea turtles were captured in rock shrimp trawls during the study period and released alive: three were taken in try nets; one was taken in a TED-equipped net. One unidentified sea turtle was taken in a try net and with an unknown release status (NOAA Fisheries 2003c). These takes occurred prior to the implementation of new regulations in February 2003, which required modifications to those devices (Section 3.1.12.1.2).

3.1.12.2.2 Bycatch practicability analysis

3.1.12.2.2.1 Population effects for the bycatch species

Section 3.1.12.1.3.1 provides a general description of the effects of bycatch on populations of species that experience bycatch mortality. Little is known about the status of those finfish (e.g., dusky flounder, inshore lizardfish, spot and red goatfish) and invertebrate (e.g., iridescent swimming crab, longspine swimming crab and blotched swimming crab) species that are present in rock shrimp trawl bycatch in the greatest numbers. None of these species have undergone (or are likely to undergo) formal stock assessments because most, with the exception of spot, are not targeted in commercial or recreational fisheries. Data are inadequate to conduct a formal, coast-wide assessment of spot. But fishery managers believe that a combination of BRD and minimum size limit requirements would be sufficient to protect this stock until such an assessment can be completed (ASMFC 2004d).

Given that four loggerhead sea turtles were caught and released alive during the study period suggests the level of interaction with the rock shrimp fishery is high. However, recent modifications to the TED rule designed to better protect larger species of sea turtles are expected to decrease shrimp trawl related mortality by 94% for loggerheads (68 FR 8456; February 21, 2003). As noted in Section 3.1.12.1.2, NOAA Fisheries determined in a 2002 biological opinion that shrimp trawling in the southeastern United States under the proposed revisions to the sea turtle conservation regulations and as managed by the South Atlantic and Gulf of Mexico Shrimp FMPs is not likely to jeopardize the continued existence of endangered green, leatherback, hawksbill or Kemp’s ridley sea turtles, or threatened loggerhead sea turtles (NOAA Fisheries 2002).

Anecdotal information suggests that bycatch of the coral, *Oculina varicosa*, in the rock shrimp trawl fishery was negatively affecting that species. This information is supported by recent evidence of trawl tracks and *Oculina* rubble within the *Oculina* Bank HAPC (C. Koenig, Florida State University, personal observation). *Oculina* coral fragments may continue to survive after an impact (Brooke 1998). The likelihood that impacted corals could be smothered by sediments, or sufficiently removed from the current’s influence as to deprive them of nutrients, is greatly increased. Researchers estimate that past fishery-related impacts, primarily from trawl gear, have reduced the amount of intact *Oculina* coral habitat remaining within the *Oculina* Experimental Closed Area (Koenig *et al.* (in press)). The VMS requirement implemented through Amendment 5 to the Shrimp FMP is expected to improve compliance with the prohibition on rock shrimp trawling within the *Oculina* HAPC.

3.1.12.2.2.2 Ecological effects due to changes in the bycatch of shrimp (effects on other species in the ecosystem)

Discards of rock shrimp in the rock shrimp fishery have not been quantified. Anecdotal reports indicate that economic discards of unmarketable juvenile rock shrimp have increased as the temporal and spatial distribution of the fishery has changed over time. Vessels have begun to fish earlier in the year (e.g., June and July versus August or September) and have moved further south relative to historical fishing areas. However, the mesh size restrictions implemented through Amendment 5 to the South Atlantic Shrimp Plan were intended to address this problem (SAFMC 2002). Consequently, the ecosystem effects of rock shrimp discards (if any) are likely to be minimal.

3.1.12.2.2.3 Changes in the bycatch of other species of fish and invertebrates and the resulting population and ecosystem effects

Section 3.1.12.1.3.2 summarizes available information on how bycatch can affect ecological functions, particularly interactions between predator, prey and competitor species. No additional data are available on the ecosystem effects of bycatch in the South Atlantic rock shrimp fishery.

3.1.12.2.2.4 Effects on marine mammals and birds

Bycatch of marine mammals and seabirds is not considered to be a problem in the South Atlantic rock shrimp fishery. As noted in Section 3.1.12.1.3.4, the Southeastern U.S. Atlantic Shrimp Trawl fishery is classified as a Category III fishery, meaning that the annual mortality and serious injury of a stock resulting from the fishery is less than or equal to 1% of the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population (68 FR 135; July 15, 2003).

There were no documented seabird-gear interactions recorded on 1,310 trips observed in the U.S. Gulf of Mexico and southeastern Atlantic penaeid and rock shrimp fisheries between February 1992 and December 2003 (E. Scott-Denton, NOAA Fisheries, personal communication). However, the potentially high level of bycatch in the rock shrimp fishery could be affecting some seabird species. Cook (2003) notes that the availability of discards and offal have been linked to population increases in a number of species.

3.1.12.2.2.5 Changes in fishing, processing, disposal and marketing costs

The potentially high level of bycatch in the rock shrimp fishery could be adversely affecting production by unnecessarily increasing drag time, culling time and crew fatigue. Regulatory measures implemented to reduce bycatch would likely have direct costs related to purchasing and installing new technology, or limiting where and/or when a vessel could operate. But such measures could result in long-term benefits if they increased the efficiency of shrimp trawl operations. BRD technology has been shown to reduce shrimp trawl bycatch with minimal cost to shrimp fishermen.

3.1.12.2.2.6 Changes in fishing practices and behavior of fishermen

At least some participants in the rock shrimp fishery deny there is a bycatch problem. Consequently, imposing regulatory requirements to reduce bycatch could provide disincentive for responsible participation in the fishery. For example, fishermen could potentially ignore a BRD or closed season requirement, or violate the prohibition on trawling within the *Oculina* Bank HAPC. However, as noted in 3.1.12.1.3.6, it appears as though most rock shrimp fishermen already use BRDs. And the

VMS requirement implemented in October 2003 is expected to improve compliance with seasonal closure regulations and ease the enforcement burden.

3.1.12.2.2.7 Changes in research, administration and enforcement costs and management effectiveness

Bycatch in southeastern shrimp trawl fisheries has been a priority issue for scientists and administrators for a number of years. This focus is most likely to continue as the Council address future management needs in the fishery.

3.1.12.2.2.8 Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources

There is no evidence that bycatch in the South Atlantic rock shrimp fishery is adversely affecting the economic, social or cultural value of fishing activities. However, it could be unnecessarily increasing the costs of trawling operations (Section 3.1.12.1.3.8). Additionally, at least some non-consumptive users view bycatch in the fishery as wasteful even though there is no evidence that this source of mortality is having a significant adverse effect on bycatch species (Section 3.1.12.1.3.9). Technology exists that could further minimize bycatch in the fishery at a minimal cost to fishery participants.

3.1.12.2.2.9 Changes in the distribution of benefits and costs

The perception that benefits and costs are inequitably distributed between shrimp fishermen and other concerned use (and non-use) groups is described in Section 3.1.12.1.3.9. The Council attempted to address perceived inequities in the penaeid shrimp fishery by requiring the use of BRDs through Amendment 2 to the Shrimp FMP. This issue has not yet been addressed in the rock shrimp fishery, as that fishery is currently excluded from the BRD requirement.

3.1.12.2.2.10 Social effects

The social effects of rock shrimp bycatch have not been quantified. Rock shrimp fishermen could be experiencing negative effects related to unnecessarily high operating costs and/or positive effects related to having escaped the BRD requirement. Penaeid shrimp fishermen could be experiencing negative effects if they perceive the Council's failure to apply the BRD requirement to the rock shrimp fishery as unfair. The concerned public is likely experiencing negative effects related to what they perceive as an unnecessarily high amount of waste in the fishery.

3.1.12.2.2.11 Conclusion

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the South Atlantic rock shrimp fishery based on the findings in Section 3.1.12.2 and using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, recent studies indicate that finfish bycatch is a large component of the rock shrimp catch. While there is no evidence that this bycatch is adversely affecting bycatch species or the surrounding ecosystem, technological advancements in the form of BRDs are available that can effectively reduce bycatch, while minimizing losses in shrimp production. As a result current management measures are not believed to have minimized bycatch and bycatch mortality to the extent practicable. Section 4.2.4 includes an evaluation of the environmental effects of modifying the current management regime in the rock shrimp fishery to further minimize bycatch and bycatch mortality.

3.1.13 Protected species environment

Section 7(a)(2) requires federal agencies to ensure that any activity they authorize, fund or carry out is not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of designated critical habitat.

Species occurring in the action area that are listed under the ESA along with any designated critical habitat(s) are listed below. A review of the species' biology, population status, distribution and on-going threats is provided in order to evaluate potential effects of the fishery and proposed action(s) on the listed species, as required by Section 7 of the ESA.

3.1.13.1 Description of listed marine species and critical habitat designated in the South Atlantic EEZ

List of Species and Designated Critical Habitat

Endangered

Blue whale	*Balaenoptera musculus*	
Humpback whale	*Megaptera novaeangliae*	
Fin whale	*Balaenoptera physalus*	
Northern right whale	*Eubalaena glacialis*	(Critical Habitat Designated)
Sei whale	*Balaenoptera borealis*	
Sperm whale	*Physeter macrocephalus*	
Leatherback sea turtle	*Dermochelys coriacea*	
Hawksbill sea turtle	*Eretmochelys imbricata*	
Kemp's Ridley turtle	*Lepidochelys kempii*	
Green turtle*	*Chelonia mydas*	
Smalltooth sawfish**	*Pristis pectinata*	

*Green turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between populations away from nesting beaches, green turtles are considered endangered wherever they occur in U.S. Atlantic waters.

** in the U.S. distinct population segment.

Threatened

Loggerhead turtle *Caretta caretta*

Proposed Species
None

Proposed Critical Habitat
None

Species Under U.S. Fish and Wildlife Service (USFWS) Jurisdiction:

Endangered

Bermuda Petrel	*Pterodrama cahow*
Roseate Tern***	*Sterna dougallii*

*** North American populations Federally listed under the ESA: endangered on Atlantic coast south to NC / threatened elsewhere.

Birds

Bermuda petrel

During the summer, Bermuda petrels are occasionally seen in the warm waters of the Gulf Stream off the coasts of North and South Carolina (Alsop, III 2001). Sightings off the Carolinas have been of solitary birds. This pelagic species is widely distributed in open ocean environments, however, it is considered rare and occurs in low numbers off the Atlantic coast. Bermuda petrels forage primarily on cephalopods and small fish taken from the water's surface and are not known to follow boats (Alsop III 2001). Predominant threats are habitat loss, predation and contaminants. Given this species pelagic and rare occurrence off the Carolinas together with its behavior of not associating with boats, it seems unlikely that the continued prosecution of the shrimp fishery in federal waters of the southeast Atlantic will adversely affect the Bermuda petrel and therefore is discountable. Accordingly, Bermuda petrels are not likely to be adversely affected by the proposed actions.

Roseate tern

Roseate terns are known to wander widely along the Atlantic coast during the summer but occur mainly off the northeast and in parts of the Florida Keys (data from USFWS). They are considered to be uncommon to rare in other areas of the southeast Atlantic coast (Alsop, III 2001). Roseate terns are plunge divers and feed primarily on small schooling fish. Their numbers declined due, in large part, to hunting for the plume trade. Today, primary threats include losing territory on their island colonies to Herring gulls, human disturbance and predation by domesticated and feral cats on nesting grounds. Given this species uncommon occurrence in the southeast region, it seems unlikely that the continued prosecution of the shrimp fishery in federal waters of the southeast Atlantic will adversely affect the roseate tern.

Whales

Species of large whales protected by the ESA can be found in or near the South Atlantic. Blue, fin, sei and sperm whales are predominantly found seaward of the continental shelf where shrimping does not take place. Northern right whales and humpback whales are coastal animals and have been sighted in the nearshore area along the southeast Atlantic, November through March. There have been no reported interactions between large whales and shrimp vessels in the Atlantic. Also shrimp trawlers move slowly (1 to 2 knots while trawling), which would give a whale or the fishing vessel time to avoid a collision. Based on the above information, the chance of the proposed action affecting species of large whales protected by the ESA is extremely unlikely to occur.

Designated northern right whale critical habitat

Designated northern right whale critical habitat (50 FR 28793) can be found in the South Atlantic from the mouth of the Altamaha River, Georgia to Jacksonville, Florida, out 15 nautical miles (nm) and from Jacksonville, Florida to Sebastian Inlet, Florida, out 5 nm. The continued prosecution of the shrimp fishery in Federal waters will not alter the physical and biological features (water depth, water temperature and the distribution of right whale cow/calf pairs in relation to the distance from the shoreline to the 40 m isobath [Kraus *et al.* 1993]), which were the basis for determining this habitat to be critical. Therefore, northern right whale critical habitat is not expected to be adversely modified by the proposed action.

Turtles

Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed primarily due to direct take, incidental capture in various fisheries and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic Ocean, Pacific Ocean, Indian Ocean, Caribbean Sea and Mediterranean Sea. Developmental habitat for small juveniles is the pelagic waters of the North Atlantic and the Mediterranean Sea (NOAA Fisheries and USFWS 1991b). Within the continental United States, loggerhead sea turtles nest from Louisiana to Virginia. Major nesting areas include coastal islands of Georgia, South Carolina, North Carolina and the Atlantic and Gulf coasts of Florida, with the bulk of the nesting occurring on the Atlantic coast of Florida.

In the western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. There are five western Atlantic subpopulations, divided geographically as follows: 1) a northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29^{o} N; 2) a south Florida nesting subpopulation, occurring from 29^{o} N on the east coast to Sarasota on the west coast; 3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; 4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez 1990; TEWG 2000); and 5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NOAA Fisheries SEFSC 2001). The fidelity of nesting females to their nesting beach is the reason these subpopulations can be differentiated from one another. This nest beach fidelity will prevent recolonization of nesting beaches with sea turtles from other subpopulations.

Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985; Frazer *et al.* 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings and nesting surveys NOAA Fisheries SEFSC (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests/individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 16-24 in (40-60 cm) straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U. S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads (sea turtles that have come back to inshore and nearshore waters), the life stage following the pelagic immature stage, have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in Northeastern Mexico. Tagging studies have shown that loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year round in offshore waters off of North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly *et al.* 1995c; Epperly *et al.* 1995a; Epperly *et al.* 1995b), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in Mid-Atlantic and Northeast areas until late Fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to waters offshore of North Carolina, particularly off of Cape Hatteras and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (Epperly *et al.* 1995c; Epperly *et al.* 1995a; Epperly *et al.* 1995b).

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

A number of stock assessments (TEWG 1998; TEWG 2000; NOAA Fisheries SEFSC 2001) have examined the stock status of loggerheads in the waters of the United States, but have been unable to develop any reliable estimates of absolute population size. Based on nesting data of the five western Atlantic subpopulations, the south Florida-nesting and the northern-nesting subpopulations are the most abundant (TEWG 2000; NOAA Fisheries SEFSC 2001). Between 1989 and 1998, the total number of nests laid along the U.S. Atlantic and Gulf coasts ranged from 53,014 to 92,182, annually with a mean of 73,751 (TEWG 2000). On average, 90.7% of these nests were from the south Florida subpopulation and 8.5% were from the northern subpopulation (TEWG 2000). The Turtle Expert Working Group's (TEWG) (2000) assessment of the status of these two better-studied populations concluded that the south Florida subpopulation is increasing, while no trend is evident (maybe stable but possibly declining) for the northern subpopulation. However, more recent analysis, including nesting data through 2003, indicate that there is no discernable trend in the south Florida nesting subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide and Index Nesting Beach Survey Programs, unpublished data). Another consideration adding to the importance and vulnerability of the northern subpopulation is that NOAA Fisheries' scientists estimate that the northern subpopulation produces 65 % males (NOAA Fisheries SEFSC 2001). Since nesting loggerhead sea turtles exhibit nest fidelity, the continued existence of the northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will in term limit the number of subsequent offspring produced by the subpopulation.

The remaining three subpopulations (the Dry Tortugas, Florida Panhandle and Yucatán) are much smaller subpopulations but no less relevant to the continued existence of the species. Nesting surveys for the Dry Tortugas subpopulation are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2003 (although the 2002 year was missed) (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide and Index Nesting Beach Survey Program, unpublished data). Nest counts ranged from 168-270 but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide and Index Nesting Beach Survey Program, unpublished data). Nest counts for the Florida Panhandle subpopulation are focused on index beaches rather than all beaches where nesting occurs. Currently, there is not enough information to detect a trend for the subpopulation (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide and Index Nesting Beach Survey Program, unpublished data). Similarly nesting survey effort has been inconsistent amongst the Yucatán nesting beaches and no trend can be determined for this subpopulation. However, there is some optimistic news. Zurita *et al.* (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico from 1987-2001 where survey effort was consistent during the period.

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms as well as wave action can appreciably reduce hatchling success. For example, in 1992, all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton *et al.* 1994). Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult female turtles on land, or the success of nesting and hatching include: beach erosion, beach armoring and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; beach driving; coastal construction and fishing piers; exotic dune and beach vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs and an increased presence of native species (e.g., raccoons, armadillos and opossums) which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the northwest Atlantic coast (in areas like Merritt Island, Archie Carr and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration; coastal development and transportation; marine pollution; underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching and fishery interactions. In the pelagic environment loggerheads are exposed to a series of longline fisheries that include the U.S. Atlantic tuna and swordfish longline fisheries, an Azorean longline fleet, a Spanish longline fleet and various fleets in the Mediterranean Sea (Aguilar *et al.* 1995; Bolten *et al.* 1994; Crouse 1999). In the benthic environment in waters off the coastal U.S., loggerheads are exposed to a suite of fisheries in Federal and state waters including trawl, purse seine, hook and line, gillnet, pound net, longline and trap fisheries.

Green Sea Turtle

Federal listing of the green sea turtle occurred on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered. The complete nesting range of the green turtle within the NOAA Fisheries' Southeast Region includes sandy beaches of mainland shores, barrier islands, coral islands and volcanic islands between Texas and North Carolina and the United States Virgin Islands (U.S.V.I.) and Puerto Rico (NOAA Fisheries and USFWS 1991a). Principal United States nesting areas for green turtles are in eastern Florida, predominantly Brevard through Broward Counties (Ehrhart and Witherington 1992). Green turtle nesting also occurs regularly on St. Croix, U.S.V.I. and on Vieques, Culebra, Mona and the main island of Puerto Rico (Mackay and Rebholz 1996).

Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, while males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling pelagic stage where they are associated with drift lines of algae and other debris.

Green turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or sea grasses near mainland coastlines, islands, reefs or shelves and any open ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997; NOAA Fisheries and USFWS 1991a). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957; Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon System, Florida (Ehrhart 1983) and the Atlantic Ocean off Florida from Brevard through Broward counties (Wershoven and Wershoven 1992; Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs. Age at sexual maturity is estimated to be between 20-50 years (Balazs 1982; Frazer and Ehrhart 1985).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but few data are available.

The vast majority of green turtle nesting within the southeastern United States occurs in Florida (Meylan *et al.* 1995; Johnson and Ehrhart 1994). It is unclear how much green turtle nesting in the whole of Florida has been reduced from historical levels (Dodd 1981). However, based on 1989-2002 nesting information, green turtle nesting in Florida has been increasing (Florida Marine Research Institute Statewide Nesting 2002, Database). Total nest counts and trends at index beach sites during the past decade suggest that green turtles that nest within the southeastern United States are increasing.

There are no reliable estimates of the number of immature green turtles that inhabit coastal areas (where they come to forage) off the southeastern United States. However, information on incidental captures of immature green turtles at the St. Lucie Power Plant (average 215 green turtle captures per year since 1977) in St. Lucie County, Florida (on the Atlantic coast) indicates that the annual number of immature green turtles captured has increase significantly in the past 26 years (FPL 2002). At the St. Lucie power plant, the annual number of immature green turtle captures has increased significantly in the past 26 years. It is not known whether or not this increase is indicative of local or Florida east coast populations.

It is likely that immature green turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán and Tortuguero. Trends at Florida beaches are presented above. Trends in nesting at Yucatán beaches cannot be assessed because of a lack of consistent beach surveys over time. Trends at Tortuguero (ca. 20,000-50,000 nests/year) show a significant increase in nesting during the period 1971-1996 (Bjorndal *et al.* 1999). Therefore, it seems reasonable that there is an increase in immature green turtles inhabiting coastal areas of the southeastern United States; however, the magnitude of this increase is unknown.

The principal cause of past declines and extirpations of green turtle assemblages has been the over-exploitation of green turtles for food and other products. Although intentional take of green turtles and their eggs is not extensive within the southeastern United States, green turtles that nest and forage in the region may spend large portions of their life history outside the region and outside United States jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities and fishing gear. There is also the increasing threat from occurrences of green turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson *et al.* 1991).

<u>Kemp's Ridley Sea Turtle</u>
The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977; Groombridge 1982; TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico, Tamaulipas State. The species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the United States.

Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Benthic immature Kemp's ridleys have been found along the east coast of the United States and in the Gulf of Mexico. In the Atlantic, benthic immature turtles travel northward as the water warms to feed in the productive, coastal offshore waters (Georgia through New England), migrating southward with the onset of winter (Lutcavage and Musick 1985; Henwood and Ogren 1987; Ogren 1989). In the Gulf, studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995). Little is known of the movements of the post-hatching stage (pelagic stage) within the Gulf. Studies have shown that the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). The TEWG (1998) estimates age at maturity from 7-15 years.

Stomach contents of Kemp's ridleys taken from the lower Texas coast consisted of mainly nearshore crabs and mollusks, as well as fish, shrimp and other foods considered to be shrimp fishery discards (Shaver 1991). Pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the Gulf of Mexico.

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, recent observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the Kemp's ridley population has stopped and the population is now increasing (USFWS 2000).

A period of steady increase in benthic immature Kemp's ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature turtles beginning in 1990. The increased survivorship of immature turtles is due in part to the introduction of turtle excluder devices (TEDs) in the United States and Mexican shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult Kemp's ridley numbers have grown. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the intermediate recovery goal identified in the Recovery Plan, of 10,000 nesters by the year 2015.

The largest contributor to the decline of the Kemp's ridley in the past was commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico shrimp trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to rebound. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development and tourism pressures.

<u>Leatherback Sea Turtle</u>
The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific and Indian oceans; the Caribbean Sea; and the Gulf of Mexico (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species; their large size and tolerance of relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NOAA Fisheries and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations between 90°N and 20°S, to and from the tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 (adult females) globally (Pritchard 1982). By 1995, this global population of adult females had declined to 34,500 (Spotila *et al.* 1996).

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada and Norway and as far south as Uruguay, Argentina and South Africa (NOAA Fisheries SEFSC 2001). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NOAA Fisheries SEFSC 2001). Genetic analyses of leatherbacks to date indicate that within the Atlantic basin there are genetically different nesting populations; the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica and Suriname/French Guiana) and the Trinidad nesting population (Dutton *et al.* 1999). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 3281 feet (1,000 m) (Eckert *et al.* 1989).

Leatherbacks are a long-lived species, living for over 30 years. They reach sexually maturity somewhat faster than other sea turtles, with an estimated range from 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). They nest frequently (up to 7 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30%) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs will incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <57 in (<145 cm) curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 78.8° F (26° C) until they exceed 40 in (100 cm) ccl.

Leatherbacks are the most pelagic of the sea turtles, but enter coastal waters on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate and tropical waters (NOAA Fisheries and USFWS 1992). A 1979 aerial survey of the outer Continental Shelf from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in water depths ranging from 3.28-13,620 feet (1-4,151 m) but 84.4% of sightings were in waters less than 180 m (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as compared to loggerheads; from 44.6-80.9° F (7-27.2° C) (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters since more leatherbacks were found at the lower temperature range as compared to loggerheads (Shoop and Kenney 1992). This aerial survey estimated the leatherback population for the northeastern U.S. at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina).

The status of the Atlantic leatherback population is less clear than for the Pacific population. In 1996, the entire western Atlantic population was reported to be stable at best (Spotila *et al.* 1996), with numbers of nesting females reported to be on the order of 18,800, but subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the western Atlantic nesting population had decreased to about 15,000 nesting females. According to NOAA Fisheries SEFSC (2001) the nesting aggregation in French Guiana has been declining at about 15% per year since 1987. However, from 1979-1986, the number of nests was reported as increasing at about 15% annually which could mean that the current 15% decline could be part of a nesting cycle which coincides with the erosion cycle of Guiana beaches described by Schultz (1975). In recent years, the number of leatherback nests in Suriname have shown a large increase (more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001) with the long-term trend for the Suriname and French Guiana population showing an apparent increase overall (Girondot *et al.*2002). The number of nests in Florida and the U.S. Caribbean has been increasing at about 10.3% and 7.5 %, respectively, per year since the early 1980s but the magnitude of nesting is much smaller than that along the French Guiana coast (NOAA Fisheries SEFSC 2001). The conflicting information regarding the status of Atlantic leatherbacks makes it difficult to conclude whether or not the population is currently in decline. Numbers at some nesting sites are up, while at others they are down. Tag return data emphasize the global nature of the leatherback and the link between these South American nesters and animals found in U.S. waters. For example, a nesting female tagged May 29, 1990, in French Guiana was later recovered and released alive from the York River, VA. Another nester tagged in French Guiana on June 21, 1990, was later found dead in Palm Beach, Florida (STSSN database).

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic are the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat and boat strikes.

Of the Atlantic turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers and lack of a hard shell) and their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface and perhaps to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not ingest longline bait. Instead, leatherbacks are foul hooked by longline gear (e.g., on the flipper or shoulder area) rather than mouth or throat hooked. According to observer records, an estimated 6,363 leatherback sea turtles were caught by the U.S. Atlantic tuna and swordfish longline fisheries between 1992-1999, of which 88 were released dead (NOAA Fisheries SEFSC 2001). Since the U.S. fleet accounts for only 5-8% of the hooks fished in the Atlantic Ocean, adding up the under-represented observed takes of the other 23 countries actively fishing in the area would likely result in annual take estimates of thousands of leatherbacks over different life stages. Lewison *et al.* (2004) estimated that, basin-wide, 30,000-60,000 leatherback sea turtles were caught in Atlantic pelagic longline fisheries in the year 2000 alone.

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer *et al.* 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer *et al.* 2002). Fixed gear fisheries in the Mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound off of Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries as documented on stranding forms. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 were due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill). Since many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the southeast shrimp fishery, which operates predominately from North Carolina through southeast Florida (NOAA Fisheries 2002), have also been a common occurrence. Leatherbacks are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast (from Cape Canaveral, Florida to the Virginia/North Carolina border) as they make their annual spring migration north. For many years the TEDs required in the southeast shrimp fishery were less effective for leatherbacks as compared to the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, NOAA Fisheries issued a final rule to amend the TED regulations. Modifications to the design of TEDs are now required in order to exclude leatherbacks and large and sexually mature loggerhead and green turtles. Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Center Observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off of Delaware. TEDs are not required in the squid fishery.

Gillnet fisheries operating in the nearshore waters of the Mid-Atlantic states are also suspected of capturing, injuring and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54% to 92%.

Poaching is not known to be a problem for nesting populations in the continental U.S. However, the NOAA Fisheries SEFSC (2001) notes that poaching of juveniles and adults is still occurring in the U.S. Virgin Islands. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching targets eggs.

Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage *et al.* 1997; Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44% of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13%) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object may resemble a food item by its shape, color, size or even movement as it drifts about and induces a feeding response in leatherbacks.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland /Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France and Ireland that participate in Atlantic pelagic longline fisheries (see NOAA Fisheries SEFSC 2001, for a complete description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo *et al.* 1994; Graff 1995). Gillnets are one of the suspected causes for the decline in the leatherback sea turtle population in French Guiana (Chevalier *et al.* 1999) and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lagueux *et al.* 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio 2000). An estimated 1,000 mature female leatherback sea turtles are caught annually in fishing nets off of Trinidad and Tobago with mortality estimated to be between 50-95% (Eckert and Lien 1999). However, many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NOAA Fisheries SEFSC 2001).

Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered on June 2, 1970. The hawksbill is a medium-sized sea turtle with adults in the Caribbean ranging in size from approximately 25-37 in (62.5 to 94 cm) straight carapace length. The species occurs in all ocean basins although it is relatively rare in the Eastern Atlantic and Eastern Pacific and absent from the Mediterranean Sea. Hawksbills are the most tropical of the marine turtles, ranging from approximately 30° N to 30° S. They are closely associated with coral reefs and other hard-bottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NOAA Fisheries and USFWS 1993).

There are five regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia and two in Australia (Meylan and Donnelly 1999). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor (Meylan 1999b). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999; Richardson *et al.* 1999). The average clutch size of hawksbill sea turtles is higher (up to 250 eggs) than other turtle species (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

The life history of hawksbill turtles consists of a pelagic stage lasting from hatchlings until they are approximately 9-10 in (22-25 cm) in straight carapace length (Meylan 1988; Meylan and Donnelly 1999), followed by residency in developmental habitats (foraging areas where immature turtles reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbill turtles show fidelity to their foraging areas over periods of time as great as several years (van Dam and Diez 1998).

Their diet is highly specialized and consists primarily of sponges (Meylan 1988) although other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (van Dam and Diez 1997; Mayor *et al.* 1998; Leon and Diez 2000).

There has been a global population decline of over 80% during the last three generations (105 years) (Meylan and Donnelly 1999).

In the Western Atlantic, the largest hawksbill nesting population occurs in the Yucatán Península of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán and Quintana Roo (Garduño-Andrade *et al.* 1999). Important but significantly smaller nesting aggregations are documented elsewhere in the region in Puerto Rico, the U.S. Virgin Islands, Antigua, Barbados, Costa Rica, Cuba and Jamaica (Meylan 1999a). Estimates of the annual number of nests for each of these areas are on the order of hundreds to a few thousand. Nesting within the southeastern U.S. and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr) and, rarely, Florida (0-4 nests/yr)(Eckert 1995; Meylan 1999a; Florida Statewide Nesting Beach Survey database 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999a).

Fish

Smalltooth sawfish

The smalltooth sawfish, *Pristis pectinata*, was listed as endangered, April 2003 (68 FR 15674). Its historic range in the western Atlantic extended from New Jersey to Brazil, including the Gulf of Mexico and Caribbean islands. Available information indicates that some large [>13 ft (>4 m)], mature smalltooth sawfish historically migrated northward along the Atlantic coast in late spring, occupying the coastal waters of Georgia, South Carolina, North Carolina and Virginia (Adams and Wilson 1995) and, occasionally, reaching as far north as New Jersey (Bigelow and Schroeder 1953). NOAA Fisheries has only one smalltooth sawfish record in the Atlantic north of Florida since 1963. A smalltooth sawfish was caught (on a shark bottom longline) off the northern coast of Georgia in 2002. If conservation efforts are successful and the population rebuilds, it is possible that northern migrations may become important for mature animals.

In 1999, Mote Marine Laboratory (MML) began a research project assessing the distribution, abundance, movement, habitat use and population biology of the smalltooth sawfish. MML data indicate that smalltooth sawfish occur over a range of temperatures but appear to prefer water temperatures greater than 64.4 °F (18 °C). Data suggest that sawfish may utilize warm water sources such as thermal outflows from power stations as thermal refuges during colder months to enhance their survival or may become trapped by surrounding cold water from which they would normally migrate. Significant use of these areas by sawfish may disrupt their normal migratory patterns.

Data from the MML research project show that the majority of smalltooth sawfish are observed in waters less than 23 ft (7 m) deep and that almost half of the fish are observed in waters less than 3.28 ft (1 m) deep (Simpfendorfer 2001). This is consistent with literature for North American waters indicating that smalltooth sawfish occur in waters less than 32.8 ft (10 m) deep (e.g. Boschung 1979; Adams and Wilson 1995). However, the MML data also show that smalltooth sawfish occur in deeper water with records of fish being captured in over 230 ft (70 m) of water depth. An examination of the relationship between the depth at which sawfish occur and their estimated size indicates that larger animals are more likely to be found in deeper waters. Since large animals are also observed in very shallow waters, it is believed that smaller (younger) animals are restricted to shallow waters, while large animals roam over a much larger depth range (Simpfendorfer 2001).

The feeding habitats of smalltooth sawfish have been poorly studied. Norman and Fraser (1937) suggested that the saw was mostly used to slash through schooling fish. However, Breder (1952) demonstrated that sawfish are capable of using their saw to strike at individual fish. They also appear to use the bottom for pushing fish off their saw after impaling them (Breder 1952). Mullet are considered to be the most common prey of sawfish in southwestern Florida, as well as jacks and ladyfish. In addition to fish, small smalltooth sawfish also consume crustaceans (mostly shrimp and crabs) that they locate by digging up the bottom with their saw (Simpfendorfer 2001).

Information on the habitat needs for this species is almost non-existent in the literature. Areas that MML has identified as important for smalltooth sawfish include:

St. Johns River
This area was described as an important nursery area for sawfish around the turn of the century, with small animals occurring in lower salinity areas on the river around Jacksonville. This area has been identified because of its historic importance.

Indian River
This area was historically important to smalltooth sawfish with a large resident population present in the late 1800s. Although Snelson and Williams (1981) suggested that sawfish were extirpated from this area, there continue to be occasional reports from this area. This area was identified because this area may again become important if the sawfish population recovers.

Everglades, Florida Bay, Biscayne Bay and Florida Keys
This area represents the center of abundance for smalltooth sawfish in U.S. waters and contains vast areas of suitable habitat, including shallow waters, mangroves, river mouths, low salinity areas and channels through shallow banks and abundant prey. This area is essential to the long-term survival of sawfish. The presence of the Everglades National Park, the Biscayne Bay National Park and the Florida Keys National Marine Sanctuary provides a good framework for the protection of sawfish.

Bycatch in fisheries has played a principal role in the decline of smalltooth sawfish. Historical records indicate that smalltooth sawfish were often caught as bycatch in various fishing gears, including gillnet, otter trawl, trammel net, seine and, to a lesser degree, hand line (NOAA Fisheries 2000). Sawfish are extremely vulnerable to incidental capture in gillnets (Cook and Compagno 1994; Compagno and Cook 1995). Their long, toothed rostrum make it difficult to avoid entanglement in virtually all kinds of large mesh gillnet gear. The saw easily pierces though net causing the animal to become entangled. Shrimp trawling is another source of incidental mortality for smalltooth sawfish. An entangled fish being cut free often causes extensive damage to nets and presents a substantial hazard if brought on board. For these reasons, most smalltooth sawfish caught by fishermen, historically, were either killed outright or released only after removal of their saw (Adams and Wilson, 1995).

Once abundant on the east coast of the United States, a thorough review of available data, indicate that smalltooth sawfish have declined dramatically in U.S. waters over the last century (NOAA Fisheries 2000). Though it is unclear as to the number of smalltooth sawfish remaining in U. S. waters today, it is thought that the population has declined by at least as much as 95% since 1900 (MML 2004). The decline in abundance has been attributed primarily to bycatch in various fisheries and to habitat destruction. These together with the smalltooth's slow growth, late maturation and low fecundity, makes the recovery potential for this species slow.

Smalltooth sawfish distribution and shrimping effort

Although smalltooth sawfish are vulnerable to shrimp trawls, there are presently no confirmed reports of smalltooth sawfish being taken by the South Atlantic shrimp fishery. The South Atlantic shrimp fishery operate mainly in waters north of Florida, where smalltooth sawfish are much less likely to be present. Data from the Sawfish Reporting Database indicate that the current distribution of smalltooth sawfish extends from the central Florida Panhandle to northern Georgia. However, they are most frequently reported in state waters between Naples and Florida Bay, with their abundance reducing the further you move away from that area (Simpfedorfer 2003). Within the SAFMC's jurisdiction, there are far fewer smalltooth sawfish reported. These individuals are mostly larger animals occurring along the beaches and at offshore reefs. Observations are based on sightings densities that have not been corrected for sightings effort and so may be biased by the amount of fishing effort (i.e., more fishing effort in the Gulf of Mexico state waters than off the Atlantic coast).

To investigate the potential impact of the South Atlantic shrimp fishery operating in Florida, shrimp trip effort within the EEZ for Florida was examined by month for the years 2001 through 2002 (Table 3.1-9). Trips identified as using trawl gear were included in the analysis, thus various types of trawl gear may be included. Because smalltooth sawfish are a demersal species, some of those gear types (i.e., skimmer trawls) may be less likely to catch smalltooth sawfish than other gear types. In general, the area fished that was reported is the area where the trip was mostly executed. Approximately 20-30% of the Florida trips were recorded as occurring within the EEZ. Only trips occurring within the Council's area of jurisdiction were included in the analysis.

Table 3.1-9. Florida trips conducted by month within the waters of the South Atlantic EEZ for the years 2000-2002.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total trips
2001	328	206	178	180	225	292	228	248	258	268	261	261	2933
2002	262	188	161	205	198	185	130	152	137	176	174	222	2190

Between 22% and 28% of the trip effort was reported as conducted in the South Atlantic off the Tortugas. Fishing trips in the South Atlantic off Key West represented 6% to9% of the effort. Slow moving, bottom-dwellers, smalltooth sawfish are vulnerable to incidental capture in these areas. As they swim or forage on or near the bottom, shrimp trawls pulled across the bottom at 1.5-3 knots can sweep over them.

3.1.13.2 Species of concern

NOAA Fisheries has recently revised the Candidate Species list and, in conjunction, has created a list entitled Species of Concern as a publicly available list identifying other species of concern. Regulations implementing Section 4 of the ESA (5 U.S.C. 1533) define "candidate" as "any species being considered by the Secretary (of Commerce or Interior) for listing as an endangered or threatened species but not yet subject to a proposed rule" (50 CFR 424.02). In the past, NOAA Fisheries has also placed species on the candidate species list for other reasons including to: 1) identify species potentially at risk; 2) increase public awareness about those species; 3) identify data deficiencies and uncertainties in species' status and threats; 4) stimulate cooperative research efforts to obtain the necessary information to evaluate species status and threats; and 5) foster voluntary efforts to provide stewardship for the species before an ESA listing becomes warranted. In addition, NOAA Fisheries identified species as candidates as those for which an ESA biological status review determined that listing under the ESA was "not warranted" under Section 4(b)(3)(B)(I) but for which significant concerns or uncertainties regarding their biological status and/or threats remained. As a result of these broader purposes being used for identifying species as candidates, the majority of NOAA Fisheries candidate species were not actively being considered for listing but rather were identified as candidates because of concerns or great uncertainties about their biological status and threats. To restore the candidate species list to its original meaning, NOAA Fisheries has established a Species of Concern list so as to maintain a publicly available list identifying species that, although not being considered for listing, are of concern. This has resulted in 25 species being transferred from the candidate species list to the Species of Concern list. Included in these transferred species are the species listed below, previously identified as marine candidate species found in the Southeastern United States.

There is no mandatory federal protection for a species of concern under the ESA though voluntary protection of these species is urged. An assessment of potential impacts to species of concern found in the action area; however, such analyses may stimulate voluntary conservation efforts. If such efforts are effective, they may alleviate or eliminate existing threats thus possibly avoiding any future need for listing.

List of Marine Species of Concern in the Southeastern U. S.

Dusky shark	*Carcharhinus obscurus*
Sand Tiger Shark	*Odontaspis taurus*
Night Tiger	*Carcharhinus signatus*
Atlantic sturgeon	*Acipenser oxyrhynchus oxyrhynchus*
Mangrove rivulus	*Rivulus mamoratus*
Opposum pipefish	*Microphis barchyurus lineatus*
Key silverside	*Menidia conchorum*
Goliath grouper	*Epinephelus itajara*
Speckled hind	*Epinephelus drummondhayi*

Warsaw grouper	*Epinephelus nigritus*
Nassau grouper	*Epinephelus striatus*
Atlantic White Marlin	*Tetrapturus albidus*

Review of Marine Species of Concern

To date, there are no reports of these marine species of concern having been incidentally captured in the shrimp fishery operated in the SE U.S. Federal waters.

3.2 The human environment

Information in this section is provided in three main categories. First, there is a summary of the permitting and licensing requirements for the shrimp fishery in each of the South Atlantic states. This is followed by a description of the gear types and methods of fishing employed in each sector of the shrimp fishery. The final subsections on the human environment contain accounts of the economic conditions, social characteristics and community profiles of the shrimp fishery in the South Atlantic.

3.2.1 State permit and license requirements for the commercial shrimp harvesting sector

The following is a summary of the state permits and licensing requirements for the food shrimp fishery in the South Atlantic. For more details on these requirements refer to Appendix J.

Florida

To commercially harvest or sell any marine fish or other saltwater products in Florida, an individual must obtain a saltwater products license (SPL). Furthermore, the harvester can sell to a licensed wholesale dealer or sell directly with a retail license. The license may be issued to an individual applicant or a valid vessel registration number. Shrimp is also considered a restricted species in Florida and to qualify for and retain a restricted species endorsement (RS) an applicant must provide acceptable proof that a specified amount or percentage of his/her total annual income (usually $5000 or 25%) during one of the past three years is attributable to the sale of saltwater products to a wholesale dealer. In addition to the SPL and RS, other licenses or permits are required to fish in specific areas:

1. A DS License (St. Johns River Food (Dead) Shrimp Production License) is required for food shrimp production within the inland waters of Nassau, Duval, St. Johns, Putnam, Flagler or Clay Counties (St. Johns River).
2. A live bait shrimp production license is required for live bait shrimp harvest within the inland waters of Nassau, Duval, St. Johns, Putnam, Flagler or Clay Counties (St. Johns River).
3. A Tampa Bay (TB) Permit is required to operate in any waters of Tampa Bay.

North Carolina

The standard commercial fishing license is an annual license for commercial fishermen who harvest and sell fish, shrimp, crab or any marine species in North Carolina. License holders 65 years or older can obtain a retired standard commercial fishing license that allows the same harvest and sell authorities as does the standard license but has a lower fee. If a vessel is used in a commercial fishing operation, that vessel must have a commercial fishing vessel registration. By law, fishermen must sell their catch to licensed fish dealers. Every catch is recorded on a trip ticket and submitted to the North Carolina Division of Marine Fisheries. The standard commercial fishing and retired standard commercial fishing licenses are only available to persons who held the standard (or retired standard) commercial fishing license the previous license year. New entrants can apply for these licenses from a pool if they meet specific eligibility criteria. Additionally, fishermen on vessels homeported in a state other than North Carolina, and who fish in the EEZ, can obtain the Land or Sell license. They can only sell catch obtained in the EEZ to licensed fish dealers and must obtain the license before unloading.

Georgia

All individuals who harvest shrimp from state waters for the purpose of sale must possess a personal commercial fishing license. A trawler boat license is required for those vessels engaged in the use of trawls for harvesting shrimp. Those individuals who harvest shrimp for bait and who are also dealers must possess a commercial bait shrimp dealer’s license. A vessel licensed for use in harvesting bait shrimp cannot be used to catch shrimp for human consumption. Commercial castnetting is a controlled access fishery, with a maximum of 200 licenses issued per year. In lieu of the personal commercial fishing license, a commercial cast net license is required. Licenses not renewed are made available via a lottery. A non-trawler boat license is required for vessels used to harvest food shrimp with gear such as cast nets and seines.

South Carolina

In South Carolina two gear types are licensed for harvest of the major portion of commercial production of shrimp - otter trawls and channel nets. Cast nets infrequently are licensed for commercial shrimp harvest. Shrimp pots and traps and the use of bait with cast nets is prohibited.

Otter trawls are used primarily in nearshore ocean waters. The owner and operator of a vessel employed in the shrimp trawl fishery are responsible for obtaining a license for use of a trawl or trawls by the vessel. A commercial fisherman acting as Master or Captain on a shrimp trawler must hold a commercial saltwater fishing license. There are fee differentials for non-resident vessel trawl and individual fishermen licenses. Crew members, termed strikers, are not required to be licensed.

Channel net licenses are limited in number and may be issued to residents only. The owner and operator of a vessel employing a channel net are responsible for obtaining a license for use of a channel net by the vessel. A commercial fisherman using a channel net must hold a commercial saltwater fishing license. Strikers are not required to be licensed.

A person holding a shrimp baiting license, which is a recreational-only license, must not be a wholesale dealer, an owner or master of a trawler, a person holding a channel net license or a person licensed to use a cast net for commercial purposes.

3.2.2 Description of fishing practices, vessels and gear

For purposes of this discussion the shrimp fishery in the South Atlantic has been divided into the following categories:

1. The commercial food shrimp fishery that primarily targets rock shrimp and penaeid shrimp.
2. The commercial bait shrimp fishery where shrimp are caught using different gear types for use as bait in other fisheries.
3. The recreational shrimp fishery.

3.2.2.1 The commercial food shrimp fishery

The Penaeid Shrimp Fishery

The commercial fishing area for penaeid shrimp (white, brown and pink) species in the South Atlantic is mainly concentrated from Fort Pierce, Florida to Pamlico Sound and Ocracoke Inlet, North Carolina. There is another fishery off the Florida Keys where the main target is pink shrimp. In North Carolina, the important shrimping areas are Pamlico Sound, Core Sound, major rivers and off the southern coast, south of Ocracoke Inlet. The most important fishing area in Florida is the northeastern part of the state, between Fernandina Beach and Melbourne, just south of Cape Canaveral. In Georgia, shrimping takes place along the entire coast. In South Carolina, the most important shrimping areas are from Georgetown (Winyah Bay) south. Commercial shrimp catches in all four states are taken from internal waters, state waters out to three miles and from the EEZ. Most of the shrimp in these states are caught by otter trawls (SAFMC 1996b).

In North Carolina, the brown shrimp fishery is the most important fishery followed by the white shrimp fishery in the fall and the pink shrimp fishery in the spring. Vessels operate night and day in Pamlico Sound, Neuse River, Bay River, Core Sound, Newport River, North River, White Oak River, New River and the Intercoastal Waterway in the southern portion of the state as well as the ocean off the central and southern coasts. Daytime shrimping in North Carolina takes place along the southern coast and in the New River during the fall. The summer to winter white shrimp fishery is the most important shrimp fishery for South Carolina vessels. The fishery also occurs in federal waters as 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. The Florida shrimp fishery, occurring mainly along the northeast Atlantic coast, is characterized by brown shrimp dominating the summer fishery and white shrimp dominating the fall and winter fisheries. Pink shrimp are harvested in Biscayne Bay generally during the period November through May.

In Georgia, shrimp are harvested in estuarine and nearshore waters of each coastal county. Georgia law allows for state waters to be opened for the harvest of food shrimp from May 15 until December 31. At the discretion of the Commissioner of the Department of Natural Resources, the season can be extended through the last day in February. All decisions regarding the opening and closing of the state’s waters to the harvest of food shrimp are based on current, sound principles of wildlife research and management. On average, Georgia waters are open from Mid-June through January. In Georgia, white shrimp comprise the largest annual portion of the commercial catch, yielding approximately 80% of all harvested shrimp and is the most economically valuable. This species is primarily harvested in state waters during the late summer, fall, winter and spring months, though it may be caught year round in federal waters adjacent to Georgia. The brown shrimp comprises approximately 18% of the total annual catch. During the summer months, when it is most prevalent in state waters, brown shrimp may comprise upwards of 70% of the total harvested shrimp. Pink shrimp makes up less than 2% of the total and is rarely if ever targeted.

South Carolina's major food shrimp trawling area is continuous in the Atlantic Ocean from the entrance of Winyah Bay near Georgetown southwestward to the South Carolina - Georgia state line near Savannah, Georgia, including the mouths of two sounds. Effort occurs to a lesser extent in state waters northwest of the Winyah Bay entrance to the South Carolina-North Carolina state line at Little River. Trawling often occurs in the Exclusive Economic Zone (EEZ) off South Carolina prior to the opening of the territorial sea and during the open state trawling season. The season runs from mid-May through December, generally. The channel net fishery is prosecuted in inshore waters of North Santee Bay near Cape Romain and in Winyah Bay near Georgetown from mid-September through November, generally.

The shrimp trawler is used in the commercial shrimp fishery prosecuted in the South Atlantic. There is a range of vessel lengths in this fishery (Section 3.2.3.3.1). The otter trawl is the most common gear used to harvest these shrimp species and 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 to be more effective at capturing brown and pink 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 the more active white shrimp (SAFMC 1996b).

Most trawl vessels are rigged for towing two to four nets simultaneously. In Florida, this is only the case for vessels operating in offshore waters. In inland and nearshore waters, Florida trawlers are restricted to no more than two nets each having a maximum surface area not to exceed 500 square feet. 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. 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. This rig has some advantages in ease of handling and increased efficiency. The quad trawl net configuration allows faster towing speed and wider net spread compared to double-rigged trawls. In South Carolina, it is unlawful to have onboard a vessel or to trawl with any trawl or trawls having a total foot rope length of two hundred and twenty feet or greater, not including try nets or nets bundled below deck.

The length of tows varies depending on many factors including amount of bycatch species and concentration of shrimp. Small boats fishing in inshore waters make much shorter drags than the larger, offshore vessels whose tows generally last several hours (SAFMC 1993). Trawlers operating in Georgia waters are restricted to a combined maximum length of 220 feet of foot rope, defined as the measure from brail line to brail line, first tie to last tie on the bottom line, but not to include a try net up to 16 feet in length.

In Biscayne Bay, Florida, food production shrimp are harvested with wing nets. A wing net is a net in the form of an elongated bag kept open by a rigid frame that is attached to either side of a vessel and is not towed behind a vessel or dragged along the bottom. Vessels are equipped with two such nets each with a perimeter no greater than 28 feet and a surface area not exceeding 500 square feet. This is a top water fishery and shrimp are harvested as they leave the bay. Roller frame trawls are also allowed; however, these are not used in the food shrimp fishery on the Atlantic coast.

Trawling accounts for more than 95% of the food shrimp landed in Georgia. Georgia's fleet is comprised of large trawl vessels, with 66% in excess of 40 feet in length. Hand-retrieved trawls, those with no mechanical retrieval capabilities and typically less than 25 feet in length, account for approximately 28% of all vessels harvesting food shrimp. Their minimal size restricts their effective fishing range to shallow, near-shore areas close to the shoreline. In 1977, Georgia's sounds were closed to shrimp trawling. Since that time, the sounds have been opened only five times. Each opening lasted less than seven days. Most hand-retrieved trawl fishery participants do so for personal consumption or for supplemental income. Cast netting is Georgia's second most popular means of commercially harvesting food shrimp. Like the hand-retrieval fishery, most individuals who are commercially licensed utilize this fishery recreationally or as a form of supplemental income. Operating under the same season as that of the trawl fisheries, but without area restrictions, participants typically target shrimp in waters within the estuary proper, frequently fishing near or adjacent to sounds and tidal river mouths. During the initial years of its existence, the commercial cast net fishery in Georgia operated under minimal restrictions; however, regulatory changes in 1998 created gear restrictions and catch limits. Currently, the commercial catch limit for the cast net fishery is 60 quarts of heads-on shrimp (38 quarts of shrimp tails) per day per boat.

Cast nets must be constructed of uniform mesh and material from the thimble or horn, to the lead line, with a minimum of ¾ pound of lead per radius. Tape or other modification is not allowed. Commercial nets must have a minimum mesh size of 5/8 inch and cannot exceed a radius of 12 feet.

In some areas, primarily North and South Carolina, channel nets are also used for commercial shrimping. Channel nets are essentially anchored shrimp trawls that fish almost the entire water column as they are held open by currents. In South Carolina channel nets are required to have top-opening turtle excluder devices.

In North Carolina, skimmer trawls are used in shallow tributaries. This gear is attached to frames that can be raised and lowered into the water on either side of the vessel. The tailbag can be retrieved and dumped without stopping and "hauling back." Butterfly nets, rectangular nets held open by a frame and attached to the side of the vessel, are used in a few areas. Haul or beach seines are also used to a minor extent for commercial fishing in some areas.

The use of non-trawl gear, especially in North Carolina inshore waters is on the increase. Landings from these methods of fishing (e.g., beam trawls and chopstick gear) has increased from 137,000 lb in 1993 to 827,000 lb in 2002.

In Georgia, seines 12 feet or less, with a maximum depth of 4 feet and maximum stretched mesh of 1 inch may be used any time in state waters. Seines less than 100 feet in length, with minimum stretched mesh size of 1 ¼ in, may be used on any sand beach or on any barrier island in Georgia but are prohibited in inlets or tidal sloughs. Seines 100-300 feet in length are allowed only on the oceanfront sides of beaches and must have a minimum stretched mesh of 2 ½ in.

The Rock Shrimp Fishery

Rock shrimp found a niche in the local fresh market and restaurant trade during the early 1970's and became a regional delicacy. During those early years rock shrimping was primarily a local fishery. Most vessels were homeported on the east coast of Florida, Georgia, North Carolina and South Carolina. When the rock shrimp industry began few vessels participated on a full-time basis, while most vessels made a few trips per year when the white and brown shrimp seasons ended (Dennis 1992). During the period 1986 to 1994 there was a substantial increase in effort and number of vessels participating in this fishery (SAFMC 1996a). During development of Shrimp Amendment 1 sources indicated that this increase was due in large part to vessels from the Gulf of Mexico region entering the fishery.

Historically, the rock shrimp fishery was prosecuted along Florida's east coast from Cape Canaveral to Jacksonville. The increase in participants and market opportunities for smaller rock shrimp brought about a subsequent change in harvesting patterns as the fishing grounds extended south as far as St. Lucie County (SAFMC 1996a). Limited sporadic harvest has also occurred off Georgia, North Carolina and South Carolina. A limited access program was established in 2003 for vessels harvesting, in possession of and landing rock shrimp in Georgia and Florida.

There are two types of vessels in the rock shrimp fishery: ice or fresh boats and freezer boats. Most newer rock shrimp trawlers are 75-80 feet in length and are rigged to tow two to four nets simultaneously. Testimony at public hearings for Shrimp Amendment 1 indicated that a standard freezer trawler was around 73 feet and would pull four forty-foot nets. 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 seventy-foot nets the vessel tows four forty-foot nets. This rig has some advantages in ease of handling and increased efficiency.

The only gear used in the rock shrimp fishery is the trawl, which was described in detail in the previous section on the penaeid shrimp fishery. A flat net is more often used when fishing for rock shrimp since they burrow into the bottom to escape the trawl. This net has a wider horizontal spread than other designs and is believed to be more effective at catching rock shrimp (SAFMC 1996a).

Tow length in this fishery varies depending on many factors including the concentration of shrimp. Based on information collected from the six vessels participating in a recent rock shrimp observer pilot study, tow depth averaged 33.2 fathoms and ranged from 8.3 to 73.2 fathoms. Tow time ranged from 1.2 to 7.0 hours, with average tow time being 4.4 hours (Appendix C).

3.2.2.2 The commercial bait shrimp fishery

The commercial bait shrimp fishery in Florida is much larger than operations in the other South Atlantic states. Live shrimp for bait are caught in Dade County and in six counties around the St. Johns River. A variety of gear is used in this fishery, but otter trawls (St. Johns) and roller frame trawls (Biscayne Bay) are the most commonly used. Wing nets are used in Volusia County for live bait shrimp harvest.

There is very little effort directed specifically for commercial bait shrimp in either North or South Carolina. In Georgia, however, the commercial bait shrimp fishery is the state’s fourth most valuable commercial fishery. Targeting smaller shrimp than the food shrimp industry, the commercial bait shrimp fishery is restricted to designated zones inside the estuary. Prior to 1978, bait shrimp fishermen had no restrictions on area; however, as a result of consecutive freezes in the winters of 1977 and 1978, and the subsequent depletion of overwintering stocks of white shrimp, experimental “bait zones” were developed in an effort to protect nursery grounds and facilitate law enforcement (Music, Georgia DNR, pers. comm. 2003). As a result, both recreational and commercial bait fishermen are restricted to fishing in these designated zones, which are located throughout coastal Georgia in tidal creeks and rivers. Commercial bait harvesters may possess up to 50 quarts of shrimp, no more than ten percent of which can be dead.

Vessels participating in the commercial bait shrimp fishery in Georgia are generally 25 feet in length or less, are equipped with large live wells and are powered by outboard motors. Typically, these vessels employ either a mongoose or flat/box net, with the headrope not to exceed 20 feet in length.

3.2.2.3 The recreational fishery

Recreational shrimp harvest in the South Atlantic occurs almost exclusively in state waters and is comprised mostly of penaeid shrimp (white, brown and pink) species. A variety of gear types are employed for recreational food shrimp activities and recreational shrimping for bait. Given the distance from shore, depth of water and gear necessary to harvest rock shrimp, there is no recreational rock shrimp fishery.

The major areas for recreational shrimping in North Carolina are from Carteret County south to the state line and to a lesser extent in the tributaries of Pamlico Sound. In South Carolina, recreational shrimping takes place along the entire coast, with most activity from Winyah Bay southward to the South Carolina-Georgia state line. Georgia’s sport bait trawling zones occur throughout the coastal area. Recreational beach seining is concentrated on Tybee, Sapelo, St. Simons, Jekyll and Cumberland Islands. In Florida, major sport shrimping areas are the St. Johns River area, the area around Ponce De Leon Inlet and in the southern part of the state in Biscayne Bay (SAFMC 1993).

Licensing requirements are not consistent across all states and not all recreational shrimp fishermen are required to obtain a state permit or license to fish for penaeid shrimp species. In North Carolina, a person must obtain a Recreational Commercial Gear License (RCGL) to shrimp trawl for recreational purposes (i.e., not sell). The license holder can only trawl in open areas and must use a shrimp trawl with a maximum headrope length of 26 ft. The shrimp trawl must be equipped with a bycatch reduction device (BRD) and the use of mechanical methods for retrieval is prohibited. According to the RCGL data, recreational shrimping (trawling) takes place from the Pamlico District south. Areas of high activity are the tributaries of Pamlico Sound, most notably the Neuse River, Pamlico River and their tributaries. Recreational fishermen in North Carolina do not require a license to use seines and cast nets. In Georgia, a Recreational Fishing License is required to engage in the not-for-sale harvest of shrimp with a cast net, seine and for the not-for-sale harvest of bait shrimp with a trawl.

In South Carolina, a license to cast net for shrimp over bait during a regulated recreational season has been required since 1988. The season is restricted to 60 days during the white shrimp season generally between mid-September to mid-November. A study conducted in South Carolina showed that shrimping over bait produces relatively little finfish bycatch compared to traditional cast netting for shrimp (Whitaker 1992). Shrimp seines may be used in South Carolina year-round. Also, if the catch is kept for personal (non-commercial) use, a shrimp cast net not thrown over bait (without shrimp bait) can be used from May 1 through December 15 in South Carolina

In Georgia, cast netting for shrimp is the most popular recreational shrimping activity. Currently, the recreational catch limit in Georgia is 48 quarts of heads-on shrimp (30 quarts of shrimp tails) per day per boat. Also, certain estuarine zones are open for recreational live bait shrimping with single 10 foot trawl nets. Persons engaged in recreational, or sport, bait shrimping are limited to two quarts of bait per person, with no more than ½ pint dead, or four quarts per boat, with no more than one pint dead. Recreationally caught bait shrimp cannot be sold or consumed. Harvesting is restricted to the period ½ hour before official sunrise until ½ hour after official sunset.

Gear used by the 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. Similarly, in North Carolina a wide variety of gear types are used in the recreational fishery.

3.2.3 Economic description of the shrimp fishery in the South Atlantic

3.2.3.1 General economic conditions in the South Atlantic commercial shrimp fishery

This section is divided into several topic areas. The first subsection presents an overall economic profile of the South Atlantic shrimp fishery that highlights major trends and discusses the economic structure of this industry. This is followed by a section on imported shrimp and its effect on ex-vessel prices for domestic shrimp. Next, there is a profile of the shrimp fishery for each state and a separate examination of the rock shrimp fishery. There is a separate subsection on vessel economics and heterogeneity as these analyses as required by the Regulatory Flexibility Act.

3.2.3.1.1 The South Atlantic shrimp fishery

The South Atlantic shrimp fishery generates the most revenue for the commercial harvesting sector in this region. During the last two years for which data are available, 2001 and 2002, shrimp harvested in the South Atlantic generated an average of $63.56 million annually (Table 3.2-1). In comparison, the overall revenue from landings of all seafood in the South Atlantic averaged $175 million during those years (NOAA Fisheries 2003b).

Historically, since 1950, shrimp landings in the South Atlantic states fluctuated considerably and reached a peak of around 39 million pounds in 1995. Overall landings in the South Atlantic did not show an increasing trend as observed in the Gulf of Mexico during this period. Historical price trend data indicates that the real average ex-vessel price for all shrimp species increased during the 1950s through to the late 1970s, fluctuated in the 1980s with no discernible trend and dropped substantially in the 1990s. Most of this decline was attributed to the increased market supply from imports (Vondruska 2001).

During 1997 through 2000 the ex-vessel value of shrimp landings averaged $93.57 million annually (Table 3.2-1). In comparison, average ex-vessel revenue in 2001 and 2002 decreased by 32%. Even though landings and effort during 2001and 2002 decreased, a large portion of this revenue loss can be attributed to the decline in ex-vessel prices. The average ex-vessel price for shrimp declined from a high of $2.71 per pound in 1997 to a low of $1.95 per pound in 2002. These figures represent average prices calculated for all shrimp species (heads on) and size categories. Thus, the magnitude of this price decline may not reflect trends for all species and size categories. However, these overall statistics highlight the current economic hardship faced by a majority of fishermen in the shrimp harvesting sector. Shrimp ex-vessel prices in the South Atlantic are determined by a number of factors. The most important factors include shrimp imports, regional and local shrimp landings, consumer preferences and the state of the U.S. economy (as reflected in personal income).

It must be noted that some fishermen have changed their mode of operation and marketing strategies in response to this economic downturn. Some of these fishermen have developed “niche” markets for their product and have not experienced these severe price declines. In addition, there are those who sell directly to retail outlets and processors thereby capturing profit margins that would have gone to dealers and wholesalers in the industry.

Some vessels in the South Atlantic shrimp fishery also operate in the Gulf of Mexico. Similarly, a number of vessels home ported in the Gulf of Mexico operate in the South Atlantic penaeid and rock shrimp fisheries. Data sets from the South Atlantic states and Gulf of Mexico shrimp database were utilized in deriving industry catch and participation statistics.

Table 3.2-1. Shrimp harvested in the South Atlantic: annual landings, ex-vessel revenue and effort.

Item	1997	1998	1999	2000	2001	2002
Landings (lb)	34,751,409	35,596,541	39,313,132	39,167,937	28,867,334	32,632,752
Ex-vessel revenue	$94,108,498	$84,888,798	$97,632,615	$97,648,407	$63,446,943	$63,681,721
Real ex-vessel revenue in $2002*	$105,502,800	$93,696,245	$105,434,789	$102,035,953	$64,478,601	$63,681,721
Price/lb	$2.71	$2.38	$2.48	$2.49	$2.20	$1.95
Real price/lb $2002*	$3.04	$2.63	$2.68	$2.61	$2.23	$1.95
Number of trips (excludes South Carolina)	46,988	41,372	44,347	40,396	31,556	37,596
Number of vessels				2,129	1,835	1,731
Proportion of harvest in the EEZ				19%	20%	21%
Number of dealers	610	545	596	589	544	669
Number of processors	19	21	17	15	16	14
Number of vessels operating exclusively in inshore areas				599	468	488

Landings information from the Gulf of Mexico and other (unknown) states are included in this table. Thus, statistics for the South Atlantic fishery presented in this table will be higher than the sum of respective values in the individual state tables.
Data on proportion of landings in the EEZ prior to 2000 were not presented because area fished was not reported for a large quantity of these landings.
* The CPI was used to adjust these values for inflation.

The number of vessels that participated in the South Atlantic shrimp fishery appears to have declined from 2,129 in 2000 to 1,731 in 2002 (Table 3.2-1). This trend may not be completely accurate since there was no vessel identification information associated with a large proportion of reported shrimp landings. It is expected that there would be some contraction in the shrimp harvesting sector due to the declining trend in dockside shrimp prices and continuously increasing prices for inputs such as fuel (Table 3.2-13), which would decrease aggregate profitability. Changes in vessel level profits would also depend on the number of vessels active in the fishery for a given year and other vessel specific costs detailed in Table 3.2-13.

Overall annual harvest in the South Atlantic is dominated by white and brown shrimp species. Annual landings of the three penaeid species vary considerably from year to year (Table 3.2-2a). These fluctuations have been attributed to environmental influences (Section 3.1.4). For example, white shrimp landings are much lower in years following severe winter weather (SAFMC 1993). This could explain the low level of white shrimp landings in 2001. Fluctuation in landings is also tied to the level of effort in the fishery, which in turn is influenced by expected market prices.

The trend in brown shrimp landings is somewhat misleading. It appears that landings suddenly increased by more than 5 million pounds in 1999. However, during the years prior to 1999 North Carolina classified a large portion of their brown and white shrimp harvest in the marine shrimp category. Beginning in 1999 the state took steps to separate these species out of the marine shrimp grouping (Table 3.2-2a).

Table 3.2-2a. Shrimp species harvested in the South Atlantic 1997-2002 (pounds).

Species	1997	1998	1999	2000	2001	2002
White shrimp	13,885,793	14,155,682	19,191,188	14,989,596	8,145,370	13,925,709
Brown shrimp	3,041,158	2,502,550	8,562,007	9,442,316	9,070,087	9,787,284
Marine shrimp*	6,988,243	4,635,189	1,411,088	469,137	255,580	545,562
Pink shrimp	5,990,537	9,262,157	4,699,501	4,371,593	4,389,640	6,326,684
Rock shrimp	3,530,305	3,960,560	4,265,196	8,180,124	6,095,654	834,962
Other species	416,012	238,054	225,400	167,127	199,411	209,661
Royal red shrimp	266,958	154,452	373,958	694,433	242,273	466,022
Bait shrimp	632,403	687,897	584,795	853,610	469,318	536,868

*This category is comprised of white and brown shrimp landings principally in North Carolina.

White shrimp generates the greatest revenue in the South Atlantic shrimp fishery. Ex-vessel revenue from this species declined in recent years (2001 and 2002) due, in part, to lower prices (Tables 3.2-2b and 3.2-2c). In fact, the value of white shrimp harvested in 2002 was 46.6% lower that the value of the harvest in 1999. The decrease in the brown shrimp revenue has not been as substantial. In comparison to the 2000 landings value, ex-vessel revenue for brown shrimp dropped by 26.2% in 2002. During this period (1999 to 2000), commercial fisheries in states such as Georgia that are mostly dependent on the white shrimp fishery would have experienced greater revenue losses than fisheries in states such as North Carolina that are more reliant on brown shrimp.

Table 3.2-2b. Annual ex-vessel revenue by shrimp species for the South Atlantic.

Species	1997	1998	1999	2000	2001	2002
White shrimp	$41,755,998	$39,301,469	$53,580,350	$44,243,943	$20,575,382	$28,605,790
Brown shrimp	$8,749,986	$5,382,330	$17,883,516	$23,614,771	$19,690,278	$17,426,588
Marine shrimp	$18,202,774	$10,857,720	$3,190,068	$956,077	$653,619	$1,061,875
Pink shrimp	$17,920,788	$21,049,873	$12,120,339	$12,499,279	$11,950,636	$11,849,452
Rock shrimp	$3,617,206	$5,336,844	$7,719,324	$12,146,227	$7,858,454	$1,529,435
Other species	$1,614,935	$944,498	$914,573	$792,477	$789,937	$815,456
Royal red shrimp	$613,237	$391,047	$721,632	$1,486,824	$483,732	$690,536
Bait shrimp	$1,633,573	$1,625,018	$1,502,815	$1,908,809	$1,444,906	$1,702,589

As reflected in the overall average price for shrimp in the South Atlantic, there has been a substantial decrease in ex-vessels prices for all shrimp species during 2001 and 2002 (Table 3.2-2c). Similar price declines during this period were observed in all states in the Gulf of Mexico (Antozzi 2002). This decreasing price trend has been linked to the corresponding increase in imports, which has had and continues to have a substantial effect on the fisheries operating in the South Atlantic and Gulf of Mexico.

Table 3.2-2c. Annual ex-vessel price per pound of shrimp species harvested in the South Atlantic.

Species	1997	1998	1999	2000	2001	2002
White shrimp	$3.01	$2.78	$2.79	$2.95	$2.53	$2.05
Brown shrimp	$2.88	$2.15	$2.09	$2.50	$2.17	$1.78
Marine shrimp	$2.60	$2.34	$2.26	$2.04	$2.56	$1.95
Pink shrimp	$2.99	$2.27	$2.58	$2.86	$2.72	$1.87
Rock shrimp	$1.02	$1.35	$1.81	$1.48	$1.29	$1.83
Other species	$3.88	$3.97	$4.06	$4.74	$3.96	$3.89
Royal red shrimp	$2.30	$2.53	$1.93	$2.14	$2.00	$1.48
Bait shrimp	$2.58	$2.36	$2.57	$2.24	$3.08	$3.17

Apart from the vessels that operate in this fishery, there are a number of processors and dealers in this industry whose businesses are located not only in the South Atlantic but also in the Gulf of Mexico. Shrimp is the primary product for the South Atlantic processing industry and in the 1990s constituted 80% of the total edible production activities by value for Southeast processors (Keithley *et al.* 1991).

Keithly *et al.* (1991) found that there was a decline in the number of shrimp processors in the South Atlantic and Gulf of Mexico during the period 1973 to 1990 which was accompanied by a large increase in the productivity per firm due to an increase in peeling activity. These researchers also observed a decrease in price per pound of output, a declining trend in input prices for raw materials and increased product output during this time period. These trends can be explained by the fact that the increased supply of imported raw material allowed the processing sector to become progressively more specialized so that most firms began operating year round; previously they operated on a seasonal basis (Keithly *et al.* 1991).

The number of shrimp processors appears to have declined in the South Atlantic from 1998 through 2002 (Table 3.2-1). This phenomenon could be a response to the downturn in the domestic shrimp harvesting sector or reflective of consolidation within the processing sector. Shrimp processors also handle other species such as clams, oysters and scallops. Changes in the supply of these products would affect the economic performance of processing firms and could partly explain the decline in the number of processors observed. An increasing supply of final demand imported products could also be partly responsible for contractions in the processing sector. Another study by Keithly *et al.* (2002) indicated that profit margins for shrimp processors have been declining since the 1980s and attributed to the increase in imports of value-added peeled products (Keithly *et al.* 2002).

3.2.3.1.2 Global shrimp supply trends

Shrimp is produced throughout the world with more than 100 countries reporting production in 2003. United States shrimp imports expanded from about 260 million pounds (headless, shell-on basis) in 1980, to 563 million pounds in 1989 and 579 million pounds in 1990 (Vondruska 1991). Imports continued to steadily increase and reached 721 million pounds in 1996. Subsequently, this growth continued at a more rapid rate and in 2000 imported shrimp products, converted to shell-on headless weight, was estimated at 1.024 billion pounds (Haby *et al.* 2003).

During 2000 to 2003 the quantity of imports of all product forms increased (Table 3.2-3a). It must be noted that these imports are not converted to equivalent shell-on weight and are not directly comparable to the statistics referenced in the previous paragraph. The cost of shrimp imports was $3.7 billion in 2003 (http://www.st.nmfs.gov/st1.html). The increase in the breaded/frozen shrimp category more than quadrupled during 2000 to 2003, and is noted because of its possible negative impact on the segment of the domestic processing sector which relies on adding value through breading. While the breaded fraction of total shrimp imports has increased from 4.2 million pounds in 2000 to 19.3 million pounds in 2003, breaded shrimp represented only 1.7 percent of total shrimp imports in 2003 (Table 3.2-3a).

Table 3.2-3a. Shrimp imported into the United States by product category (pounds): 2000-2003.

Product	2000	2001	2002	2003
SHRIMP PEELED FROZEN	283,800,134	274,297,936	274,997,820	329,397,233
SHRIMP FROZEN OTHER PREPARATIONS	124,487,832	147,616,830	190,631,863	194,407,195
SHRIMP SHELL-ON FROZEN < 15	35,983,449	46,605,838	54,675,513	51,967,520
SHRIMP SHELL-ON FROZEN 15/20	36,553,966	49,782,207	50,037,537	56,548,153
SHRIMP SHELL-ON FROZEN 26/30	34,857,537	58,077,008	43,040,523	66,132,673
SHRIMP SHELL-ON FROZEN 21/25	30,872,448	47,142,663	43,713,870	53,565,679
SHRIMP SHELL-ON FROZEN 31/40	63,811,647	78,559,023	71,370,922	101,764,370
SHRIMP OTHER PREPARATIONS	3,150,572	4,852,335	6,281,385	9,403,112
SHRIMP SHELL-ON FROZEN 41/50	36,241,889	45,483,346	48,317,238	63,575,934
SHRIMP SHELL-ON FROZEN > 70	45,590,547	43,897,454	50,568,874	45,767,088
SHRIMP SHELL-ON FROZEN 51/60	31,005,095	40,938,412	52,062,503	62,632,671
SHRIMP BREADED FROZEN	4,221,615	7,086,717	9,931,684	19,265,613
SHRIMP CANNED	3,647,941	4,263,618	4,067,351	3,899,007
SHRIMP SHELL-ON FROZEN 61/70	21,217,935	28,431,315	39,693,969	44,940,694
SHRIMP PEELED FRESH/DRIED/SALTED/BRINE	1,366,952	1,642,337	2,140,470	2,012,435
SHRIMP FROZEN IN ATC	463,804	325,336	1,567,852	3,811,361
SHRIMP SHELL-ON FRESH/DRIED/SALTED/BRINE	1,895,674	1,739,278	1,366,631	797,331
Total	759,169,037	880,741,653	944,466,006	1,109,888,072

Source: NOAA Fisheries web site (http://www.st.nmfs.gov/st1.html).

When the fraction of total U.S. shrimp supplies attributable to domestic landings as opposed to imports is calculated using shell-on, headless values for domestic landings but product weights for imported shrimp, imports represent only about 70% of the total U.S. shrimp supply (i.e., the domestic market share is approximately 30%). Total domestic shrimp landings in 2001 and 2002 averaged 366.3 million pounds (http://www.st.nmfs.gov/st1.html). This quantity represents both warmwater and cold water domestic shrimp harvests. However, as would be expected, the domestic market share estimate drops by approximately 15% when imports are converted from product weights to a shell-on, headless equivalent (Haby *et al.* 2003). Thus, imports comprise at least 85% of the U.S. shrimp supply. Determining the most appropriate market form (e.g., live weight, shell-on, headless, etc.) depends on the purpose for which the information is to be used. For example, Fisheries of the United States expresses commercial shrimp landings in two different market forms: round or live weight and shell-on, headless weight. Live or round weight is typically used when comparing the biomass of different species. However, since shell-on headless weight is the customary market form packed by primary processors, it is the more appropriate market form to use when determining the contribution of domestic landings to U.S. shrimp supplies. Further, although shrimp imports are expressed in actual product weights in the foreign trade segment of Fisheries of the United States, these weights are converted into shell-on, headless equivalents when determining the contribution of imports to U.S. shrimp supplies.

Much of the increase in shrimp imports to the United States since the 1980s came from farm-raised production. During the early 1980s, the growth in imports was attributed to farm raised production in Ecuador. Currently, most of the production and supply to the U.S. market originates from Asian countries led by Thailand and China. In fact, imports of shrimp products from Thailand are at about the same level as domestic landings from the Gulf of Mexico and South Atlantic states (Table 3.2-3b).

Table 3.2-3b. Top countries exporting shrimp to the United States (pounds): 2000-2003.

Country	2000	2001	2002	2003
THAILAND	278,185,622	299,372,465	253,229,970	293,084,816
CHINA	40,046,222	61,637,979	108,916,491	178,224,354
VIET NAM	34,580,060	73,189,541	98,309,902	126,230,784
INDIA	62,425,031	72,334,764	97,338,450	100,031,232
ECUADOR	42,013,398	58,871,089	65,372,600	74,864,117
MEXICO	63,963,757	66,036,705	53,453,631	56,086,708
BRAZIL	12,970,445	21,600,880	39,012,701	47,923,539
INDONESIA	36,865,176	34,864,806	38,361,213	47,658,378

The continual trend for increased imports has also resulted in decreased prices for imported shrimp products and is observed for all product forms (Table 3.2-3c). Ex-vessel prices for domestic production declined in the South Atlantic during 2000 to 2003 (Table 3.2-2c). The price of imports will also be affected by the demand for shrimp in the other major markets of Japan and Europe. Import restrictions or an economic recession in either of these countries would have a downward influence on U.S. import prices for shrimp products.

Table 3.2-3c. Average price (per pound) of shrimp imported into the United States by product category: 2000-2003.

Product	2000	2001	2002	2003
SHRIMP PEELED FROZEN	$4.47	$4.38	$3.64	$3.06
SHRIMP FROZEN OTHER PREPARATIONS	$3.74	$3.47	$2.92	$2.85
SHRIMP SHELL-ON FROZEN < 15	$7.23	$6.96	$6.82	$6.92
SHRIMP SHELL-ON FROZEN 15/20	$6.65	$6.27	$5.63	$5.30
SHRIMP SHELL-ON FROZEN 26/30	$5.61	$4.68	$4.01	$3.94
SHRIMP SHELL-ON FROZEN 21/25	$6.23	$5.41	$4.66	$4.57
SHRIMP SHELL-ON FROZEN 31/40	$4.95	$4.15	$3.45	$3.27
SHRIMP OTHER PREPARATIONS	$4.29	$5.35	$4.53	$4.48
SHRIMP SHELL-ON FROZEN 41/50	$4.36	$3.38	$2.72	$2.61
SHRIMP SHELL-ON FROZEN > 70	$3.00	$3.01	$2.23	$2.24
SHRIMP SHELL-ON FROZEN 51/60	$3.94	$3.23	$2.63	$2.30
SHRIMP BREADED FROZEN	$3.76	$3.48	$2.99	$3.03
SHRIMP CANNED	$3.03	$2.87	$2.65	$2.51
SHRIMP SHELL-ON FROZEN 61/70	$3.44	$2.84	$2.39	$2.24
SHRIMP PEELED FRESH/DRIED/SALTED/BRINE	$5.94	$5.25	$5.00	$6.02
SHRIMP FROZEN IN ATC	$2.20	$2.52	$1.56	$2.75
SHRIMP SHELL-ON FRESH/DRIED/SALTED/BRINE	$6.17	$5.07	$4.67	$4.72

A more detailed examination of domestic prices in South Carolina indicates that since 2000 price per pound has decreased for all domestic shrimp count sizes by at least 28% (Table 3.2-3d).

Table 3.2-3d. Average price (per pound) of shrimp by count size for South Carolina.

Year	Size category (count per pound)										
	21	**31**	**41**	**51**	**52**	**61**	**62**	**71**	**72**	**81**	**91**
1997	$6.94	$6.13	$5.70	$4.98	$4.72	$4.15	$3.89	$3.41	$3.11	$2.80	$1.99
1998	$6.86	$5.83	$5.14	$4.03	$3.37	$2.78	$2.72	$2.24	$2.21	$1.86	$1.35
1999	$6.69	$5.81	$5.07	$4.09	$3.75	$3.35	$3.37	$2.76	$2.80	$2.22	$1.89
2000	$7.36	$6.21	$5.03	$4.69	$4.51	$3.81	$3.93	$3.43	$3.12	$2.95	$2.33
2001	$6.67	$5.08	$4.63	$3.74	$3.10	$2.73	$2.67	$2.42	$2.15	$1.97	$1.84
2002	$4.33	$4.47	$3.47	$2.97	$3.17	$2.61	$2.74	$2.32	$1.95	$1.88	$1.61
Price change 2000 to 2002	-41%	-28%	-31%	-37%	-30%	-32%	-30%	-33%	-38%	-36%	-31%
Real price change 2000 to 2002 *	-44%	-31%	-34%	-39%	-33%	-34%	-33%	-35%	-40%	-39%	-34%

*These changes are based on prices that were adjusted for inflation using the CPI.

A study conducted in 1988 examined the economic consequences of shrimp imports to shrimp harvesters in the South Atlantic and Gulf of Mexico (Keithly *et al.* 1989). Results of this econometric model demonstrated that farm raised shrimp elevated U.S. import levels by about 175 million pounds. At that time (1989) 563 million pounds of shrimp were imported. This model also indicated that import prices and domestic dockside prices would have been about 70% higher in the short run in the absence of imports of farm-raised shrimp. The authors suggested, however, that any rise in domestic warm water ex-vessel prices brought about by a reduction in U.S. shrimp imports would encourage additional effort in the domestic shrimp fleet and this would dissipate initial gains in profits as well as increase total harvest costs for the industry. Ward (1992) found that there was an asymmetrical response between change in vessel profits and entry/exit behavior in the Gulf of Mexico shrimp fishery. There is a higher probability that vessels will enter the fishery if profits increase while for the same magnitude in decreased profits fewer vessels will exit the industry.

Another econometric study directly evaluated the impact of shrimp imports on prices to South Atlantic shrimpers (Houston and Nieto 1988). Results suggest that shrimp imports have a different effect on regional markets. There was a significantly greater impact on South Atlantic shrimp prices, than on Gulf of Mexico, West Coast or New England markets. Although the authors concluded that restricting imports of shrimp would increase dockside prices in the short run, the merits of that action are debatable because new entrants would be expected to dissipate any economic rents derived from the fishery in the long run.

From the point of view of shrimp fishermen, imports decrease benefits by depressing dockside prices as demonstrated by Keithly *et al.* (1989). However, imports increase the aggregate U.S. supply of shrimp leading to lower retail prices for consumers (Anderson 1986). Thus, consumers in this country clearly benefit from imports although there are also balance of trade considerations with imports, which affect the buying power of U.S. consumers in the long run. Import restrictions would probably raise both dockside and retail prices and increased retail prices would decrease benefits to consumers. In addition, import restrictions would also impact U.S. wholesalers and retailers who currently depend on imports for a substantial portion of their sales volume.

3.2.3.1.3 The rock shrimp fishery

Vessels harvesting rock shrimp in the South Atlantic Council’s area of jurisdiction land most of the product in the states of Florida, Alabama and Georgia. Small quantities are landed in South Carolina and North Carolina. The majority of the landings come from the east coast of Florida. In the subsequent tables rock shrimp landings data are aggregated for all states so as not to reveal confidential information.

During the period 1984 to 1996 landings of rock shrimp increased substantially (SAFMC 1996a). The ex-vessel value of rock shrimp peaked in 1996 at $15.37 million coinciding with the highest level of recorded landings for this fishery (SAFMC 2002). Much of this increase was attributed to increased effort within the fishery. However, there does seem to be a cyclical pattern to the abundance of rock shrimp that is driven primarily by environmental factors.

Rock shrimp landings dropped from the record high level in 1996 to 3.53 million pounds in 1997. Since 1997 landings and ex-vessel revenue were on an increasing trend peaking at 8.18 million pounds and $12.15 million in 2000 (Table 3.2-4).

Table 3.2-4. Rock shrimp harvested in the South Atlantic: annual landings, ex-vessel revenue and effort.

Item	1997	1998	1999	2000	2001	2002
Landings (lb.)	3,530,305	3,960,560	4,265,196	8,180,124	6,095,654	834,962
Ex-vessel value	$3,617,206	$5,336,844	$7,719,324	$12,146,227	$7,858,454	$1,492,686
Real ex-vessel revenue in $2002*	$4,055,164	$5,890,556	$8,336,203	$12,691,982	$7,986,234	$1,492,686
Price/lb.	$1.02	$1.35	$1.81	$1.48	$1.29	$1.79
Real price/lb. in $2002*	$1.14	$1.49	$1.95	$1.55	$1.31	$1.79
Trips**	575	641	878	782	524	395
Number of vessels	180	195	261	182	159	148
Total fishing income for these vessels***				$43,876,424	$38,137,950	$28,490,368
Real fishing income for these vessels in $2002*				$45,847,882	$38,758,081	$28,490,368
Rock shrimp trips where penaeid shrimp comprised less than 1% of the catch	44	103	62	128	98	14
Number of dealers****	41	27	29	29	32	30
Landings not associated with a vessel	157,673	47,912	125,256	243,065	53,956	15,411

Landings information from the Gulf of Mexico and other (unknown) states are included in this table.
* The CPI was used to adjust these values for inflation.
**Rock shrimp may not be the primary target on all of these trips. Typically shrimpers target penaeid shrimp and rock shrimp on the same trip.
***Includes vessel income from rock shrimp harvest and harvest of other species in the South Atlantic and Gulf of Mexico. Typically vessels in the South Atlantic rock shrimp fishery operate in the penaeid shrimp fishery in the South Atlantic and Gulf of Mexico.
****Data on dealers only compiled for the Gulf of Mexico for 2000, 2001 and 2002.

The proportion of rock shrimp landings to total shrimp landings for the east coast of Florida was greater than 40% during 2000 and 2001. The actual percentage cannot be reported as it would then be possible to calculate the level of rock shrimp landings in the other states. These are confidential data because there was less than 3 dealers or vessels reporting rock shrimp landings in these states.

There was a substantial decrease in rock shrimp landings and corresponding ex-vessel value in 2002. Landings declined from 6.1 million pounds in 2001 to 0.83 million pounds in 2002 (Table 3.2-4). Rock shrimp fishermen reported that 2002 was an unusually poor year for rock shrimp catches on the Atlantic coast of Florida and even though harvest levels increased in 2003 catches were still below "normal" levels. Preliminary data for 2003 from the ACCSP web site revealed that 1.59 million pounds of rock shrimp were harvested from the east coast of Florida in 2003 (note that information for 2003 is not complete and this figure does not represent total landings for the entire year). There were no explanations for the atypical catches in 2002. These markedly low catch levels could be linked to unusual environmental conditions.

During 1997 to 2002 participation in the rock shrimp fishery increased until 1999. During that year 261 vessels participated in this fishery. Thereafter, there was a decline in number of vessels landing rock shrimp to a low of 148 in 2002. A limited access program was approved for this fishery in July 2002. Thus far, 145 limited access rock shrimp endorsements have been issued to qualified individual vessel owners. Additional endorsements will be issued to other qualifying fishermen once they provide documentation of vessel ownership.

Vessels in the rock shrimp fishery also participate in the penaeid shrimp fishery and other fisheries in the South Atlantic and Gulf of Mexico. In fact, on many trips where rock shrimp are caught it is typical for penaeid shrimp species to be targeted. The total number of trips in which rock shrimp were caught has decreased since 1999 (Table 3.2-4). Additional information would be required to determine the primary target of these trips and to correctly interpret observed trends in effort.

Legally, rock shrimpcaught in the South Atlantic can only be sold to permitted rock shrimp dealers. The number of dealers issued permits annually varied between 65 and 83 during 1997 to 2000 (SAFMC 2002). However, since 1997 no more than 32 dealers were active in this fishery each year. These rock shrimp dealers also hold permits in other fisheries such as snapper/grouper (SAFMC 2002).

The statistics on this fishery presented in Table 3.2-4 are different from similar data on the rock shrimp industry reported in Amendment 5 to the South Atlantic Shrimp Fishery Management Plan (SAFMC 2002). In 2002, the Florida trip ticket database was updated with information from rock shrimp fishermen who submitted a number of apparently unreported trip tickets or trip ticket data not in Florida's database. This exercise corrected Florida's rock shrimp catch and effort data for several years and explains the higher rock shrimp landings and ex-vessel value in Table 3.2-4 compared to similar data in Table 9 of Amendment 5 (SAFMC 2002).

3.2.3.1.4 Profile of the shrimp fishery in the South Atlantic states

Information from previous amendment documents and more recent databases showed that the contribution of each species to total landings varies in a relatively consistent pattern among the four southeastern states. In North Carolina, brown shrimp dominates total harvest, and generates more than 60% of overall revenue. In contrast to other South Atlantic states, white shrimp makes up a smaller component of the overall catch. In some years, pink shrimp catches in North Carolina can exceed 500,000 pounds (Table 3.2-5a).

In South Carolina and Georgia, there are virtually no pink shrimp in the landings which are dominated by white shrimp. In 2002, white shrimp accounted for nearly 80% of the revenue from all shrimp species in Georgia and nearly 75% of the revenue from all species in South Carolina (Tables 3.2-5b and 3.2-5d). The relative contribution of brown shrimp to the catch varies yearly, but rarely exceeds the catch of white shrimp. Nevertheless, this species is somewhat important to the shrimp industry in these two states.

Most of the pink shrimp harvest on the east coast of Florida comes from the offshore areas around the Dry Tortugas and the Florida Keys. In northeast Florida, some pink shrimp enter the catch primarily as a bycatch of the rock shrimp fishery. Overall shrimp revenue in Florida is not dominated by the harvest and sale of any one species (Table 3.2-5c). White shrimp is probably the most important species in terms of overall revenue in the northeast Florida shrimp fishery (SAFMC 1993). In some years, rock shrimp accounted for the dominant share of ex-vessel value (Table 3.2-5c).

Table 3.2-5a. Ex-vessel value of shrimp landings in North Carolina by species.

Species	1999	2000	2001	2002
Brown	$8,490,294	$16,060,844	$8,870,166	$11,155,906
Pink	$206,931	$315,852	$407,901	$1,242,744
White	$9,859,193	$8,067,399	$1,976,753	$4,877,140
Other	$3,190,179	$956,077	$653,742	$1,061,887
Total	$21,746,596	$25,400,172	$11,908,561	$18,337,677

Table 3.2-5b. Ex-vessel value of shrimp landings in Georgia by species.

Species	1999	2000	2001	2002
Brown	$2,432,979	$2,116,366	$3,323,971	$1,668,970
White	$15,706,844	$14,954,395	$6,690,629	$9,257,364
Other	$890,785	$700,191	$748,235	$745,235
Total	$19,030,608	$17,770,952	$10,762,834	$11,671,569

Table 3.2-5c. Ex-vessel value of shrimp harvested in Florida by species.

Species	1999	2000	2001	2002
Brown	$3,735,373	$2,256,383	$3,537,742	$2,074,932
Pink	$11,861,145	$12,177,794	$11,468,843	$10,523,606
White	$11,947,840	$8,695,483	$6,927,633	$7,419,840
Other	$9,128,031	$15,098,190	$9,552,743	$3,670,227
Total	$36,672,390	$38,227,850	$31,486,961	$23,688,605

Table 3.2-5d. Ex-vessel value of shrimp landed in South Carolina by species.

Species	1999	2000	2001	2002
Brown	$3,070,695	$3,063,183	$3,928,255	$2,253,873
White	$15,270,512	$12,429,765	$4,746,388	$6,723,195
Other	$227,049	$179,767	$190,510	$85,282
Total	$18,568,256	$15,672,714	$8,865,152	$9,062,350

Data presented in previous amendments indicated that in North Carolina almost all of the shrimp catch comes from internal waters. In South Carolina, it was estimated that about 5 to 10% of the shrimp catch is taken in the EEZ. In Georgia, because of extensive nearshore shoaling, significant effort is expended beyond three miles, and a higher percentage of the catch was reportedly taken from the EEZ (SAFMC 1996b). In Florida, it was estimated that 12 to 15% of the non-rock shrimp catch came from the EEZ. The more recent data used in this amendment confirms that a substantial quantity of the shrimp harvest is taken in state waters. An average of 20% of the shrimp catch in the South Atlantic was recorded as harvested within Federal waters (Table 3.2-1). This may not represent the total harvest taken from Federal waters. Tows on a single shrimp trip could traverse several locations or statistical reporting areas yet only one location is reported for each trip on the data reporting form. Thus, harvest from several locations could be attributed to one area especially in the case of multi-day trips.

In terms of the ex-vessel revenue generated, the states of North Carolina and Florida are more important to the South Atlantic shrimp industry (Tables 3.2-6a, 3.2-6b and 3.2-7). The revenue generated by the shrimp industry in Georgia and South Carolina is fairly comparable. It must be noted that the sum of landings and value in these four states will be less than the same statistics presented in Table 3.2-1 for the entire South Atlantic. This is due to the fact that the shrimp profile for the entire South Atlantic also includes statistics on shrimp caught in the South Atlantic and landed at Gulf of Mexico ports and shrimp landings in the Atlantic where the area caught or state landed was unknown.

The industry in all four states faced lower prices in 2001 and 2002 compared to previous years. For the three states where vessel level landings are available it appears that vessel identification information is not always reported or it is not possible to link landings to a particular vessel. Compliance with this reporting requirement in the states of Georgia and North Carolina appears to have improved over time. Of concern are the data from Florida. For 2002, it was not possible to identify the vessels that landed 1.31 million pounds of shrimp in Florida (Table 3.2-6a).

There are two ways to represent shrimp catches on the east coast of Florida. The first table contains the data on shrimp harvested on the east coast of Florida some of which was landed at ports on the west coast of Florida (Table 3.2-6a). The second table contains data on shrimp catches landed at east coast Florida ports (Table 3.2-6b).

Table 3.2-6a. Shrimp harvested from the east coast of Florida (South Atlantic): annual landings, ex-vessel revenue and effort.

Year	1997	1998	1999	2000	2001	2002
Landings (lb)	12,564,991	16,875,159	14,598,511	16,829,921	14,538,855	11,601,699
Ex-vessel revenue	$32,254,006	$37,605,629	$36,672,390	$38,227,850	$31,486,961	$23,688,605
Real revenue in $2002	$36,159,200	$41,507,317	$39,603,013	$39,945,507	$31,998,944	$23,688,605
Price/lb	$2.57	$2.23	$2.51	$2.27	$2.17	$2.04
Real price/lb $2002	$2.88	$2.46	$2.71	$2.37	$2.21	$2.04
Number of trips	15,169	15,782	14,750	13,276	11,745	11,771
Number of Dealers	176	156	153	155	145	144
Landings (lb) without information on vessel id	567,544	1,086,470	529,735	306,671	707,739	1,311,951
Number of Vessels	840	831	755	759	625	573
Vessel fishing exclusively in inshore areas				134	101	101

Includes harvest taken from area 0029 for all years.

Table 3.2-6b. Shrimp landings on the east coast of Florida: annual landings, ex-vessel revenue and effort.

Year	1997	1998	1999	2000	2001	2002
Landings (lb)	6,271,129	6,898,796	8,148,395	10,894,135	10,413,789	6,176,387
Ex-vessel revenue	$14,032,122	$15,736,525	$20,712,380	$23,054,217	$20,198,256	$13,180,214
Real revenue in $2002	$15,731,078	$17,369,233	$22,367,581	$24,090,091	$20,526,683	$13,180,214
Price/lb	$2.24	$2.28	$2.54	$2.12	$1.94	$2.13
Real price/lb $2002	$2.51	$2.52	$2.74	$2.22	$1.97	$2.13

The value of all seafood landed on the east coast of Florida amounted to $48.14 million in 2001 and $38.9 million in 2002 (NOAA Fisheries 2003b). The average dockside value of shrimp landings in those years amounted to $16.69 million (using data presented in Table 3.2-6b). Therefore, east coast shrimp landings comprised an average of 38% of the value of seafood sold at the dock in the past two years. In comparison, for South Carolina the total ex-vessel value of commercial landings was $23.9 million and $20.8 million dollars in 2001 and 2002 respectively (NOAA Fisheries 2003b). Shrimp comprised an average of 40% of the total value for those two years. Shrimp harvests comprised an average of 75% of the total ex-vessel revenue of landings in Georgia during the years 2001 and 2002. Reported commercial landings for the state of Georgia were $14.8 million and $15.1 million in 2001 and 2002 respectively (NOAA Fisheries 2003b). In contrast, North Carolina's shrimp harvesting sector is relatively less important to the entire commercial industry in this state.

The ex-vessel value of shrimp comprised 16% of the average overall value of commercial landings in 2001 and 2002 ($94.6 million) (NOAA Fisheries 2003b).

In North Carolina, brown shrimp and white shrimp landings were lower than normal in 2001 (Table 3.2-5a). This 5.1 million pound decline coupled with lower prices decreased overall shrimp revenue by $13.5 million compared to 2000. Revenue and landings increased in 2002. However, average prices decreased in 2002 even though the supply increased by 4.7 million pounds over the harvest in 2001 (Table 3.2-7).

North Carolina and Florida have the largest fleets in the South Atlantic shrimp harvesting sector. Vessels in these states' shrimp fishery tend to be more diverse. Many vessels participate in other non-shrimp fisheries, and shrimp species comprise a smaller proportion of their overall revenue base compared to vessel firms in other states. Also, many of the restrictions that apply to shrimp trawling in inshore areas of other states do not exist in North Carolina. This provides more opportunities for smaller vessels to participate in the North Carolina shrimp fishery. As a result of these differences in operations, catch per vessel may not be directly comparable across all states.

Table 3.2-7. Shrimp landings in North Carolina: annual landings, ex-vessel revenue and effort.

Year	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Landings (lb)	6,988,826	4,636,343	9,004,430	10,334,916	5,254,214	9,954,785
Ex-vessel revenue	$18,203,357	$10,858,874	$21,746,596	$25,400,172	$11,908,561	$18,337,677
Real revenue in $2002	$20,407,351	$11,985,512	$23,484,445	$26,541,455	$12,102,196	$18,337,677
Price/lb	$2.60	$2.34	$2.42	$2.46	$2.27	$1.84
Real price/lb $2002	$2.91	$2.58	$2.61	$2.57	$2.31	$1.84
Number of trips	18,974	14,130	19,179	18,474	14,084	18,394
Number of dealers	248	234	272	254	225	283
Landings without information on vessel id			2,407,572	6,649	5,009	2,166
Number of vessels				773	595	585
Vessels fishing in inshore areas				465	337	322

The decrease in shrimp landings in South Carolina and Georgia during 2002 and 2001 is reflective of a reduction in white shrimp harvest in both states (Tables 3.2-8 and 3.2-9). In North Carolina, average ex-vessel prices were lower in 2002 and 2001 even though supply declined. In the Georgia fishery, there has been a steady decline in number of trips from 1997 through 2001. In contrast, the number of trips harvesting shrimp fluctuated during this time period with no distinct trend for North Carolina (Table 3.2-7).

It was not possible to determine the actual number of vessels that operated in the South Carolina shrimp fishery since this state recently implemented a trip ticket program in 2003. The number of trawler licenses sold may not equate to the number of vessels participating in this fishery as some vessel owners may purchase a license in a given year but not go shrimping. However, the marked decrease in license sales indicates a reduced demand for shrimp fishing in 2001 and 2002 (Table 3.2-8).

It would be misleading to interpret the observed trend of increased vessel participation with actual changes in fleet size in the Georgia fishery because there is a large portion of shrimp landings not associated with any vessel in years prior to 2002. Compliance with the vessel identification reporting requirement improved substantially in 2002 compared to previous years. Other data from commercial shrimp license sales may provide a better indicator of participation trends in the Georgia shrimp fishery. License sales data for fiscal year 1998/99 through 2003/04 are 496, 467, 469, 484, 407 and 362 respectively. There is a noticeable decrease in license sales during the last two years compared to previous years. There may also have been a shift in the composition of the fleet during this period as the number of Coast Guard registered vessels has consistently declined throughout the entire time period while the number of state registered boats actually increased in fiscal years 2000/01 and 2001/02, before dropping sharply in 2002/03 (Travis, NOAA Fisheries, pers. comm. 2004).

Table 3.2-8. Shrimp landings in South Carolina: annual landings, ex-vessel revenue and effort.

Year	1997	1998	1999	2000	2001	2002
Landings (lb)	6,904,351	6,402,768	8,062,014	6,112,047	4,497,780	5,238,237
Ex-vessel revenue	$19,288,432	$15,641,722	$18,568,256	$15,672,714	$8,865,152	$9,062,350
Real revenue in $2002	$21,623,803	$17,264,594	$20,052,112	$16,376,922	$9,009,301	$9,062,350
Price/lb	$2.79	$2.44	$2.30	$2.56	$1.97	$1.73
Real price/lb $2002	$3.13	$2.69	$2.48	$2.68	$2.00	$1.73
Number of dealers	104	89	93	82	93	94
Number of trawler vessel licenses**	887	922	884	915	693	720

**This data is available by fiscal year and not calendar year.

Table 3.2-9. Shrimp landings in Georgia: annual landings, ex-vessel revenue and effort.

	1997	1998	1999	2000	2001	2002
Landings (lb)	7,301,864	6,996,499	7,013,620	5,629,096	4,379,989	5,412,940
Ex-vessel revenue	$22,933,018	$19,714,697	$19,030,608	$17,770,952	$10,762,834	$11,671,569
Real revenue in $2002	$25,709,661	$21,760,151	$20,551,413	$18,569,438	$10,937,839	$11,671,569
Price/lb	$3.14	$2.82	$2.71	$3.16	$2.46	$2.16
Real price/lb $2002	$3.52	$3.11	$2.93	$3.30	$2.50	$2.16
Number of trips	12,845	11,460	10,418	8,620	5,696	7,387
Number of dealers	78	66	77	89	74	136
Landings without information on vessel id						
Number of vessels**	287	312	280	268	289	340
Vessel that only operate in the inshore areas					30	65

** This data is somewhat misleading since there was a fair amount of landings reported without corresponding vessel identification information. Reporting compliance increased over time.
Note: License sales data for fiscal year 1998/99 through 2003/04 are 496, 467, 469, 484, 407 and 362 respectively.

In 2001 the State of Georgia began requiring all commercial castnet shrimpers to report as dealers. Castnet shrimpers often sell directly to the consumer and/or split their catch between several small markets. By requiring all castnetters to report as dealers, Georgia is able to collect more reliable trip level data. The marked increase in shrimp dealers in 2002 can be attributed to two factors: more castnetters selling their catch rather than keeping it for personal consumption; and more shrimp trawl owners marketing their own catch rather than selling to a shrimp packing house. For reporting purposes, those vessel owners are considered dealers. In the past, it was very unusual for vessel owners to market their entire catch directly to final consumers and retail outlets. With shrimp prices at an all-time low, vessel owners are employing non-traditional marketing methods in an attempt to command higher prices than the packing house can offer. Thus, there has not been an actual increase in the number of shrimp docks in Georgia but there was an increased number of individuals acting as dealers. For the other states there is a definite increase in the number of dealers in 2002 compared to 2000.

Seafood dealer operations are usually diverse in that they depend on more that one type of seafood product. For example, dealers in the shrimp industry may also handle clams, oysters and finfish. The relative health of these separate seafood markets would determine the financial viability of dealer operations or fish houses. Some dealers and vessel owners may also operate processing facilities where there is considerable value added to the final shrimp product.

The declining trend in prices and ex-vessel revenue in the shrimp harvesting sector, observed across all states, could play a major role in the financial solvency of dealers and fish houses that depend on shrimp. These businesses would be especially vulnerable if they are not able to transition to alternative sources of revenue from other fisheries.

Reduced revenues in the shrimp harvesting sector would also result in reduced economic activity to the sectors of the economy that are directly and indirectly associated with the shrimp industry in the South Atlantic. If vessels respond to lower revenues by reducing input costs, there would be negative effects on the sectors that supply inputs such as fuel and gear. If there is a reduction in the number of vessels, there would be further direct economic losses to impacted industries since annual and fixed expenditures would not be incurred. Apart from the direct effects there will also be indirect and induced effects on other sectors of the economy (the multiplier effect) which could have far reaching implications in the short-term. Assuming the economy is operating at full employment, economists theorize that these economic losses are distributional, and unlike net revenue to commercial fishermen there is no resulting changes in national GDP (gross domestic product). It is assumed that these monetary resources would be redirected to purchases that increase economic activity in other industries/sectors. The economy will adjust to these changes in the long run but there could be sectoral and regional shifts in the number of jobs, wages and business revenue.

3.2.3.2 Seasonal harvest patterns

Shrimp landings vary seasonally in each state governed primarily by the life cycle of the species targeted. The summer brown shrimp fishery occurs principally from June through September in North Carolina. September represents the transition month to the fall pink and white shrimp fisheries (SAFMC 1996b). The summer shrimp fishery generally occurs between June through August with June being a transition month dominated by white shrimp landings. In Georgia, the shrimp trawl season extends from June through December. If no winter freeze occurs the season is extended through January or February. The South Carolina shrimp trawl fishery opens May 15 and closes December 31 through state statute.

The peak rock shrimping season generally runs from July through October (SAFMC 2002). Historically, the fishery did not begin until August or September (SAFMC 1996a). To a degree, the amount and timing of effort in the rock shrimp fishery are dependent on the success of the white and brown shrimp fisheries.

The following tables were developed to analyze the impacts from a seasonal closure in the rock shrimp fishery. Seasonal groupings are based on the classification used for the rock shrimp observer coverage data presented in Section 3.1.9. Data on rock shrimp harvest, ex-vessel value and number of trips are presented by season because monthly summaries could reveal confidential data (Tables 3.2-10a, 3.2-10b and 3.2-10c). It appears that the highest level of landings have consistently been taken in the summer and fall seasons (Table 3.2-10a).

Table 3.2-10a. Harvest of rock shrimp from the South Atlantic by season (pounds).

Season	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
Winter	538,033	648,231	744,427	398,138	215,870	213,639
Spring	190,616	67,460	147,043	231,200	83,389	38,092
Summer	1,567,890	714,117	1,517,117	4,690,493	2,471,910	315,488
Fall	1,233,766	2,530,752	1,856,609	2,860,293	3,324,485	267,743
Total	3,530,305	3,960,560	4,265,196	8,180,124	6,095,654	834,962

Table 3.2-10b. Ex-vessel value of rock shrimp harvested from the South Atlantic by season.

Season	1997	1998	1999	2000	2001	2002
Winter	$536,562	$951,900	$1,211,563	$724,751	$327,079	$346,617
Spring	$187,484	$126,016	$248,992	$453,813	$152,723	$58,908
Summer	$1,481,597	$859,996	$2,695,208	$7,432,017	$3,470,167	$535,792
Fall	$1,411,563	$3,398,933	$3,563,560	$3,535,647	$3,908,484	$551,370
Total	$3,617,206	$5,336,844	$7,719,324	$12,146,227	$7,858,454	$1,492,686

Table 3.2-10c. Number of trips on which rock shrimp were caught by season.

Season	1997	1998	1999	2000	2001	2002
Winter	156	193	266	158	89	123
Spring	137	93	192	140	66	64
Summer	159	132	166	324	164	112
Fall	123	223	254	160	205	99
Total	575	641	878	782	524	398

3.2.3.3 Vessel economics and heterogeneity in the harvesting sector

The diversity in the penaeid shrimp and rock shrimp fisheries can be described primarily by firm size, level of economic dependence on shrimp and vessel length and horse power (indicators of vessel capacity). There is a certain degree of diversity in the shrimp fishery in terms of firm size and the structure of the industry. Information from public hearings and the Shrimp Advisory Panels indicate that some firms own processing plants and a number of these firms are also affiliated with marketing and distribution interests. At the other end of the spectrum is the individual vessel firm where the owner is the operator and is solely employed in the harvesting sector. At this time it is not possible to trace ownership of all shrimp vessels back to the firm since data on corporate identification is not collected by the Coast Guard vessel information system or state licensing agencies. As a result, each vessel is considered to be a separate firm.

3.2.3.3.1 Fleet characteristics

This section describes the length composition of active vessels in the South Atlantic shrimp fleet where data are available. Vessel length is often correlated with the capacity of individual harvesting platforms, crew size and fixed and operating costs.

Most, 59%, of the vessels that were active in the Georgia shrimp fishery in 2002 ranged in length from 41 to 80 feet (Table 3.2-11a). Also, there appears to be a larger number of vessels in the larger size categories in 2002 compared to previous years. This apparent trend could also be explained by the increased compliance with the reporting of vessel identification information in 2002.

Table 3.2-11a. Proportion of vessels in each length category in the Georgia shrimp fishery.

Vessel length category (feet)	**2000**	**2001**	**2002**
Less than 21	0%	11%	12%
21-30	0%	4%	3%
31-40	2%	4%	1%
41-50	13%	11%	5%
51-60	21%	16%	11%
61-70	34%	29%	20%
71-80	26%	22%	23%
81-90	3%	2%	14%
90-100	0%	0%	7%
Greater than 100	0%	0%	3%

In contrast to the composition of the Georgia fishery, the North Carolina shrimp fishery is comprised of a larger proportion of smaller vessels. In 2002 the proportion of active boats less that 40 feet in length amounted to 61%, and 39% of these boats were under 30 feet in length. In North Carolina, there were no vessels larger than 90 feet in the shrimp fishery (Table 3.2-11b).

Table 3.2-11b. Proportion of vessels in each length category in the North Carolina shrimp fishery.

Vessel length category (feet)	**1999**	**2000**	**2001**	**2002**
Less than 21	23%	24%	20%	16%
21-30	24%	22%	20%	23%
31-40	17%	19%	20%	22%
41-50	10%	10%	11%	11%
51-60	7%	7%	8%	7%
61-70	7%	8%	9%	9%
71-80	10%	9%	10%	11%
81-90	1%	1%	2%	2%

As expected, the majority of vessels that traverse between the Gulf of Mexico and South Atlantic shrimp fishery are larger craft. During the period 2000 through 2002, at least 87% of the fleet in both region's shrimp fishery was comprised of vessels greater than 60 feet in length (Table 3.2-11c).

Table 3.2-11c. Proportion of vessels in each length category operating in both the Gulf of Mexico and South Atlantic shrimp fishery.

Vessel length category (feet)	**2000**	**2001**	**2002**
21-30	1%	0%	<1%
31-40	4%	4%	2%
41-50	3%	3%	3%
51-60	6%	6%	6%
61-70	56%	55%	52%
71-80	23%	24%	25%
81-90	7%	7%	10%
90-100	1%	<1%	1%

As observed in the North Carolina shrimp fishery, the shrimp fishery in the State of Florida is comprised of a large proportion of small boats. During the three years, 2000, 2001 and 2002, at least 42% of the active Florida shrimp fleet was comprised of boats under 40 feet in length, and at least 30% of these boats were under 30 feet in length (Table 3.2-11d).

Table 3.2-11d. Proportion of vessels in each length category in the Florida shrimp fishery.

Vessel length category (feet)	**2000**	**2001**	**2002**
11-20	11%	8%	9%
21-30	27%	22%	27%
31-40	10%	12%	11%
41-50	2%	3%	1%
51-60	4%	5%	3%
61-70	31%	34%	34%
71-80	12%	13%	11%
81-90	4%	3%	4%
90-100	<1%	<1%	<1%

Data on active vessels in the South Carolina shrimp fishery were derived from a list of applications submitted for disaster relief aid in 2003. Most of the vessels in the active trawl fleet are in the larger size categories (Table 3.2-11e). Even though there is a closure of inshore areas to shrimp trawling in South Carolina, the absence of vessels less than 30 feet in this database is somewhat surprising since a 1999 Clemson cost and earnings study reported active commercial shrimp trawlers in the smaller size categories (Table 3.2-11e; Henry *et al.* 2001). Perhaps the smaller shrimp vessels did not apply for disaster relief aid. The 1999 Clemson study estimated that 38% of the vessels in the South Carolina shrimp fishery was comprised of boats under 31 feet; 35% of these vessels were in the 31 to 60 foot length category and 27% of these vessels were larger than 60 feet (Henry *et al.* 2001).

Table 3.2-11e. Proportion of vessels in each length category in the South Carolina shrimp fishery based on information from the 2003 South Carolina disaster relief applicants.

Vessel length category (feet)	2000	2001	2002
30-40	1%	5%	15%
41-50	7%	0%	15%
51-60	20%	23%	18%
61-70	19%	18%	15%
71-80	39%	41%	26%
81-90	14%	14%	12%
90-100	1%	5%	15%

Data from the analyses conducted for Shrimp Amendment 5 indicated that 74% of all vessels active in the rock shrimp fishery were in the 60-80 foot range in 2000 (SAFMC 2002). Most of the active vessels are above 60 feet in length, and during the period 1996 to 2000 there was an increase in the size composition of active vessels in the fleet. In 1996 around 10% of vessels in the fishery were larger than 80 feet, and by 2000 this proportion increased to 22.5%. (SAFMC 2002).

3.2.3.3.2 Participation in other fisheries and economic dependence on the shrimp fishery

Information on participation in and economic dependence on all fisheries would result in a better understanding of the impacts of management regulations on shrimp vessels. Some participants in the commercial penaeid shrimp fishery are involved in a wide variety of other fisheries. Small boats may be involved in virtually any inshore fishery from clamming and oystering to crab trap fishing and a variety of net fisheries. Larger vessels often participate in other trawl fisheries including rock shrimp and calico scallop as well as hook and line fisheries for bottom fishes. In addition to participating in fisheries for other species, many of the larger shrimp vessels in the region are very mobile within the shrimp fishery and may move anywhere throughout the South Atlantic states and the Gulf of Mexico (SAFMC 1996b).

More recent data from the ACCSP and Florida’s trip ticket program indicate that the shrimp harvesting sector in North Carolina depends on non-shrimp species to a larger extent than harvesting sectors operating in Florida and Georgia. During the period 2000 to 2002 an average of 38% of total revenue earned by North Carolina shrimpers came from other species caught on the shrimp trip or other trips that targeted non-shrimp species (Table 3.2-12).

Table 3.2-12. Revenue earned from non-shrimp species in the shrimp harvesting sector and percent of total annual revenue (from shrimp and non-shrimp species).

State	Item	2000	2001	2002
Georgia	Revenue	$250,641	$413,256	$289,810
	% of total revenue	1%	4%	2%
North Carolina	Revenue	$10,841,444	$10,479,661	$12,169,948
	% of total revenue	30%	47%	40%
Florida	Revenue	$429,792	$343,460	$284,341
	% of total revenue	1%	1%	1%

There was no information available for South Carolina to afford a similar comparison since the trip ticket program only began in 2003.

Participants in the commercial rock shrimp fishery are also involved in other fisheries. Larger vessels often participate in other trawl fisheries mainly for white, brown and pink shrimp in the South Atlantic and Gulf of Mexico. These vessels tend to be larger than the average shrimp vessel and are thus very mobile. Many vessels fish the open Gulf shrimp season during the summer months just prior to the rock shrimp season. Also, the peak in the pink shrimp fishing on Florida’s west coast occurs just after the rock shrimp season. Apart from penaeid shrimp species, to a lesser extent other species are targeted throughout the year (SAFMC 1996a).

3.2.3.3.3 Cost and earnings in the shrimp fishery

One way to evaluate profitability of the shrimp fleet rigorously would involve collecting current cost and earnings data specifically for each South Atlantic state (the shrimp fishery in this region differs by state as to the species targeted, seasonality, number of boats and other factors). From cost and earnings data, an indirect cost function (Ward 1992) could be developed to analyze harvester profit levels. Unfortunately, the cost and earnings data necessary to build such an equation system are not available at this time. It is expected that costs and revenue vary widely among vessels in this fishery and are correlated with vessel length, hull material and age. This section summarizes some of the existing studies on cost and revenue relevant to the South Atlantic shrimp fishery.

An extensive study of profitability and mobility of South Atlantic shrimp fishing firms was undertaken in 1979 (Liao 1979). This study found that mobility of vessels in the South Atlantic shrimp fishery was positively correlated to vessel size and horsepower. Also, vessels tended to fish away from home ports and home states if the captain expected higher prices and catch rates at these new locations. Average daily productivity was found to be higher for vessels that were more mobile in this fishery. Mobility class II vessels were 58 to 64 feet in length and mobility class III vessels were in the range of 65 to 73 feet. Net revenue per vessel ranged from $5,208 to $25,293 after all variable costs and captain and crew shares were deducted from gross revenue. At that time the captain's share was $12,707 and $17,369 annually for the two mobility classes. Crew shares were $26,144 and $44,190 for the vessels in mobility classes II and III. (Liao 1979).

Cost and earnings information for the commercial shrimp fishery in South Atlantic waters was collected for 1987 by the South Carolina Wildlife and Marine Resources Department, Marine Resources Division. However, a greater number of small vessels were active in the fishery during 1987, prior to the permanent closure of bay and sound areas to shrimp trawling (SAFMC 1993). Analysts developed cost and earnings profiles using responses from vessels greater than 37 feet in length. In 1987, these vessels fished an average of 120 days in South Carolina waters and an average of 75 days in other states. An average number of eight days was reported fishing for species other than shrimp, with the majority of respondents reporting zero days. There was considerable variability in reported trip costs, which indicates that vessels had very different cost structures and requirements because of their gear specifications, differences in vessel types or differences in travel distances to and from fishing grounds. Net revenue before taxes was estimated by subtracting the sum of variable (exclusive of crew share) and fixed costs (exclusive of depreciation) from total annual revenue reported by a given respondent. The average vessel landed roughly 24,000 pounds of shrimp (heads off) in 1987 and received an average of $3.20 per pound. Total revenue from the average vessel's annual landings was roughly $74,000. Net revenue to owner/operator (or owner and operator), crew and vessel (before taxes) was estimated to be $38,750. Net returns ranged from slightly negative values to as large as $75,200. Median net revenue was $35,900. Finally, reported revenues from sales of species other than shrimp by commercial shrimpers were relatively low. The average shrimp trawler received less than $1,500 from sales of bycatch in 1987. The reported high value was $2,800 and the reported low was zero.

A 1994 poll of shrimp vessels participating in the rock shrimp fishery found that the larger freezer boats needed to make a minimum of $1,200 (gross revenue gross revenue) a day to break even. Ice boats required gross revenue of $800 a day to break even. Forty percent of the gross revenue went to the crew. The remaining 60% went to the boat owner to cover fixed costs and operating costs. Average total catch per trip was approximately 36,000 pounds for freezer boats and 15,000 pounds for ice boats (heads-on). Freezer boats received an average of $1.25 per pound as ex-vessel price, while ice boats received an average of $1.00 per pound in 1994. No information was available on the detailed fixed and operating costs. Based on total revenue and minimum revenue needed to operate, fixed and operating costs per trip were estimated at $12,000 to $14,400 and $3,360 for freezer and ice boats respectively during 1994. At this time this represents the best available data on vessel costs and revenue in the rock shrimp fishery.

However, it is expected that current costs and revenue could vary from these figures as operating practices, input costs and market prices are likely to be different. Import levels and other factors affecting shrimp harvesting have changed markedly since these studies were conducted, and the costs and earnings profiles generated from these studies are essentially a “snap shot” of economic performance in the South Atlantic shrimp fishery at that time.

There are more recent data on operating costs from studies on the penaeid shrimp fisheries in the Gulf of Mexico and South Carolina. These cost estimates could be applicable to vessels in the rock shrimp and penaeid shrimp fisheries in the South Atlantic. Rock shrimp vessels traditionally participate in the penaeid shrimp fishery, and both penaeid shrimp and rock shrimp could be targeted on different days during the same multi-day trip. In particular, it is expected that costs and average rates of return for penaeid shrimp vessels 60 feet and larger should be similar to operating costs of vessels in the rock shrimp fishery.

One study of the Gulf shrimp fishery revealed that vessels in the 60-foot and larger size range showed the smallest revenue over cash cost (6.2%). In addition, large vessels had the least flexibility in substituting and adjusting inputs in response to poor conditions in the fishery. They require skilled crew to operate the vessel and are not able to reduce labor costs as readily as vessels in the smaller size categories. Also, these vessels had the largest number of years with revenue losses. Furthermore, households are more dependent on income from these vessels as compared to vessels less than 45 feet in length (Funk 1998).

A study on the penaeid shrimp fishery off South Carolina during 1999 indicated that many vessels were operating on break-even levels of activity (Henry *et al.* 2001). The South Carolina penaeid shrimp fishery was classified into three size categories based on differences in operating costs, profit margins and ability of the vessel owner to make input substitutions as follows:

Category 1. Small vessels less than 31 feet in length. Owners usually operated these vessels and tend to be part-time shrimpers. The market value of these vessels averaged $9,416 per year. Average effort in the shrimp fishery was about 3 days per week and 47 days per year.

Category 2. Medium sized vessels between 31 and 60 feet usually have one or two crew members. These vessels are more dependent on shrimp and less dependent on other fisheries compared to category 1 vessels. The market value of these vessels averaged $62,964 per year. Average effort in the shrimp fishery was about 5 days per week and 153 days per year.

Category 3. Large vessels between 60 and 100 feet were characterized by different operating costs from category 2 vessels. There is little flexibility in making changes to another fishery and vessels are not able to fish in inshore areas. These vessels are more able to travel longer distances and remain at sea for longer periods compared to Category 1 and 2 vessels. Vessel income is primarily dependent on shrimp. The market value of these vessels averaged $125,234 per year. Average effort in the shrimp fishery was about 6 days per week and 198 days per year.

Results of this cost and earnings study are summarized in Table 3.2-13. The annual total operating costs of vessels in the 60-100 ft range was $166,067 in 1999 (Henry *et al.* 2001). On average the number of days fished was 198 per year (average per day cost of $837). For all vessel categories, the largest operating cost items were crew and captain wages, routine repair and maintenance expenses and fuel expenses (Table 3.2-13).

Table 3.2-13. Expenditures, effort, revenue, net returns and cash flow for South Carolina shrimp vessels in 1999 (Henry *et al.* 2001).

Item	Small 15-30 Feet	Medium 31 – 60 Feet	Large 61-100 Feet
Days	47	153	198
Fuel costs	$980	$7,117	$14,036
Repair and maintenance	$776	$5,128	$16,657
BRDs	$13	$113	$173
TEDs	$50	$424	$973
Other equipment replacement costs	$366	$3,038	$6,335
Other operating costs	$1,602	$10,725	$28,365
Total variable costs	**$3,787**	**$26,546**	**$66,539**
Variable cost per day	**$81**	**$174**	**$336**
Captain costs	$1,886	$12,207	$27,949
Crew costs	$1,415	$14,411	$37,550
Crew share after expenses for fuel, ice, groceries	13%	20%	23%
Captain's Share	18%	17%	17%
Total labor costs	**$3,301**	**$26,618**	**$65,499**
Labor cost per day	**$70**	**$174**	**$331**
Number of crew members including captain	2	2	3
Labor cost per crew member per day	**$35**	**$87**	**$110**
Fixed costs 1 - includes depreciation and interest	$1,061	$8,307	$23,408
Fixed costs 2 - does not include depreciation and interest	$381	$3,402	$11,428
Net annual returns (all costs including depreciation and interest)	$1,833	$5,180	-$3,342
Net cash flow - does not include depreciation and interest	$2,533	$10,086	$8,639

The study also indicated that about 25% of all vessel owners have revenues above $150,000, and the average rate of return on investment was 3% on vessels larger than 60 feet. More importantly, these authors found that most full-time owner/captains were operating at break-even levels of activity (Henry *et al.* 2001). It is unknown to what extent these study results are reflective of the vessels currently operating in the rock shrimp and penaeid shrimp fisheries.

In addition, the degree to which economic returns to South Carolina shrimpers reflect conditions in other states, and as such are an adequate proxy, is not known precisely. In general, however, the shrimp fishery in South Carolina is probably similar to the shrimp fishery in Georgia (SAFMC 1993).

These authors surmised that if catches were at their 1999 levels or lower during the next five to ten years then 20% of the large (greater than 60 feet) vessels and 2% of the mid-sized (31 to 60 feet) vessels could be forced to exit the industry. Vessels in these categories were much more vulnerable than smaller vessels as revenue decreased by several scales. It appears that for these large categories, most of the vessel revenue and household income of captains come from shrimping. This analysis also showed that a price decline of $0.25 per pound from 1999 prices of $3.85 resulted in a 10.2% decline in the number of Category 2 vessels and a 26.6% decline in the number of Category 3 vessels.

As documented in Section 3.2.3.1, since 1999 ex-vessel prices have declined substantially. Also fuel cost has continued to increase. Historically, fuel prices increased steadily until 1981 and subsequently declined by about one third. From 1999 to 2000 fuel prices increased by 33%, declined in 2001 and 2002 by about 6% annually and increased continually in 2003 and 2004 (Table 3.2-14).

Table 3.2-14. The fuel price index for diesel during the period 1999-2004.

Year	**Fuel price index (diesel)**	**Annual % change in price from the previous year**
1999	112.00	
2000	149.32	33.3%
2001	140.40	-6.0%
2002	131.52	-6.3%
2003	150.83	14.7%
2004*	158.75	5.3%

Source: Department of Energy.
*The fuel price index in 2004 only reflects the trend calculated through March 2004.

Various studies have shown that fuel costs tend to represent 20-25% of a shrimp vessel's total operating costs. Considerable increases in fuel prices will significantly increase total costs and, in turn, significantly reduce profits (Travis and Griffin 2004).

It is expected that these factors (fuel prices and decreased shrimp prices) have had an extreme negative effect on vessel level profitability (NOAA Fisheries 2001b) and current profit margins are expected to be lower than represented in the 1999 South Carolina study.

As profit margins have declined vessel owners have employed a number of cost cutting measures to maintain a positive cash flow and continue participation in this fishery. As reported by industry sources, vessel owners have reduced the numbers of crew and restructured crew share arrangements that lower crew wages. The are some constraints on the ability of larger vessels to reduce labor costs to the same degree as smaller vessels in the fishery, since the former require more skilled crew to operate the vessel and gear. It appears that average crew size has decreased by 1 crew member in the South Atlantic shrimp harvesting sector between 1997 and 2002 (Travis, NOAA Fisheries, pers. comm. 2004). Other cost cutting measures include the failure to obtain or renew vessel and personal and indemnity insurance. Repair and maintenance costs have also been reduced. These measures could jeopardize the future viability of the vessel firm. Fish house operations provide services to shrimpers that dock at their facilities such as fuel, ice, repair parts, gear and supplies. In many cases, these fish houses have extended credit to vessel owners with negative cash flow problems.

Even with some of these cost cutting measures, the economic downturn in this industry has been so severe that at times some shrimpers could not afford the operating trips costs and remained at the dock. In extreme situations some vessels have been repossessed by lending agencies and auctioned off to other owners (Appendix I).

The future outlook for the industry will depend on several factors. Recently, relief programs provided shrimpers in the South Atlantic with financial aid through special congressional appropriations. Congress appropriated $17.5 million to South Atlantic states specifically to assist the shrimp industry in offsetting some of the diminishing value of the domestic catch. This money was disbursed to shrimpers in 2003. In addition, shrimpers in the South Atlantic were also successful in their petition for USDA Trade Adjustment Assistance in 2003.

The Southern Shrimp Alliance, an organization that represents domestic shrimpers from states in the Gulf of Mexico and South Atlantic, filed antidumping petitions claiming that imports from six countries (China, Thailand, Ecuador, Vietnam, India and Brazil) materially damaged the domestic shrimp industry. The Department of Commerce is evaluating the extent of this injury and whether or not to impose tariffs on the imports from these countries. Should they rule in favor of tariffs it is likely that the industry outlook would improve in the future. If tariffs are imposed on these countries there will likely be some increases in domestic ex-vessel prices from a contraction in supply. This gain may be short-lived if other countries that are not subject to tariffs increase their production. However, this respite could offer an opportunity to restructure the industry to ensure long-term viability of the shrimp harvesting sector. The extent of further changes in the profitability of commercial shrimp fishing will depend on the levels and price of shrimp imports, changes in prices of variable and fixed cost items to shrimp producers and global economic trends (Vondruska 1991).

A comprehensive cost and earnings study of the shrimp industry is needed to describe the changes and adaptive behavior that has occurred in this industry since 1999. Also, the information generated from such a study would greatly assist the Council in evaluation of a limited access program for the South Atlantic shrimp fishery.

3.2.3.3.4 Revenue profiles for the South Atlantic shrimp fishery

Revenue profiles were developed for vessels in the South Atlantic shrimp fleet during 2000 and 2001 (Table 3.2-15a). Revenue categories represent income earned from all fisheries. As discussed previously these shrimp vessels participate in other fisheries.

It would appear that a large number of shrimp boats earn less than $5,000 annually (Table 3.2-15a). It is likely that some of these vessel owners are part-time fishermen and go fishing infrequently or that the vessel was dry docked during a large portion of the fishing year. There were reports that because of the current economic downturn, some vessel owners could not afford the trip costs to fully participate in this fishery. Another reason to explain this observation is the large quantity of reported landings with no associated vessel identification information. If some of these catches were landed by any of the identified vessels (and not assigned to that vessel), the frequency distributions would shift in the direction of the lower revenue classes. Also, the true average revenue per vessel would be higher than the figure(s) reported in Table 3.2-15a.

Table 3.2-15a. Distribution of ex-vessel revenue within the South Atlantic shrimp fleet. Ex-vessel revenue represents income from all fisheries including shrimp.

	Number			Percent		
Revenue category	2000	2001	2002	2000	2001	2002
Less than $5,000	658	572	525	31%	31%	30%
$5,000 - $29,999	475	436	406	22%	24%	23%
$30,000 - $49,999	173	186	128	8%	10%	7%
$50,000 - $99,999	266	215	220	12%	12%	13%
$100,000 - $149,999	163	118	158	8%	6%	9%
$150,000 - $199,999	109	99	117	5%	5%	7%
$200,000 - $299,999	160	135	138	8%	7%	8%
$300,000 - $399,999	83	44	29	4%	2%	2%
$400,000 - $875,000	42	30	10	2%	2%	1%
Total number of vessels	2,129	1,835	1,731			
Average revenue per vessel	$76,879	$67,706	$66,853			

There is a wide distribution of income reported for the South Atlantic shrimp fleet as observed in Table 3.2-15a. To explore the heterogeneity in this fleet, the distribution of fishing income was separated into three vessel size classes: small (less than 30 feet in length); medium (30 to 60 feet in length) and large (greater than 60 feet in length) (Table 3.2-15b). This classification was chosen to reflect groupings in the South Carolina cost and earnings study (Henry *et al.* 2001). During 2000 the active fleet in the South Atlantic was about evenly distributed among the three different size categories (Table 3.2-15b).

In 2000, almost all (99%) of the small vessels earned less than $30,000, 88% of the medium sized vessels earned less than $100,000 and 71% earned less than $50,000 (Table 3.2-15b). As expected, most (85%) of the large vessels earned more than $50,000 and gross revenue for 67% of these vessels exceeded $100,000 (Table 3.2-15b).

Table 3.2-15b. Distribution of ex-vessel revenue within the South Atlantic shrimp fleet by vessel size category in 2000.

Revenue category	Small (<30 feet)	Medium (30 to 60 feet)	Large (>60 feet)
Less than $5,000	73%	23%	2%
$5,000 - $29,000	25%	31%	8%
$30,000 - $49,999	2%	16%	5%
$50,000 - $99,999		19%	18%
$100,000 - $149,999		8%	15%
$150,000 - $199,999		2%	13%
$200,000 - $299,999		1%	22%
$300,000 - $399,999			11%
$400,000 - $850,000			5%
Percent of total fleet	33%	30%	37%
Average revenue per vessel	$4,801	$39,017	$180,154

Length data was not available for all vessels in the data set.

Information presented in Shrimp Amendment 5 indicated that for most rock shrimp vessels additional revenue comes from other shrimp as opposed to finfish fisheries. At least 25% of vessels landing in Florida obtained anywhere from 80-100% of their Florida fishing revenue from rock shrimp, and 62% of all vessels landing rock shrimp in Florida obtained at least 40% of fishing income from rock shrimp (SAFMC 2002).

Some of these vessels depend on the rock shrimp resource for a large part of their revenue while others depend on the fishery for a small part of their fishing income and are not in the fishery every year. It is evident from the Amendment 5 analyses that there was a core group of vessels that account for the bulk of rock shrimp landings. The rock shrimp fishery is now a limited access fishery. Limited access endorsements became a requirement in July 2003. Thus far 145 limited access endorsements have been issued. A number of endorsements are waiting for eligible applicants to obtain a vessel (the issued permit must be attached to a vessel). It is expected that there is a larger proportion of vessels in the rock shrimp fishery that are now more dependent on the rock shrimp harvest since low volume producers did not qualify for a limited access endorsement.

3.2.3.4 Recreational shrimp fishery

Data on the number of recreational shrimp fishermen and recreational shrimp catches are not routinely collected throughout the South Atlantic region. Recreational licenses are only required for certain gear types and licensing requirements are not consistent across all states making it somewhat difficult to estimate total participation. However, there have been a number of ad hoc studies conducted to provide estimates of catch, participation and effort information on these recreational fisheries. Some of these studies are dated and estimates of catch and participation may not reflect current activity levels or recreational harvest of penaeid shrimp.

In South Carolina, sales for shrimp baiting permits increased from 5,509 in 1988 to a record high of 17,497 in 1998. After 1998, there was a decline in permit sales. However, the number of permits issued remained above 13,698 (Table 3.2-16). South Carolina conducts a post-season annual survey of these license holders to collect information on participation, effort and catches. Recreational shrimp harvests have fluctuated over time but ranged from a low of 0.91 million pounds in 2000 (an unusually poor year) to a high of 3.63 million pounds in 1997. In certain years, the recreational harvest by shrimp baiters comprised a large proportion of the total fall shrimp harvest (Table 3.2-16). The estimates from this survey does not represent the total recreational shrimp catch in South Carolina since landings of all shrimp species caught by recreational shrimpers using other gear are not recorded.

Table 3.2-16. Summary of results from the annual shrimp baiting surveys in South Carolina (Low 2002).

Year	**Permits issued**	**Participants**	**Trips**	**Pounds (heads on) million**	**Pounds/ participants**
1987		21,735	40,101	1.80	83
1988	5,509	17,749	35,609	1.16	65
1989	6,644	17,171	31,624	1.25	73
1990	9,703	34,662	71,153	2.75	79
1991	12,005	34,821	71,034	2.14	61
1992	11,571	31,812	62,459	2.35	74
1993	12,984	40,620	80,709	2.72	67
1994	13,366	38,081	70,429	1.91	50
1995	13,919	41,971	81,632	3.40	81
1996	14,156	38,932	68,927	1.73	44
1997	15,488	48,544	94,154	3.63	75
1998	17,497	50,436	92,484	2.91	58
1999	15,895	39,514	66,396	2.02	51
2000	15,929	37,622	61,445	0.91	24
2001	13,698	38,699	69,847	2.09	54

It has been speculated that shrimp baiting could reduce the catches of commercial shrimp trawlers in South Carolina in the fall season (Henry *et al.* 2001). In fact, the findings from this cost and earnings study indicated that commercial shrimp vessels in the larger size categories could exit the industry if the harvest declined. This would reduce economic benefits in the commercial harvesting sector. However, recreational shrimp baiting also generates economic activity within the State of South Carolina from expenditures on travel, fuel, poles, bait and other items to participate in this sport.

From a survey conducted in North Carolina it was estimated that recreational shrimpers caught 91,000 pounds of shrimp, or less than 3% of the reported commercial catch in 1979 (Maiolo and Faison 1980). A more recent survey of recreational/commercial gear license holders conducted by the North Carolina Division of Marine Fisheries during 2002 estimated that this group made 5,035 trips. Shrimp accounted for 101,154 pounds of the 118,468 pounds captured by the use of shrimp trawls. Blue crab and flounders were the only other species contributing greater than 1,000 pounds to the overall shrimp trawl harvest (NCDNR 2003).

A combined telephone/intercept access survey was carried out in coastal Georgia during 1989 to estimate recreational shrimp catch and effort. Total cast netting participation was estimated at 47,723 and 23,298 individuals during the summer and fall waves respectively. These cast netters were estimated to have taken 184,887 total trips and to have caught 576,000 pounds of shrimp, most of which were white shrimp (Williams 1990). There are no estimates of recreational shrimp catches for Florida, but it is believed that the recreational catch is substantial.

3.2.4 Social and community profile

3.2.4.1 Social characteristics of shrimpers in the South Atlantic

More than an industry, commercial shrimping is a way of life for many of the individuals. Through long, historic participation in the shrimp industry by fishermen, fish dealers, gear suppliers, etc., shrimping has become tradition and a part of group identity in many coastal communities (Sabella *et al.* 1979). In a very real sense, shrimping and shrimp boats are the common denominator for fishing communities in the South Atlantic. Shrimping communities *are* fishing communities, and in the South Atlantic at least for now, a fishing community *is* a shrimping community. There are of course exceptions to this, but they are rare.

There is little complete information on the shrimp fishery itself in the South Atlantic. What do exist are bits and pieces of anecdotal data, usually reported for a state or a single community, but there is a great need for a broader, consistent assessment of the fishery from a social science perspective. There have been some compelling changes in the composition of crews, packing house labor, dealers and processors and shrimp boat owners. There have been changes in technology and regulations and changes in the marketplace and in the coastal communities where shrimpers reside. Much of this change is occurring at a rapid pace and those in charge of collecting such data need to move fast before all has faded before them.

Modern day shrimping can be traced to the early 1900s and Sicilian and Portuguese immigrants that settled in northeast Florida in the areas of Fernandina Beach on Amelia Island and the smaller settlement of Mayport, Florida. By the 1920s, the otter trawl had been invented and was becoming more widely adopted. Simultaneously with the trawl gear development, offshore trawling became possible with motorized vessels. In the 1930s, shrimp trawling technology spread north from Fernandina Beach, through North and South Carolina and Georgia. With changes in the technology, there came changes in fishing behavior, which will be touched on below.

In North Carolina, Brunswick County was the center of that state's shrimp industry in the 1920s and thirties. According to Maiolo (2004:25):

> *In Southport alone, sixty-two boats, along with those coming from other areas, were in the harvesting sector in 1932. This generated employment for somewhere between five and six hundred people, including more than two hundred seasonal and part-time workers in the packing house…shrimping had become the community's most important industry and began to dominate its way of life…*

By the mid-1930s, those living in Carteret County began to shrimp in earnest. Shrimping came as an alternative to slackened activity in other fisheries and in farming. This was also the time of the Depression, and many were impoverished and looked for a ways out of the lean times. According to Maiolo (2004:28), those from Carteret County traveled to Brunswick County to learn shrimping skills and buy the necessary gear to carry on shrimping activity further north. While not mentioned directly by Maiolo, it is surmised that at that time, some of the first ties of friendship and partnerships were struck that would later serve fishermen well as the fishery became more mobile (Johnson and Orbach 1990).

Maiolo also notes that it was during the 1930s and in the more inshore, [Pamlico]sound shrimp fishery that shrimping became entrenched in what anthropologists call the "annual round," (2004:29):

> *Fishing and other activities became organized around the shrimping season. This included work in non-fishing jobs, later including government work for those employed at the Cherry Point Marine Corps Air Station, the Division of Marine Fisheries in Morehead, and the NOAA Fisheries station in Beaufort. Vacation time, sick leave, and person-leave days were scheduled to take advantage of the peak abundance periods for those who had grown up in fishing families and saw fishing activity as an important supplement to their incomes, as well as an important feature of their culture. For the full-time commercial fishermen, boat building or repairs, farming, home repairs, and even community political activity began to revolve around the increasingly lucrative shrimp harvest, processing and marketing.*

As the industry grew, "shrimpers from Florida, South Carolina, North Carolina and Georgia would gather in Southport, North Carolina for the late summer shrimp season (Maiolo 2004:31). As the seasons progressed, the larger boats would move southward towards Cape Canaveral and the Florida Keys, following the annual peaks in shrimp species (white, brown and pink).

In South Carolina, the shrimp industry developed along a similar track, with the Port Royal/Beaufort area and Hilton Head being centers of the nascent industry. Here, some immigrants from Italy and Portugal who had settled in Fernandina Beach, Florida relocated to South Carolina, at first just shrimping off South Carolina's shores and unloading shrimp to be shipped to Savannah, Georgia in barges. Starting in the Port Royal and Beaufort area, then elsewhere, people worked at shrimping, and alternated with the harvest of oysters and blue crab (Jakubiak 2001). Here the annual round was also evident in shrimping activity in the spring and early summer, giving way to crabbing, and then finfishing in the late summer and early fall.

In Georgia the pattern of development for shrimping was similar to other locations, but Darien and Brunswick stood out as places having a high concentration of shrimpers.

It should be noted that the geographic coastal configurations along the coasts often allowed – and still do – shrimpers to sail their vessels up into the rivers and creeks, docking their boats close to or at their own homes. Therefore there might be a high number of fishermen in one county, but all scattered in diverse locations. The community ties of shrimpers were forged not at a homeport per say, but rather at packing houses and along their annual migratory trips north and south along the coasts.

By World War II, traveling to follow the shrimp became common, taking fishermen to the northern coasts of South America and to the Yucatan Peninsula of Mexico. This was particularly true with the "discovery" of pink shrimp in south Florida and in the Tortugas (Iversen and Idyll 1959). At this time Fernandina, Florida lost its prominence in shrimping to other areas further south in Florida and to the Gulf of Mexico. Shrimping in the South Atlantic probably peaked in stature (landings, profits, number of employed) in the late 1970s. As regulations increased, such as for TEDS or the state closures of inshore sounds to trawling in the 1980s, other events in the world came to impact the present-day viability of the South Atlantic shrimp fleet. The two most significant events, discussed in the economic description of the fishery (Section 3.2.3), are the rise in fuel prices and the decline in prices for domestic shrimp in light of increased foreign imports of the same to the United States.

Overall, shrimpers remain mobile, and this tendency to follow the shrimp remains to this day. Many shrimpers are gone from home for long stretches of time, traveling from, for example, Georgia to Key West, Florida or into the Gulf of Mexico. However, there are some other shrimpers that perhaps for personal reasons or their age, have decided to shrimp only in waters close to home. These shrimpers might possess smaller boats; those with larger boats may have more debt and hence more reason to continue to shrimp as much as possible.

According to a 2001 study of South Carolina shrimpers, the larger the vessel owned, the more days were spent shrimping each week (Henry *et al.* 2001: 16). Boats averaging less than 30 feet LOA fished only an average of 47 days per year, while boats 31-60 feet and those 61-100 feet LOA fished 153 and 198 days per year, respectively. This observation would lead one to predict that the larger boats must travel far from their home port in order to shrimp for so many days out of the year. This increase in days shrimping is also related to the larger expenditures demanded by the larger vessels.

Additionally, smaller boats are more prone to being affected by bad weather conditions, and so might stay in port more often than larger vessels.

The size, structure and functions of crews employed in commercial shrimping vary somewhat from vessel to vessel, but several variables appear to be fairly universal throughout the fishery. Small boats (18-35 ft) typically are run by the captain alone and perhaps one other crew member, while larger boats have crews of one to four.

The number of crew members is adjusted depending on what the captain believes the catch and profits to be like. Many captains have told me that they have cut back on their crew size recently due to dropping prices for shrimp. This may pose safety problems and is a problem faced not only in the shrimp industry (ICSF 2003).

Henry *et al.* (2001) determined that in South Carolina at least, about one half of all crew members are family of the owner or captain (Table 3.2-17). In the past, crews were frequently recruited from the shrimp fishermen's relatives (Johnson and Orbach 1990; Sabella *et al.* 1979). However, that practice may be changing, as some shrimpers interviewed in the past two years (Kitner 2001) have claimed to be hiring more Hispanic immigrants, and one owner-operator employs crew through a firm that finds Mexican workers for the HB2 Visa program.

Table 3.2-17. Captain and crew characteristics, 1999. From Henry *et al.* (2001).

Selected fishermen's characteristics			
	15-30 feet (standard error) No. of observations	31 – 60 feet (standard error) No. of observations	61-100 feet (standard error) No. of observations
Years of captain's experience	12 (1.7) [27]	20 (1.9) [33]	27 (2.4) [30]
No. of crew (including captain)	2 (0.2) [29]	2 (0.1) [36	3 (0.1) [32]
# Family in crew	1 (0.2) [25]	2 (1.4) [32]	1 (0.3) [27]
% Striker's share[1]	15% (4.5) [18]	24% (2.6) [29]	27% (2.9%) [30]
% Household income from shrimping	17% (5.3) [22]	63% (6.4) [32]	72% (6.1) [30]

[1] Total share of all strikers in crew before expense deductions.

Tasks performed by the crew include rigging and repairing the boat and equipment, setting and hauling the nets, cooking meals on board and culling, icing and heading the shrimp. The crew is typically paid through a share system. The share system divides the costs for fuel, groceries and other expenses among the captain and crew, then goes on to divide the profits from the catch in the following manner: a certain percentage up front goes to the captain, a certain percentage to the owner of the boat and the crew and captain divide the rest among themselves (Bradley M. P. Fellows 1992). In 2001, the crew share for a vessel 30 feet and under was 15% of the total share before expenses, while for boats 31 feet and larger, the share was between 24 and 27%.

The ethnic composition of the crew will vary, but most shrimp boat owners are white males, and so is their crew. Some owners and crew may be African American, although Blount documented the drastic decline of African American ownership of shrimp vessels in the years leading up to WWII (Blount 2000). Vietnamese appear to crew on boats belonging to other Vietnamese; the South Atlantic does not have as large a Vietnamese population as do communities in the Gulf of Mexico.

Along with the crew, another group that is potentially affected by new regulation or other events outside of the immediate community is the labor force that works at the packing houses, heading and packing the fresh shrimp (along with other seafood species, such as blue crab and scallops, in different seasons).

In the recent past, according to Griffith (2003), most packing and processing workers were African American; however, since about 1990 the demographics of this sector of the seafood industry have changed (as African American women took advantage of better, more stable employment opportunities), and there are many Hispanic/Latino women now employed in the packing houses and plants of North Carolina. According to the North Carolina Institute of Medicine (NCIOM 2003), almost eight percent of all Hispanics in North Carolina are employed in the farming/fishing/forestry category. The NCIOM admits that this is most likely an undercount by the Census, as the Census is conducted in April when migrant workers are not present in the state and furthermore, there is difficulty in counting temporary housing and/or illegal immigrants. However, it may be that at different times of the year, reflecting migrant flows, the composition of the workforce at packing houses and processors changes.

In turn, the number of number of processors in the South Atlantic/Southeast has decreased from 103 processors in 1997 to 64 in 2001 – a decrease of almost 38% - the last year for which we have data. While these data refer to seafood processors in the Southeast region that have voluntarily filled out a survey, and not only shrimp processors, it still illustrates one of the problems faced by another part of the shrimping sector: a trend towards consolidation and globalization of primary production and the continuing gentrification of the coast. These trends do have a negative impact on the communities where shrimp boat owners, crew and other laborers live.

Maiolo (2004), based on his and other studies, divides dealer/processors into three categories – large, medium and small – each with their own general characteristics and business behaviors. Large dealers are characterized as doing business with the largest vessels in the fleet, owning their own fleets, unloading out of state vessels and conducting interstate commerce and sometimes international trade in seafood products. Medium size dealers work more with smaller shrimping vessels – those that fish closer to shore and in the sounds and travel less often away from their homeport. The smaller dealers are described as "… [running] the gamut from seasonal sales from backs of trucks to modest, permanent facilities catering to a local market or reselling to large dealers," (Maiolo 2004:119).

3.2.4.2 Shrimping communities in the South Atlantic

All of the above mentioned sectors come together in different geographical locations, either temporarily or permanently, to form community associations. Shrimping is most often but one activity that keeps these communities going; many areas depend on different species throughout the year in order to sustain themselves.

In the case of the shrimp industry in the South Atlantic, this activity is fairly similar in gear, practice and also in social structure. The divergence from a community "norm", could one be said to exist, would come in the State of North Carolina where distinct ecological/geographical differences exist in comparison to the other southeastern states. These differences are based on the vast sounds in North Carolina, the Pamlico and Albemarle. Both of these sounds have allowed for the development and maintenance of shrimping by small vessels, creating a smaller-scale shrimp fishery that operates alongside the larger, ocean-going trawlers.

In order to identify shrimping communities in the South Atlantic, shrimp landings from 1996/97 through 2002 were examined, and those communities (identified through dealer addresses) recording more than 50,000 pounds in shrimp landed per year were chosen to be listed. While some communities had landings approaching 50,000 pounds, the landings were inconsistent throughout the chosen time frame. Furthermore, when compared with current analysis on the identification of fishing communities in the South Atlantic, those “outlier” communities did not show up on other scales (number of federal permits, state permits and other fisheries). These communities have been “ground-truthed” using past interviews and field visits.

All species of shrimp were lumped together, as there is little analytical utility at this point of looking at “pink shrimp communities” versus “brown shrimp” communities. Furthermore, each state had different ways of recording the landings data for the years of 1996/97 through 2002, and to attempt consistency in the analysis, all species of shrimp were counted as one.

What do the landings data tell us about communities where shrimping occurs? First, there is the phenomenon of shrimping being a backdrop, or core activity, to most of what might be considered fishing communities. In the South Atlantic, shrimp boats are present in almost every community that has commercial fishing as an activity.

It is important to note that while our data are not extremely long-term, reaching back only six years, it shows a trend for declines in shrimping activity in some communities, stability in others and growth in a few. This would be expected due to various events: growth of tourist based economies along the southeast coast that are competing with more traditional coastal economies, increasing gentrification in communities, again related to growth and higher in-migration, competition with domestic shrimp in the markets from foreign-sourced shrimp, a weak national (U.S.) economy, etc.

Overall, approximately 60 South Atlantic shrimping communities were identified from the landings data supplied. It is not reasonable to describe in detail each of the 60 communities, so one brief description of an indicator community will be given instead after an overview of the state population and fishery demographics.

North Carolina

According to the NOAAFisheries (2002) the State of North Carolina has landed close to 140 and 160 million pounds of seafood in 2001 and 2002 respectively. Two ports, Wanchese-Stumpy Point and Beaufort-Morehead City, both rank within the top 50 ports in the United States in terms of landings and value for those same years. Since 1998, North Carolina has had a high of 535 registered fishing vessels with federal permits, but this number was reduced to 439 in 2001, likely due to changes in state fisheries regulations (Table 3.2-18). Most vessels with federal permits had either king or Spanish mackerel with snapper grouper class 1 permits being the next most common.

Table 3.2-18 Number of federal permits by type for North Carolina. (Source: NOAA Fisheries 2002).

Type of permit	1998	1999	2000	2001
Total permitted vessels	535	513	477	439
Commercial king mackerel	428	362	356	336
Commercial Spanish mackerel	376	256	211	216
Commercial spiny lobster	21	23	17	13
Charter/headboat for coastal pelagics	155	148	141	129
Charter/headboat for snapper grouper	89	94	98	95
Snapper grouper class 1	153	191	155	164
Snapper grouper class 2	28	33	27	26
Swordfish	1	19	17	20
Shark	1	39	24	43
Rock shrimp	0	0	35	37

There were over 9,500 state licenses sold with capability of sale and over 5,500 reported sales in 2002 (Table 3.2-19). Although the overall number of license sold has been increasing since 1994, the number of licenses reporting sales has been decreasing. The majority of license sales are for commercial fishing vessels with over 9,400 permits or 46.9% in 2002 (Table 3.2-20). Standard commercial fishing license is the next most frequent with 32.9% and shellfish licenses third at 11.4%. There were 832 dealer license sold for the year 2002 in North Carolina.

Table 3.2-19 Number of licenses sold by the North Carolina Division of Marine Fisheries each license year, the number of licenses with selling privileges that potentially can report catch on trip tickets by license year and the number of licenses actually used to report catches. Individuals may hold more than one license with selling privileges. (Source: NCDMF 2002).

License year	Number of licenses sold*	Number of licenses reporting sales	Number of licenses sold, but did not report sales
1994	6,781	Not available	Not available
1994/1995	7,535	6,710	825
1995/1996	7,898	7,285	613
1996/1997	8,173	6,700	1,473
1997/1998	8,595	7,000	1,595
1998/1999	8,426*	6,515	1,911
1999/2000+	9,711	6,015	3,696
2000/2001*	9,677	6,057	3,620
2001/2002*	9,712	5,509	4,203

*Licenses from 1994 to June 1999 are Endorsement to Sell licenses. Licenses from 1999 to the present include number of SCFL, RSCFL, Shellfish, Menhaden License for Non-Residents without SCFL, Recreational Fishing Tournament License to Sell Fish and Land or Sell licenses. License year is July to June. Source: 1994-1997/98 license year sales were derived from historical reports. 1998/99-2001/2002 from FIN license sales reports.
*1998/99 was a transition year and not all dBase licenses were migrated to FIN. The numbers provided were from FIN.
*1999/00 to 2001/02 include licenses sold that were subsequently surrendered without a refund.
+1999/2000 license counts were stated as much higher in other documents. This was due to the grace period when switching from ETS to SCFL. The number above is correct.

Table 3.2-20 Number of state permits by type for North Carolina. (Source: NCDMF 2002).

Type	Permits	Percent
Commercial fishing vessel registration	9469	46.9
Dealer license	832	4.1
Flounder license	133	0.7
Land or sell license	59	0.3
Non-resident menhaden license	10	0.0
Ocean fishing pier license	25	0.1
Spotter plane license	11	0.1
Retired standard commercial fishing license	676	3.3
Standard commercial fishing license	6632	32.9
Shellfish license	2302	11.4
Recreational fishing tournament to sell license	31	0.2
Total	20180	100.0

The communities of **Carteret County**, North Carolina that exhibit high shrimp landings **are Atlantic, Beaufort, Cedar Island, Davis, Harkers Island, Morehead City, Newport, Sea Level, Smyrna and Stacy**. These communities are located along the banks of Core Sound and area of North Carolina referred to as Down East. More remote and less developed than many other North Carolina coastal communities, the traditions of fishing both for profit and subsistence remain important in day to day life. These communities may rely less on shrimping as the only source of fishing income and participants in the shrimp fishery also participate in other fisheries throughout the year. Other fisheries are blue crab, spot, mullet, bluefish and scallops. Duck hunting is also still conducted as a subsistence activity.

In **Onslow County** there are two communities that show high amounts of shrimp landings. These communities are **Sneads Ferry** and **Swansboro**. The county itself is partly dominated by the large U.S. Marine base, Camp Lejeune, which occupies a fifth of the county's land area. The coastal areas are being slowly more developed for tourism.

Dare County is often thought of as the Outer Banks of North Carolina, but located next to Manteo, North Carolina is **Wanchese**, one of the fishing communities with the largest amount of seafood landings in the nation. Stumpy Point is sometimes lumped together with Wanchese, although it is a much smaller village characterized by small-scale fishing operations. If one drives North Carolina Route 264, one enters **Hyde County** and comes to Englehard, which depends economically almost equally on agricultural operations and fishing. While Census data do not count Englehard separately, there is a large Hispanic population in Englehard, tied closely to agricultural work. The women are often found working alongside the African American women at the shrimp tables at the dealers' docks. **Swans Quarter** is located next to Swans Quarter National Wildlife Refuge and is a ferry crossing point to Ocracoke Island and Cedar Point.

Other shrimping communities in North Carolina are, in Pamlico County: **Bayboro**, **Belhaven**, **Hobucken**, **Lowland**, **Vandemere** and **Oriental.** In **Brunswick County**: **Carolina Beach**, **Hampstead**, **Shallotte**, **Supply**, **Varnamtown and Wilmington**. Brunswick County is becoming rapidly developed with golf courses, retirement villages and private residential homes. As this development continues, one can reasonably expect that dependence on commercial fishing and shrimping to decline, or be marginalized to fewer areas.

Inland Shrimping/Fishing Community: Oriental, North Carolina, Pamlico County.

While the village's internet websites bills the place as the "Sailing Capital of North Carolina" and claims that there are over 2,700 boats in the town, Oriental is still very much a fishing dependent community. Located in Pamlico County and on the Neuse River, Oriental was founded in the 1870s and was originally called Smith's Creek. The town changed its name to Oriental, a name promoted by the then-postmaster's wife, Rebecca Midyette. Oriental became incorporated in 1899.

From its inception, Oriental has been heavily dependent on fishing and farming. However, in the early years of the 20^{th} century, logging grew in importance in the areas around Oriental and the village became a hub for transporting lumber by train and ship. The last lumber mill closed in the late 1950s, just as the town was being discovered by sailboat owners. Since then, commercial fishing has remained important, and the town has also attracted a following of sailboat aficionados and world-cruisers. According to one local resident, the mix is a happy one.

In general, Oriental's small population is aging, with 36% being over the age of 65 years, and another 35% being between the ages of 45 and 64 years old. However, there is a steady influx of persons from outside the community that come to Oriental to stay. Furthermore, in 2005 construction of a new subdivision will begin that, when finished, will add approximately one thousand homes to the immediate area.

One local estimate is that at least 20% of the town's population of 875 (U.S. Census 2000) is dependent on fishing in one manner or another. While this is not illustrated well by looking at the available federal permits database (Table 3.2-21), fishing effort is better defined by examining the state fishing permit table (Table 3.2-22) and in the employment table (Table 3.2-23). It is not unreasonable to assume that close to 200 people in Oriental make a living from seafood related employment.

Table 3.2-21. Number of federal permits by type for Oriental, North Carolina (Source: NOAA Fisheries 2002).

Type of permit	1998	1999	2000	2001
Total permitted vessels	**5**	**4**	**7**	**7**
Commercial king mackerel	0	0	1	1
Commercial Spanish mackerel	0	0	1	1
Commercial Spiny lobster	0	0	0	0
Charter/headboat for coastal pelagics	1	0	0	0
Charter/headboat for snapper grouper	0	0	0	0
Snapper grouper class 1	0	0	1	1
Snapper grouper class 2	0	0	0	0
Swordfish	0	0	0	0
Shark	0	0	0	0
Rock shrimp	4	4	6	6
Federal dealers	0	0	0	0

Table 3.2-22. Number of State Permits by Type for Oriental, North Carolina. (Source: NCDMF 2002).

Type	Permits
Commercial fishing vessel registration	77
Dealer license	13
Flounder license	9
Land or sell license	0
Non-resident menhaden license	0
Ocean fishing pier license	0
Spotter plane license	0
Retired standard commercial fishing license	5
Standard commercial fishing license	62
Shellfish license	3
Recreational fishing tournament to sell license	0
Total	**168**

Table 3.2-23. Employment in fishing related industry for Oriental, North Carolina. (Zip code Business Patterns, U.S. Census Bureau 1998).

Category	NAIC code	Number employed
Total other employment		
Fishing	114100	4
Seafood canning	311711	0
Seafood processing	311712	4
Boat building	336612	0
Fish and seafoods	422460	72
Fish and seafood markets	445220	0
Marinas	713930	28
Total fishing employment		**108**

The annual round of fishing, at least at one of the larger fish houses, is to shrimp during the summer months, then in the winter shift to floundering. In the spring fishermen will go scalloping. This fish house owns a fleet of over six boats and is planning to increase that number to nine or ten shortly. The fish house will usually unload about 20 boats on a regular basis during the summer shrimping season. Being on the Pamlico Sound, the boats in Oriental work both in the Sound and in the offshore, ocean waters. As noted previously, such inland, sound communities employ more small boats than other areas that work the offshore waters more.

Recreational Fishing in Oriental

While there are a few small **charter fishing** guide businesses in Oriental, there are no larger charter fishing boats based there. The closest charter boat operations are run out of Morehead City, approximately 20 miles away.

The same holds true for **bait and tackle**/sporting goods stores in the village. All businesses of this type are located out of the town, either in other surrounding small communities or in Morehead City or Beaufort.

There are at least four boat repair/service and sales businesses in town, most with an eye to serving the larger transient sailboat population in Oriental.

Tournaments

There is one known fishing tournament in Oriental and that is the Oriental Rotary Club All Release Tarpon Tournament, held around the end of July each year. It is limited to 75 boats, and prizes total around $20,000. Other water-oriented events consist mainly of sailing regattas.

Community Demographics, Oriental, North Carolina

In order to put Oriental in a larger geographic and socioeconomic context, certain census data from both the town and the county (Pamlico) have been reproduced in Table 3.2-24. One should note that Oriental has an aging population and one that is older than the county as a whole. The entire town's permanent population is only 875 persons and only 10-12% of them are under the age of 18, while 35% of the population is 65 years old or older.

Ethnically, Oriental is fairly homogenous, with 90% of the population being white, 7.3% African American, which are figures quite different from the larger county (73% and almost 25%, respectivel)y. There are few Hispanics or other ethnicities in the village.

Only 11% of all housing units are given to vacation rentals, which is less than Pamlico County.

Table 3.2-24. Oriental and Pamlico County, North Carolina. Source: Census 2000 summary file 1 (SF 1) 100-Percent Data (http://www.census.gov).

	ORIENTAL Number	ORIENTAL Percent	PAMLICO COUNTY Number	PAMLICO COUNTY Percent
TOTAL POPULATION	875	100.0	12,934	100.0
SEX AND AGE				
Male	419	47.9	6,513	50.4
Female	456	52.1	6,421	49.6
Median age (years)	57.2	(X)	42.9	(X)
18 years and over	781	89.3	10,208	78.9
Male	374	42.7	5,098	39.4
Female	407	46.5	5,110	39.5
21 years and over	767	87.7	9,860	76.2
62 years and over	366	41.8	2,908	22.5
65 years and over	313	35.8	2,429	18.8
RACE				
One race	866	99.0	12,838	99.3
White	794	90.7	9,464	73.2
Black or African American	64	7.3	3,178	24.6
American Indian and Alaska Native	1	0.1	68	0.5
Asian	3	0.3	49	0.4
Asian Indian	3	0.3	15	0.1
Hispanic or Latino (of any race)	12	1.4	171	1.3
HOUSEHOLDS BY TYPE				
Total households	440	100.0	5,178	100.0
Households with individuals under 18 years	57	13.0	1,565	30.2
Households with individuals 65 years and over	222	50.5	1,744	33.7
Average household size	1.98	(X)	2.38	(X)
Average family size	2.38	(X)	2.81	(X)
HOUSING OCCUPANCY				
Total housing units	576	100.0	6,781	100.0
Occupied housing units	440	76.4	5,178	76.4
Vacant housing units	136	23.6	1,603	23.6
For seasonal, recreational, or occasional use	68	11.8	903	13.3
HOUSING TENURE				
Owner-occupied housing units	353	80.2	4,256	82.2
Renter-occupied housing units	87	19.8	922	17.8
EDUCATION, POPULATION OVER 25 YEARS	752	100.0	9,332	100.0
Less than HS Diploma	82	7	2,312	24.7
High school graduate (incl. equivalency)	158	21	2,921	31.3
Some college, no degree	195	26	2,113	22.6
Two or Four Year Degree	218	29	1,500	16
Graduate Degree	99	13.1	486	5.0
MEDIAN HOUSEHOLD INCOME	44,196	X	34,084	X
PERCENT OF FAMILIES BELOW POVERTY LINE		6.2		11.8
FAMILIES W/FEMALE HOUSEHOLDER, NO HUSBAND PRESENT, IN POVERTY		10.5		36.8

South Carolina, while losing many of its traditional fishing communities to coastal development in areas like Hilton Head and Murrells Inlet, still have a shrimping industry, even if it is not as robust as in years past. As of 2002, there were still 584 trawler licenses registered in the state (SCDNR, Personal communication, 2002). As can be seen in Table 3.2-25 there has been a slight decline since 1998 through 2001 in the number of federally permitted vessels in South Carolina.

Starting from the northern part of the state and moving south, the communities most engaged in shrimping are North Myrtle Beach (which can not be considered a fishing community, but is rather an artifact of where a dealer(s) is located), **Georgetown**, **McClellanville**, **Mount Pleasant (Shem Creek)**, **Charleston**, **Wadamalaw Island**, **Edisto Beach**, **Green Pond** (again believed to reflect dealer location and not a fishing community per say), **Ridgeland**, **Port Royal**, **Frogmore** and **Saint Helena Island**.

Table 3.2-25. Number of federal permits by type for South Carolina (Source: NOAA Fisheries 2002).

Type of permit	1998	1999	2000	2001
Total permitted vessels	127	132	121	113
Commercial king mackerel	60	68	64	65
Commercial Spanish mackerel	47	36	15	19
Commercial spiny lobster	4	3	4	2
Charter/headboat for coastal pelagics	36	36	33	37
Charter/headboat for snapper grouper	41	41	36	44
Snapper grouper class 1	66	89	72	86
Snapper grouper class 2	11	14	8	9
Swordfish	0	3	3	2
Shark	0	21	15	19
Rock shrimp	12	12	12	14

The distribution of trawler permits by homeport is shown in Table 3.2-26.

Table 3.2-26. Number of South Carolina trawler permits by homeport State (SCDNR 2002).

Homeport state	Number of permits
AL	1
FL	11
GA	63
NC	119
NY	1
PA	1
SC	388
TOTAL	**584**

Georgia

Georgia's coastline is winding and oftentimes still remote and quite rural. Most of the coastal development has come in the form of more upscale tourism and resort creation than the attractions geared to the middle-class that are more evident in Florida and South Carolina. One of the biggest threats to these small fishing communities comes from rising land values that increase property taxes for smaller wholesale seafood operations, eventually making it financially impossible to continue conducting business in coastal areas. For example, in the town of Brunswick, shrimp boats used to tie up regularly at the state-owned docks. This has recently changed, as this area will be developed as a yacht marina and accompanying condominiums.

However, the most recent data available on number and types of permits does not reflect what has been observed during fieldwork, and it could be that the data do not show a long enough time line to pick up changes in the state's fisheries. There are, as of 2002, 947 vessels with commercial fishing registrations, and of those, 601 that have registered shrimping gear (Table 3.2-27).

Table 3.2-27. Number of state permits by type for Georgia (Source: GADNR 2002).

Type	**Number**
Commercial fishing vessel registration	947
Vessels with shrimp gear	482
Full-time commercial fishermen	612
Part-time commercial fishermen	147

The distribution of permits by homeport state is shown in Table 3.2-28.

Table 3.2-28. Number of state shrimp net permits by homeport state (Source: GADNR 2002).

Alaska	1
Alabama	5
Florida	46
Georgia	385
North Carolina	74
South Carolina	73
Virginia	5
Unknown	1
Total	**601**

The number of federal permits in Georgia is shown in Table 3.2-29.

Table 3.2-29. Number of federal permits by type for Georgia (Source: NOAA Fisheries 2002).

Type of permit	**1998**	**1999**	**2000**	**2001**
Total permitted vessels	50	53	57	53
Commercial king mackerel	15	17	19	16
Commercial Spanish mackerel	11	10	11	8
Commercial spiny lobster	5	4	5	5
Charter/headboat for coastal pelagics	7	6	6	5
Charter/headboat for snapper grouper	6	5	5	4
Snapper grouper class 1	14	18	14	14
Snapper grouper class 2	1	6	2	2
Swordfish	0	0	0	0
Shark	0	5	5	4
Rock shrimp	22	25	28	29

The communities, towns and cities with the highest amounts of shrimp landings are: **Brunswick, Crescent, Darien, Meridian, Richmond Hill, Savannah, St. Marys, St. Simons Island, Townsend, Tybee Island and Valona.**

Florida

Florida's coast and the communities of the littoral have changed drastically since the time when shrimp trawls were first employed off the waters of Fernandina Beach. The population has grown ten to twenty percent in most coastal communities in just the last decade or so. Whereas the other states in the South Atlantic region are just at the beginning of their coastal development booms, the east coast of Florida has very nearly been fully developed.

While shrimp landings appear to still be high in Fernandina Beach, it has been recently reported (Tampa Tribune, 4/04/04) that the waterfront area where shrimp boats and fish houses were located has been declared "blighted", which will open up the area for redevelopment such as condominiums, tourist-oriented businesses, etc. One city planner is quoted that keeping shrimp boats there will be desirable, but most likely such boats will have to fit into the redevelopment plan.

The Mayport/Jacksonville area cannot be considered a fishing community, although the "neighborhood" seaport of Mayport (considered a part of Jacksonville) might be considered a fishing community.

Further south on the coast lies St. Augustine, which in the 1970s and 1980s was a large center for shrimp boats. Most boats now are in one marina, surrounded by sailboats and sportfishing vessels.

Cape Canaveral, in Brevard County, retains an industrial fishing zone atmosphere, and does not act as a residential fishing community per say, as there are just boats, docks, fish houses and a couple of processors located at the port. The fishermen, crew and workers live elsewhere.

Table 3.2-30. Number of federal permits by type for Florida east coast (Source: NOAA Fisheries 2002**).**

Type of permit	**1998**	**1999**	**2000**	**2001**
Total permitted vessels	3384	1949	2432	2311
Commercial king mackerel	1359	1216	1559	1519
Commercial Spanish mackerel	1540	1228	1479	1377
Commercial spiny lobster	574	457	532	498
Charter/headboat for coastal pelagics	790	275	397	417
Charter/headboat for snapper grouper	401	182	241	257
Snapper grouper class 1	83	564	676	641
Snapper grouper class 2	48	239	269	258
Swordfish	460	58	79	75
Shark	1039	212	251	242
Rock shrimp	167	149	176	167

The decline in numbers of commercial fishermen in Florida overall is well illustrated in both Tables 3.2-30 and 3.2-31 (includes Atlantic and Gulf coast Florida data)

Table 3.2-31. Summary of Florida state commercial saltwater licenses data. Source: Commercial Saltwater Licenses data, FWC Division of Marine Fisheries. 2000-2001, 2001-2002, & 2002-2003 from Oracle tables.*

License year	**Number of fishermen**	**Number of fishermen w/Restricted Species Endorsements (RS)**	**Number of Saltwater Products Licenses (SPL)**	**No. of SPLs with RS Endorsements**
1985-1986	17,739	0	18,239	0
1986-1987	19,007	0	19,510	0
1987-1988	22,901	1	24,435	1
1988-1989	23,107	1,913	24,851	2,242
1989-1990	23,876	5,074	26,148	6,214
1990-1991	19,250	6,191	21,412	7,672
1991-1992	17,974	6,618	20,180	8,219
1992-1993	17,194	6,482	19,385	8,188
1993-1994	18,147	6,698	20,544	8,579
1994-1995	17,354	7,532	19,754	9,497
1995-1996	16,178	8,045	18,374	9,919
1996-1997	15,521	8,114	17,710	9,973
1997-1998	14,884	7,981	17,094	9,909
1998-1999	13,996	7,605	16,173	9,528
1999-2000	13,126	7,183	15,425	9,207
2000-2001	12,495	7,693	14,947	9,923
2001-2002	11,468	7,682	13,834	9,928
2002-2003	11,073	7,662	13,496	9,985

* Note: 2002-2003 data are incomplete. Data extracted as of July 10, 2003.

As can be seen in Table 3.2-31 above, there has been an overall decrease in the number of commercial fishermen in Florida (east and west coasts) by approximately 38% since 1985. There has been a decrease of approximately 50% in the number of Saltwater Products Licenses from a high of over 26,000 in 1989-1990. Overall, commercial fishing in Florida is on the decline now, and that would also include shrimping.

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), Initial Regulatory Flexibility Analysis (IRFA), Regulatory Impact Review (RIR), Social Impact Assessment (SIA)/Fishery Impact Statement (FIS) and Biological Assessment (BA) are incorporated into the discussion under each of the proposed action items.

4.2 Alternatives for actions in Shrimp Amendment 6

The alternatives for each action are listed in Section 4.2.1 to Section 4.2.7 and are followed by five sub-headings: Biological impacts, Protected resources impacts, Economic impacts, Social impacts and Conclusion. These are self explanatory with the first four presenting the impacts of each alternative considered. The Council's rationale for accepting or rejecting the alternative and public comments on these alternatives are presented under the heading "Conclusion".

4.2.1 Action 1. Amend the Bycatch Reduction Device (BRD) Framework to adjust Council authority in regard to modifications of the BRD testing protocol.

Alternative 1 (Preferred). Modify the BRD framework procedure to remove the authority and procedural requirements of the Council to modify the BRD Testing protocol and transfer to NOAA Fisheries the authority to make appropriate revisions to the Protocol.

Alternative 2. No action. The BRD Testing Protocol would remain in the BRD framework under the authority of the Council.

Alternative 3. The Council would retain authority for the BRD framework to modify the BRD Testing Protocol, but would remove the statistical testing methodology established in the Protocol Manual, and transfer authority to establish appropriate statistical testing methodologies to NOAA Fisheries.

Discussion

A 1999 shrimp fishery stakeholders workshop sponsored by the Gulf and South Atlantic Fisheries Foundation, Inc., identified several issues with the current Protocol (Section 1.2). Several field-testing procedures prescribed in the Protocol were deemed to be too stringent. The logistic constraints imposed from these procedures prohibited successful completion of evaluations of experimental BRDs. In response, NOAA Fisheries developed alternative procedures that address and alleviate these impediments to testing and certifying new BRD candidates, while maintaining the statistical confidence that BRDs will meet the established bycatch reduction criteria and achieve the Council's goal of bycatch reduction.

Action 1 is an administrative action regarding the designation of authority to revise and amend various procedures prescribed in the Protocol. The intent is to identify and implement the most expedient means to modify the Protocol, whereby researchers could successfully evaluate experimental BRDs for certification. NOAA Fisheries has the authority to modify the Gulf of Mexico Protocol via proposed and final rule. By contrast, for the South Atlantic Shrimp FMP, the Council must take action through its framework procedure and a regulatory amendment to modify the Protocol. This is a lengthier process than a proposed/final rule procedure available to NOAA Fisheries for the Gulf of Mexico Protocol.

The Council initiated action to modify the current Protocol, but realized that, from an administrative standpoint, it might be more expedient to amend the BRD framework to allow NOAA Fisheries the authority to modify the Protocol as necessary. Transferring the authority to modify the BRD testing protocol to NOAA Fisheries would require removal of Section A(1) of the “Modification of BRD testing protocol and BRD certification criteria and requirements” section of the framework.

Alternative 1 would modify the current framework procedures of the FMP by transferring authority to modify the BRD Protocol from the Council to NOAA Fisheries. The Council would retain the ability to establish and modify the certification criteria. NOAA Fisheries would assume the responsibility to develop appropriate procedures by which to evaluate an experimental BRD. Prior to making any changes, NOAA Fisheries would consult with the Council and relevant advisory panels regarding the proposed changes. The state/fishermen cooperative testing would continue, and university and industry participation should be emphasized in the testing and sampling for BRD certification.

Under Alternatives 2 and 3, the Council would retain control of the procedures by which a BRD candidate is evaluated. Alternative 2 would not address any of the current issues identified in Section 3.1.10 regarding such field-testing procedures or the limitations of applying standard statistical procedures to the resulting data. Alternative 3 would allow NOAA Fisheries to design and/or change statistical analyses as appropriate. The other testing parameters would be revised by the BRD AP to reflect industry concerns, as necessary, for consideration by the Council.

4.2.1.1 Biological impacts

The action does not lead to a direct change in the way in which experimental BRDs are evaluated, nor directly affect the fishery. Therefore, there are no direct biological impacts from the action no matter which alternative is selected. BRDs certified for use in the fishery are documented to reduce the catch rate of weakfish and Spanish mackerel in shrimp trawls by 40%. Additionally, those BRDs reduce a substantial amount of other finfishes as well (Section 3.1.10).

In contrast to the other alternatives presented for this action, Alternative 2 would not address any of the identified impediments in the procedures prescribed to certify new BRDs, which could have negative consequences for conservation. Evaluations of particularly productive concepts may be delayed or evaluations could cease, and BRD efficiency might never rise above the current level. This contradicts the SAFMC’s stated intent to encourage innovative developments to improve BRDs and better address the requirements of National Standard 9 to minimize bycatch in the shrimp fishery to the extent practicable.

With the ability to modify the procedures prescribed in the Protocol through proposed and final rule, as proposed in Alternative 1, NOAA Fisheries would be able to implement modifications in a more timely fashion that would facilitate completion of a BRD evaluation.

Under Alternative 3, there is the possibility of creating a problem by dividing the authority for sampling and statistical procedures. Revisions to the BRD sampling procedures could create a data set that could not be appropriately analyzed by the statistical procedures established by NOAA Fisheries. At that point, NOAA Fisheries would have to concurrently revise their statistical procedures through separate proposed and final rules. This would not be an effective method of managing the Protocol.

As with the No Action alternative, if modifications to the sampling and certification procedures were deemed necessary for both the Gulf and South Atlantic Protocols, Alternative 3 would require the Council to take action through its framework procedure to provide compatible regulations, while NOAA Fisheries would modify the Gulf Protocol through proposed and final rule. This would not allow for timely and concurrent implementation of such actions for both Protocols.

Indirectly, the proposed revisions to the administration of the BRD protocol, intended to allow for more timely revisions to the procedures, would ultimately have positive impacts on the conservation of marine resources by improving bycatch reduction.

4.2.1.2 Protected resources impacts

Action 1 is an administrative action that will not have direct or indirect impacts on protected resources regardless of which alternative is selected.

4.2.1.3 Economic impacts

This action will not have any direct economic effects for fishery participants. Also, there would be no changes in direct economic benefits that accrue to society from living marine resources. As previously described, this measure determines whether modification of a process for certification of BRDs remains within the Council's administrative authority or whether this authority is transferred to the Secretary of Commerce.

Alternative 1 would allow NOAA Fisheries to implement necessary changes to the Protocol through the publication of a proposed and final rule. In contrast, if no action is taken (Alternative 2) alteration of any of the testing parameters would require the Council to take action through the framework procedure prior to the proposed and final rule stages. Even though Alternative 3 would resolve the current problem with the statistical testing methodology, framework action would be necessary to alter any of the other parameters in the Protocol. It is likely that this situation could arise in the future. Inclusion of a framework procedure for such administrative changes will involve additional Council and agency costs in the form of staff time and expenditures for Council meetings and document preparation. Thus, the administrative cost would be lower if Alternative 1 was adopted compared to the other two alternatives under consideration.

It is possible that this action could indirectly have an influence on the magnitude of future economic benefits. As described in Section 4.2.1.1 (biological impacts) the choice of Alternative 1 will facilitate a more timely completion of a BRD evaluation and most likely certification of more effective devices than those currently employed in the fishery. Increased escapement of non-targeted finfish species from shrimp nets could conceivably improve the yield of economically important fisheries populations and enhance diversity and stability of the ecosystem. These improvements in ecosystem services could engender higher future net economic benefits to participants in other fisheries and also increase non-use benefits to society. Similarly, any revisions that lead to the certification of a wider variety of BRD designs, and flexibility of choice for shrimpers, should provide greater economic benefits. Some BRD designs may perform better in specific environmental or other work conditions, and this flexibility would allow shrimpers to select BRDs based on specific fishing activity.

In contrast, the other two alternatives would not provide for a timely evaluation of the performance of new BRDs, and if Alternative 2 (no action) was chosen it is possible that evaluations could cease. Thus, the bycatch reduction capability of certified devices might never rise above the current level (Alternative 2) or improvements may be substantially delayed (Alternative 3). Both scenarios would not afford the same potential for increasing future indirect economic benefits from bycatch reduction as compared to Alternative 1.

4.2.1.4 Social impacts

There are no direct social impacts for fishermen or communities deriving from this action. However, each alternative is associated with indirect social impacts. Alternative 1, the Preferred Alternative, would have the most positive impacts of the three proposed alternatives in that it promotes timeliness, efficiency, and responsiveness to changes in the fishery and technological innovations. Hence, it follows the principle of adaptive management. By releasing the Council from the responsibility to evaluate or modify the testing Protocol, the entire process of testing new BRDs moves much faster through what can already be a slow and cumbersome regulatory process. However, once NOAA Fisheries has determined new testing procedures, they must still return to the Council for approval. There is, with Alternative 1, a built-in check and balance system that will help maintain scientific rigor. Continuing with cooperative research with all parties will enhance social relations between researchers, fishermen and managers.

Alternative 2, No Action, leaves the process more bogged down in the amendment timeline, which can be already slow, with some regulatory changes taking more than a year from scoping to implementation. This lengthy process would work to the detriment of the fishermen and the researchers, ultimately having biological impacts on the ecosystem (as noted above), and thus returning negative feedbacks to the fishery in general (e.g., potential lowered catch of finfish in fisheries other than shrimp).

Alternative 3 is similar to the No Action alternative, but NOAA Fisheries will be responsible for the statistical testing methodology of BRDs. This alternative, like Alternative 2, offers no significant benefit of timeliness or expediency to innovations coming from the industry or research organizations. One continuous complaint made by the public - both fishing and non-fishing stakeholders – is that the management agencies move too slowly in many cases and that this hurts the fishery in general.

Alternative 1 would address the perceived issue of timeliness, and the positive benefit of better relations between management and the public may occur.

4.2.1.5 Conclusion

The current specification of the statistical test is an impediment to evaluating and possibly certifying BRDs that are more effective at reducing bycatch in the South Atlantic shrimp fishery. Members of the South Atlantic Council's BRD Advisory Panel have reported that several new devices that are approved for use in state waters achieve greater finfish reductions than the devices certified for use in federal waters. For these reasons the Council considered a number of alternatives to address these concerns through deliberations with the BRD and Shrimp Advisory Panels. At subsequent meetings the Shrimp Committee narrowed the list of suggested solutions to the three alternatives described in Section 4.2.1.

Alternative 1, the Preferred Alternative, would modify the current framework procedures of the FMP by designating the authority to maintain and revise the sampling and statistical procedures to NOAA Fisheries. Currently, NOAA Fisheries can implement necessary changes to the Gulf of Mexico Protocol through the publication of a proposed and final rule. In contrast, if no action is taken (Alternative 2) alteration of any of the testing parameters would require a regulatory amendment. Except for the statistical testing methodology, the choice of Alternative 3 would require a regulatory amendment to alter the other testing parameters in the Protocol.

The Council evaluated these alternatives and determined that Alternative 1 was superior to the other two alternatives because there would be a reduction in administrative time and monetary costs from needed modifications to the Protocol. Alternative 1 also promotes efficiency and responsiveness to changes in the fishery and technological innovations. Public comments cited these reasons for supporting Alternative 1. The choice of Alternative 1 would indirectly yield greater biological benefits from the timely approval of devices that are more effective at reducing bycatch. Under these conditions there could be future social and economic benefits that indirectly accrue to participants in other fisheries. Similarly, any revisions that lead to the certification of a wider variety of BRD designs and flexibility of choice for shrimpers should provide greater economic benefits. Some BRD designs may perform better in specific environmental or other work conditions, and this flexibility would allow shrimpers to select BRDs based on specific fishing activity.

In contrast, the other two alternatives would provide for a less timely evaluation of the performance of new BRDs, and if Alternative 2 (no action) was chosen it is possible that evaluations could cease. Thus, the bycatch reduction capability of certified devices might never rise above the current level (Alternative 2) or improvements may be substantially delayed (Alternative 3).

Alternative 3 was recommended by the BRD AP. However, for the above stated reasons, the Shrimp Committee voted to recommend Alternative 1 as the preferred alternative at the March 2002 Council meeting. The Council was of the opinion that apart from the statistical test there may be a future need to modify other testing parameters in the Protocol and thus the same delays would be encountered in the certification of new and more effective devices if Alternative 3 was chosen.

In making their recommendation, Advisory Panel members were primarily concerned that in relinquishing control of the Protocol to NOAA Fisheries there would be little input from technical experts outside the agency. Also, the main reason given by the public for supporting the "no action" alternative was the concern that public input in this process would be diminished if authority for modifying the Protocol was turned over to NOAA Fisheries. To address the concerns raised by the Advisory Panels and the public, the Council suggested that the following recommendations be followed after authority for revising the Protocol is turned over to NOAA Fisheries:

1. Prior to modifying the Protocol, NOAA Fisheries would consult with the Council and relevant Advisory Panels regarding the proposed changes.
2. The state/fishermen cooperative testing would continue, and university and industry participation should be emphasized in the testing and sampling for BRD certification.

4.2.2 Action 2. Amend the Bycatch Reduction Device (BRD) Framework to adjust the criteria for certification of new BRDs.

Alternative 1 (Preferred). For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the total weight of finfish by at least:

Subalternative a. 22%
Subalternative b. 30% **(Preferred)**

Alternative 2. No action. For a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish and Spanish mackerel by 50% or demonstrate a 40% reduction in numbers of weakfish and Spanish mackerel.

Alternative 3. Remove Spanish mackerel as a target species from the BRD certification criteria. Thus, for a new BRD to be certified, it must be statistically demonstrated that such a device can reduce the bycatch component of fishing mortality for weakfish by 50% or demonstrate a 40% reduction in the numbers of weakfish.

<u>Discussion</u>
Amendment 2 established a requirement for the use of NMFS-certified BRDs in the penaeid shrimp fishery operating in the South Atlantic EEZ and a framework procedure whereby the Council could modify the certification criteria and the BRD testing procedures. The framework discusses two issues: (1) certification procedures including establishment of bycatch reduction criteria and (2) a means to modify: [a] the BRD testing protocol and [b] the BRD certification criteria. The Council is now considering modifications to the framework that would remove its authority to modify the BRD testing protocol.

To better address National Standard 9 of the Magnuson-Stevens Act and support the Council's efforts to achieve an ecosystem approach in fisheries management, the Council is considering a more generic approach to addressing bycatch reduction in the South Atlantic shrimp fishery (Alternative 1). National Standard 9 of the Magnuson-Stevens Act requires that "conservation and management measures shall, to the extent practicable: (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch" (16 U.S.C. § 1851(9)). Section 303 of the Magnuson-Stevens Act expands on this requirement somewhat, stating that fishery management plans are required to "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority (A) minimize bycatch; and (B) minimize the mortality of bycatch which cannot be avoided" (16 U.S.C. § 1853(11)).

Currently, the BRD Framework establishes criteria that BRDs must reduce the bycatch of Spanish mackerel and weakfish (Alternative 2). When these criteria were established, both species were considered overfished, and the implementation of a requirement for the use of BRDs in the shrimp fishery was intended to help rebuild both species.

Spanish mackerel and weakfish are no longer overfished. The 2003 Report of the Mackerel Stock Assessment Panel indicates that, for Atlantic Spanish mackerel, F/F_{MSY} (current fishing mortality in relation to a fishing mortality that would achieve MSY) was 0.58, and there is only a 3% chance that overfishing occurred in the 2002/2003 fishing year. The median estimate of B_{2000}/B_{MSY} was 1.78; in other words the stock is 1.78 times the size of the stock necessary to produce MSY. There is less than a 1% chance that the stock is overfished (MSAP 2003).

The 2002 NOAA Fisheries Report to Congress classified weakfish as not overfished and not approaching an overfished condition (NOAA Fisheries 2003b). From the perspective of the Atlantic States Marine Fisheries Commission (ASMFC), the most recent assessment for weakfish indicates that the current level of standing stock biomass is well above the proposed threshold level of 14,400 mt (31.8 million pounds) (Appendix F).

4.2.2.1 Biological impacts

A general finfish reduction criterion, such as is offered in Alternative 1, would allow more flexible testing of BRDs by not emphasizing a particular species. This would better address the requirements of National Standard 9 and support the Council's efforts to achieve an ecosystem approach in fisheries management. This is especially important in testing BRDs in areas where the target species are not concurrently available.

Alternative 1a, targeting a 22% general finfish reduction, is based on evaluations conducted in 1993 and 1994 by the Gulf and South Atlantic Fisheries Foundation, Inc. Various configurations of the fisheye BRD tested in the South Atlantic region were estimated to reduce total biomass in a shrimp trawl between 4 and 9%, and the weight of total finfish by 12 to 16%. The large mesh extended funnel was estimated to reduce total biomass by 12% and total finfish by 22% (Table 3.1-6).

Alternative 1b, targeting a 30% general finfish reduction, is based on more recent assessments of data from trials conducted in both the Gulf and South Atlantic. These new data were utilized in determining the effectiveness of BRDs for use in the eastern Gulf of Mexico (Table 3.1-8). Overall, the 12x5 fisheye is estimated to reduce the weight of total finfish caught between 31 and 44%, depending on the placement of the BRD in the trawl. The extended funnel BRD (as a combination of various configurations) is estimated to reduce the weight of total finfish caught by 38%. Based on these results, the Gulf of Mexico Fishery Management Council chose a 30% overall finfish reduction criteria to certify BRDs for use in the Eastern Gulf of Mexico (east of Cape San Blas, Florida).

Results of studies by the North Carolina Division of Marine Fisheries during the Bycatch Program of the mid-1990’s were similar to the overall results considered in the development of Gulf Shrimp Amendment 10. Results indicated substantial reductions in general finfish bycatch for BRD types subsequently approved in Amendment 2 for the South Atlantic. A fisheye was demonstrated to reduce the weight of total finfish bycatch by 48% (SAFMC 1996b), with a greater than 50% exclusion of common species such as croaker and spot (SAFMC 1996b). The large mesh extended funnel similarly demonstrated reductions in the weight of total finfish of approximately 55%.

Alternative 2 would impede future increased conservation benefits from finfish reduction. Because of identified logistic constraints imposed by the current certification criteria (Section 3.1.11). Further development of particularly productive concepts may cease, and BRD efficiency might never rise above the current level. This contradicts the Council’s stated intent to encourage innovative developments to improve BRDs and to best address the requirements of National Standard 9 to minimize bycatch in the fishery to the extent practicable.

Alternative 3 is specific in its attempt to maintain compatibility with Amendment 4 of the ASMFC weakfish plan, but it still addresses identified problems where both target species are not simultaneously available. However, given that weakfish and Spanish mackerel are not overfished, Alternatives 1a and 1b provide the greatest leeway in addressing and meeting the requirements of National Standard 9. Based on the results of extensive testing of the certified BRDs, the target of Alternative 1b is achievable, and would provide the greatest benefits in addressing and meeting National Standard 9.

4.2.2.2 Protected resources impacts

There are no direct or indirect impacts on protected species from Action 2 regardless of which alternative is selected. Bycatch of either marine mammals or seabirds is not known to be a problem in the South Atlantic shrimp fishery. Sea turtles and the smalltooth sawfish would not be affected by the use of a BRD, regardless of its certification, as they are not able to escape through a BRD.

4.2.2.3 Economic impacts

These alternatives set different standards for testing bycatch reduction devices and will not have a direct economic effect on participants and firms in the shrimp fishery. The choice of a general finfish bycatch criterion, as specified by Alternative 1a or Alternative 1b, may reduce the cost of testing BRDs since researchers would not have to locate areas where weakfish and/or Spanish mackerel are present. As reported by the BRD AP these species are not always present or abundant in all locations where the shrimp fishery operates. Also, due to the pelagic nature of Spanish mackerel it is somewhat of a challenge to capture this species in shrimp trawl gear even if it is abundant in the geographic locations where these tests are conducted. Thus, overall research costs may be higher if either Alternative 2 or 3 is chosen by the Council. However, compared to Alternative 2, research (administrative) costs may be lower if Alternative 3 is chosen by eliminating the requirement to encounter both Spanish mackerel and weakfish simultaneously.

It is expected that there is diversity in the composition of demersal species assemblages throughout the shrimping grounds in the South Atlantic. Linking the bycatch reduction criteria to a specific species (Alternatives 2 and 3) ultimately reduces the flexibility of testing new BRD designs in different geographic locations and may lengthen the time period for a new BRD to be tested and approved. Thus, Alternatives 1a and 1b may facilitate a more timely completion of a BRD evaluation. The choice of Subalternative 1a may allow for less effective BRDs to be certified than the currently approved devices for this fishery. It has been demonstrated from more recent tests that currently approved devices can reduce finfish bycatch by at least 30% (Section 3.1.10).

Certification and use of more effective BRDs that increased escapement of bycatch species could conceivably improve the yield of economically important fisheries populations and increase the diversity and stability of the ecosystem. These improvements in ecosystem services could engender higher future economic benefits to participants in other fisheries and also increase non-use benefits to society. Some BRD designs may perform better in specific environmental or other work conditions, and this flexibility would allow shrimpers to select BRDs based on specific fishing activity. Thus, any revisions that lead to the certification of a wider variety of BRD designs, and flexibility of choice for shrimpers, has the potential to provide greater indirect economic benefits compared to the status quo (Alternative 2).

4.2.2.4 Social impacts

As with Action 1, there will be no direct social impacts, negative or positive, resulting from Action 2. Any impacts to come from this action will be primarily indirect.

As noted previously, one of the inherent problems in the current testing Protocol is the variability presented when testing in a marine environment where environmental changes can occur rapidly and randomization is not necessarily possible. Furthermore, the current Protocol emphasizes two species of finfish to be “indicator” species of whether or not a BRD is effective in minimizing bycatch. This protocol, the No Action Alternative, is no longer in step with current estimates of the health of these two fishery stocks, weakfish and Spanish mackerel. Therefore, the No Action Alternative is not adaptive and creates an unnecessary burden on researchers and BRD developers by setting unreasonable testing standards. This can be considered to be a negative indirect social impact.

Similar results and impacts come from Alternative 3, which removes one indicator species from the testing protocol, but leaves the other – weakfish. This alternative, focusing bycatch reduction on only one or two species, denies the importance of a functioning ecosystem to healthy fisheries. Hence Alternative 3 would also have an indirect negative impact on the fishery in general.

Alternative 1, the preferred alternative, is more adaptive in that it recognizes the current societal and scientific trend of managing fisheries based on an ecosystem approach, not a species-specific approach. Furthermore, because this alternative focuses on an ecosystem approach, it may have a better reception among scientists. As for Alternative 1a or Alternative 1b, the approval of one or the other threshold will not have any notable social impacts, direct or otherwise.

4.2.2.5 Conclusion

Amendment 2 to the Shrimp Fishery Management Plan established the existing criteria that BRDs must reduce the bycatch of Spanish mackerel and weakfish. In 1996, when these criteria were established, weakfish was overfished and there was concern about the status of the Spanish mackerel stock. However, Spanish mackerel and weakfish are no longer overfished. Based on these arguments, the South Atlantic Council's Shrimp and BRD Advisory Panels recommended that The Council consider removal of the target species from the BRD certification criteria. As a result, the Council is evaluating the need to change the BRD criteria.

A general finfish reduction criterion, such as is offered in Alternative 1, would allow more flexible testing of BRDs in areas where the target species are not concurrently available. The Council set the specific finfish bycatch reduction level so that new devices would at least meet the reduction capability of the currently approved devices. The minimum standard for finfish bycatch reduction recommended by Alternatives 1a and 1b were demonstrated reductions from trials conducted utilizing Council approved devices (Section 3.1.10). Alternative 1b proposes a 30% reduction in the weight of all bycatch based on more recent trials conducted in both the South Atlantic and the Eastern Gulf of Mexico shrimping grounds. On this basis of compatibility between both regions, Alternative 1b would be superior to Alternative 1a. Furthermore, Alternative 1b is based on more recent testing and is a realistic goal that existing devices can meet. Members of the public supported this alternative because it would facilitate an ecosystem approach to fisheries management and increase efficiency.

The Shrimp Advisory Panel expressed some concern with Subalternative 1b for in their opinion more devices are likely to be certified if Subalternative 1a (22%) was chosen. However, since it has been recently demonstrated that devices presently certified for use in this fishery can meet the 30% bycatch reduction level (Section 3.1.10) and the use of these devices have passed the "test" of minimizing bycatch to the extent practicable (Section 3.1.12), the Council did not change their preferred.

Testing trials are conducted with nets that are rigged with TEDs and bycatch reductions measured would only represent reductions from the use of BRDs and not include any reductions from the use of TEDs (refer to Section 3.1.10 for a discussion of the "TED credit").

It must be noted that new BRDs certified using a general finfish standard will also reduce the bycatch of Spanish mackerel and weakfish if these species are encountered in the catch.

Alternatives 2 and 3 would not provide the same conservation benefits as Alternative 1 if they impede the certification of more effective BRDs. This contradicts the Council's stated intent to encourage innovative development to improve BRDs and to best address the requirements of National Standard 9 to minimize bycatch in the fishery to the extent practicable. Alternative 3 is specific in its attempt to maintain compatibility with Amendment 4 of the ASMFC weakfish plan and does address the problem where both target species are not simultaneously available.

Given that weakfish and Spanish mackerel are not overfished, Alternatives 1a and 1b provide the greatest leeway in meeting the requirements of National Standard 9. Based on the results of extensive testing of the certified BRDs, the target of Alternative 1b is achievable, and would provide the greatest benefits in addressing and meeting National Standard 9.

4.2.3 Action 3. Establish a method to monitor and assess bycatch in the South Atlantic rock shrimp and penaeid shrimp fisheries.

The Magnuson-Stevens Act requires the Council to establish a standardized bycatch reporting methodology for federal fisheries and to identify and implement conservation and management measures that, to the extent practicable and in the following order: (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided (16 U.S.C. 1853(a)(11)).

Alternative 1 (Preferred). Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology. Until this module is fully funded require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.

Alternative 2. No action. Utilize existing information to estimate and characterize bycatch.

Alternative 3. Adopt the Atlantic Coastal Cooperative Statistics Program Release, Discard and Protected Species Module as the preferred methodology.

Alternative 4. Require the use of a variety of sources to assess and monitor bycatch including: observer coverage on shrimp vessels; logbooks; state cooperation; grant funded projects; and federal penaeid shrimp permits.

Discussion
The Council chose Alternative 1 as their preferred alternative which would allow for the implementation of interim programs to monitor and assess bycatch in the South Atlantic shrimp fishery until the Atlantic Coastal Cooperative Statistics Program (ACCSP) Release, Discard and Protected Species (Bycatch) Module can be fully funded. The first phase of Alternative 1 and Alternative 4 would allow for the collection of bycatch information utilizing a variety of methods and sources when this amendment is implemented as follows:

1. Require that selected shrimp trawl vessels carry observers.
2. Require that a statistically valid sample of shrimp trawl vessels utilize logbooks to provide information on fishing effort and incidental take of protected or endangered species. Some vessels could also be selected for evaluation of electronic logbooks. In the shrimp trawl fishery, logbooks are not useful in reporting bycatch of species that are caught in large numbers. Logbook programs in the shrimp trawl fishery are better utilized in recording information on infrequently caught species and providing estimates of total effort by area and season that can then be combined with observer data to estimate total bycatch.

3. Utilize bycatch information collected in conjunction with grant-funded programs such as MARFIN and Cooperative Research Program (CRP). Require that raw data are provided to NOAA Fisheries and the Council.
4. Request that bycatch data collected by states are provided to NOAA Fisheries and the Council. Many states have collected data on shrimp bycatch in the past. Furthermore, some states may be currently collecting bycatch data through studies that are conducted in state waters.
5. Develop outreach and training programs to improve reporting accuracy by fishermen.

Alternative 1 differs from Alternative 3 in that Alternative 1 would implement Alternative 4 as an interim program (the first phase) until funds are available to fully implement the ACCSP Bycatch Module. On the other hand Alternative 3 would require the immediate implementation of the ACCSP bycatch module. The ACCSP is a cooperative state-federal program to design, implement and conduct marine fisheries statistics data collection programs and to integrate those data into a single data management system throughout the Atlantic. NOAA Fisheries, U.S. Fish and Wildlife Service, the Councils and the Atlantic coastal states are partners in this initiative. The bycatch module contains both quantitative and qualitative components. Refer to Appendix G for a detailed description of this program. The main elements that would apply to the shrimp fishery are summarized below:

1. The highest priority of the ACCSP bycatch module would be reporting of protected species interactions as well as releases and discards.
2. Reporting of protected species interactions (including threatened species and protected finfish species) would be mandatory.
3. The module would utilize at-sea observer coverage to collect bycatch and effort information from commercial fisheries. Vessels would carry at-sea-observers as a condition of permitting in commercial fisheries.
4. The minimum level of coverage would vary between 2% to 5% of total trips depending on the priority assigned to the respective fishery. For fisheries with a high bycatch potential, it is recommended that the target sampling level be set at 5% of total trips or at a level that achieves a 20-30% proportional standard error. Also, data would be collected at the haul level on each observer trip.
5. Pilot surveys can be used to determine the appropriate level of observer coverage to meet relevant management objectives.
6. Minimum data elements, an extensive set of sampling protocols and quality control/assurance procedures developed by the ACCSP would be used for at-sea observer programs.
7. Training programs, as well as certification of qualifications, would be provided for all new at-sea observers by the ACCSP and program partners.
8. Observer data would be utilized in combination with information obtained from fishermen.
9. ACCSP approved standardized data elements, sampling strategies, priorities and data management would be included in the commercial fishermen reporting system. For a description of the commercial fishermen reporting system please refer to Appendix H.
10. Required reporting of protected species interactions information is mandatory for the ACCSP commercial reporting system and is mandatory for the for-hire vessels that fall under the Marine Mammal Protection Act (MMPA) requirements. Reporting of discards or releases through the catch and effort reporting system is strongly encouraged, although voluntary for non-protected discards or releases of other marine organisms.

11. The ACCSP qualitative release, discard and protected species interactions monitoring program for commercial fisheries would include interviews by state and federal port agents to verify finfish reporting in the fishermen trip report as well as strandings and entanglements data.
12. All partners would develop outreach and training programs to improve reporting accuracy by fishermen.

Alternatives 1, 3 and 4 would be combined with the requirement for a federal shrimp permit proposed in Section 4.2.5, reporting on shrimp catch and effort data and other information necessary for management of the shrimp fishery. These data elements would provide better bycatch estimates in this fishery. A federal shrimp permit will assist in identification of participants in this fishery so that they can be targeted for data collection programs. The permit requirement will also ensure a higher level of compliance with data collection initiatives.

It must be noted that the Council's intent is for NOAA Fisheries to cover the cost of observers on shrimp vessels. If electronic logbooks are used in this program, it is the Council's intent that NOAA Fisheries cover the cost of purchase and installation of these units.

Alternative 2 (no action) would not initiate any new data collection initiatives for bycatch data collection. The Council/NOAA Fisheries would have to consider data that exists. For the South Atlantic shrimp fishery there are few existing data that can be used to estimate bycatch. The latest information on bycatch in the penaeid shrimp fishery was collected during 1994-1996. These data may not be reflective of the current conditions within the fishery since there may be changes in the composition of species assemblages over time and changes in fishing practices (such as the use of BRDs) that might alter catch composition. There is more recent data on the rock shrimp fishery collected through a pilot project to characterize the composition in this fishery (Section 3.1.10). Also, Alternative 2 would not allow for the long-term systematic monitoring of bycatch. Alternatives 1, 3 and 4 would initiate new collection efforts and methods to measure and monitor bycatch in the South Atlantic shrimp fishery.

4.2.3.1 Biological impacts

Alternatives 1, 3 and 4 provide the basic options available to the Council and NOAA Fisheries to monitor bycatch in the South Atlantic shrimp trawl fisheries. There are no direct biological impacts from establishing a standardized reporting methodology to estimate bycatch. However, indirect impacts resulting from Alternatives 1, 3 and 4 would provide a better understanding of the composition and magnitude of bycatch; enhance the quality of data provided for stock assessments; increase the quality of assessment output; provide better estimates of interactions with protected species; and lead to better decisions regarding additional measures that might be needed to reduce bycatch. Shrimp trawl gear can affect the abundance of species that are targeted by other fisheries. Furthermore, management measures that affect gear and effort for a target species can influence fishing mortality in other species. Therefore, enhanced bycatch monitoring would provide better data that could be used in multi-species assessments.

Alternative 2 (no action) would consider data that currently exists and not initiate new data collection efforts. However, existing data are limited and somewhat dated to be used to accurately quantify and characterize bycatch in the South Atlantic shrimp fishery. Bycatch sampling programs in the South Atlantic have not been continuous over time. The first integrated observer program was developed through cooperative efforts between the Gulf and Atlantic Fisheries Foundation, Inc. (Foundation) and NOAA Fisheries in 1992. However, this observer program did not adequately sample temporal and spatial strata in the South Atlantic. In addition, sampling of vessels was not random. Even with these weaknesses, bycatch estimates were determined for strata with observer coverage and expansion data. The latest data on bycatch in the penaeid shrimp fisheries in the South Atlantic were collected during 1992 to 1996 (NOAA Fisheries 1998). These data may not be reflective of the current conditions within the fishery since there could have been shifts in the composition of species assemblages over time and catch composition may be different due to changes in fishing practices. Also, Alternative 2 would not allow for comparable long-term monitoring of bycatch.

The ACCSP bycatch module (Alternatives 1 and 3), when funded, would collect information from living marine resources from Maine to Florida in estuarine, inshore and offshore waters. This module would have quantitative and qualitative data collection components. The quantitative component would include an at-sea observer program and collection of release/discard data through interviews with fishermen in port. The qualitative portion of the bycatch module would utilize sea turtle and marine mammal stranding networks, beach bird surveys, trend analyses and add-ons to existing recreational and for-hire intercept and telephone surveys. Reporting of protected species interactions and managed species data currently are the highest priorities under the ACCSP bycatch module. A Discard and Release Prioritization Committee will recommend priorities for the commercial, recreational and the for-hire fisheries on an annual basis. An ACCSP partner may require the mandatory reporting of any marine organism caught and released based on jurisdictional assessments or management requirements. Partners would provide outreach and training programs to improve reporting accuracy by fishermen.

The Release, Discard and Protected Species Module is one of a number of modules developed through the ACCSP. The order in which the ACCSP intends to implement the various modules are: (1) catch and effort; (2) biological; (3) bycatch, releases, discards and protected species; (4) quota monitoring; (5) economic; and (6) sociological. The ACCSP will emphasize the collection of catch and effort data and permit and vessel registration until all these modules become fully operational. The catch and effort module is considered to be critical to stock assessments and has the highest priority for implementation. With the addition of trip level reporting in South Carolina, all four South Atlantic states (North Carolina, South Carolina, Georgia and Florida) now have trip level reporting. These partners in the ACCSP have implemented the catch and effort module. A partner such as NOAA Fisheries can implement the methods described in the ACCSP bycatch module if the necessary resources are available.

The Magnuson-Stevens Act requires that each FMP include methodology that would provide for bycatch reporting when the FMP is implemented. The first phase (or pilot program) of Alternative 1 and Alternative 4 would utilize data from a variety of sources including observers, logbooks, grants and states to assess and monitor bycatch. Congressional amendments in the 1990s to the Magnuson-Stevens Act prompted the development of a multi-year, multi-organizational shrimp trawl bycatch research program to identify and minimize the impacts of shrimp trawling on federally-managed species in the Gulf of Mexico and South Atlantic. The primary objectives of this program have been to provide data from an at-sea observer program on species composition and bycatch reduction device (BRD) effectiveness in finfish reduction and shrimp retention during commercial shrimping operations. When the program was implemented in 1992, Congressional funds were allocated between the Gulf of Mexico and South Atlantic in proportion to shrimp landings in the respective areas. However, in recent years, most funds have been used in the Gulf of Mexico due to concern about red snapper bycatch in the Gulf of Mexico shrimp trawl fishery. The first stage of Alternative 1 and Alternative 4 would allocate available Congressional funds in proportion to landings (80% Gulf and 20% Atlantic) as was done in the early years of the program. For example, if Congressional funds allocated for observer coverage on shrimp trawl vessels in the Gulf of Mexico and South Atlantic was $800,000, using the current estimation of at-sea observer rates to be $1,000/day, this would equate to 160 days at sea allocated to the South Atlantic region.

Research funds for observer programs, as well as gear testing and testing of electronic devices are also available each year in the form of grants from the Foundation, Marine Fisheries Initiative (MARFIN), Saltonstall-Kennedy (S-K) program and the Cooperative Research Program (CRP). Efforts shall be made to emphasize the need for observer and logbook data in requests for proposals issued by granting agencies. A condition of funding for these projects is that data are made available to the Councils and NOAA Fisheries upon completion of a study.

Data collected from at-sea observer programs are considered to be the most reliable method for estimating bycatch if coverage is adequate to avoid large sampling errors and there is little “observer effect” (where fishing operations are altered in the presence of an observer). Unfortunately, observer programs are expensive. However, when observer data are combined with reliable estimates of total fishing effort that can be inexpensively obtained from logbooks, bycatch rates from observer data can be used to more reliably estimate total bycatch levels in a fishery.

The first phase of Alternative 1 and Alternative 4 would also obtain fishing effort information as well as protected species interactions via a logbook. A statistically valid subset of vessels, determined from the universe of vessels identified though the requirement for a federal shrimp permit, would be required to complete a logbook that included information on vessel and gear detail. For each tow, information would be recorded on date, location, time, catch in pounds and nature of catch (tails or heads on). In addition, information would be collected on protected species interactions. The key advantage of logbooks is the ability to use them to cover all fishing activity relatively inexpensively. However, in the absence of any observer data, there are concerns about the accuracy of logbook data in collecting bycatch information. Biases associated with logbooks primarily result from inaccuracy in reporting of species that are caught in large numbers or are of little economic interest (particularly of bycatch species), and from low compliance rates. Many fishermen may perceive that accurate reporting will result in restricted fishing effort or access. This results in a disincentive for reporting accurate bycatch data and an incentive to under-report or not report. Therefore, logbook programs are more useful in recording information on infrequently caught species and providing estimates of total effort by area and season that can then be combined with observer data to estimate total bycatch.

In the future, it may be possible to implement electronic logbooks in the fishery. Electronic logbooks have been tested in the Gulf of Mexico penaeid shrimp fishery to examine the magnitude and spatial distribution of fishing effort (Gallaway *et al.* 2003a, b). Similar work would be appropriate for the South Atlantic shrimp fishery. Electronic logbooks can collect fishing effort data more easily, accurately and in a more timely fashion than paper logbooks. Gallaway *et al.* (2003a, b) used an electronic logbook that consisted of a global positioning system (GPS) that was interfaced to a microprocessor and a read-only memory circuit. It was powered by either a 110-V transformer producing 12 V or by a group of 12-V batteries. The system was able to detect tow times and position. Electronic logbooks have the potential to automatically collect information on date, time, location and tow times. Catch in pounds, nature of catch and bycatch (particularly protected species) could be manually entered into the system at the end of a tow. If the electronic format prompts a fisherman to record data as bycatch occurs, an electronic logbook may provide better estimates of bycatch than a paper logbook. However, for electronic logbooks, like paper logbooks, biases may result from inaccuracy in reporting of species that are caught in large numbers or are of little economic interest. In the shrimp trawl fisheries, electronic logbooks may be more useful for recording bycatch of infrequently caught species and estimating fishing effort that can be combined with observer data to estimate total bycatch.

Many states have collected data on shrimp bycatch in the past and some may be currently collecting bycatch data through studies conducted in state waters. It is possible that data from these studies have not been analyzed, or have been summarized through in-house reports or have not been made available to the public. The Council and NOAA Fisheries will request that states provide any available bycatch data from the shrimp trawl fishery.

4.2.3.2 Protected resources impacts

There are no direct impacts on protected resources from establishing a standardized reporting methodology to estimate bycatch in Alternatives 1, 3 and 4. However, indirect impacts of Alternatives 1 and 3 would include better estimates of protected species interactions that would allow for better decisions regarding the need for additional measures necessary to reduce interactions.

Alternative 2 (no action) would consider data that currently exists and not initiate new data collection efforts to assess the impact of shrimp trawl gear on protected resources. Current efforts include observer programs and the Marine Mammal Authorization Program (MMAP) as mandated by the Marine Mammal Protection Act (MMPA). Since 1992, an observer program has been in place for the southeastern penaeid shrimp otter trawl fishery to characterize shrimp trawl bycatch and evaluate various gear types for bycatch reduction. Currently, approximately 1,000 annual days at sea are allotted. The estimated level of observer coverage is less than 1% of trips. From February 1992 through December 2003, a total of 12,749 sea days was completed; approximately 88% of these days were in the Gulf of Mexico, with 12% targeting waters off the east coast. In 2001, NOAA Fisheries initiated an observer program for the rock shrimp fishery operating in the southeastern Atlantic. The primary objective of this effort is to estimate catch rates for target and non-target species by area, season and depth. Current allotted annual days at sea are 100. Participation by industry is voluntary. The MMAP has as its primary focus the self-reporting of marine mammal bycatch. The MMAP requires that any fisherman participating in a state or federal fishery that operates in U.S. waters report all injuries and mortalities of marine mammals associated with fishing operations to NOAA Fisheries within 48 hours of returning to port.

The 2002 shrimp Biological opinion requires that NOAA Fisheries monitor on-going as well as new projects aimed at determining the catch rate of sea turtles in the shrimp fishery. Monitoring of turtle mortality rates is also required. NOAA Fisheries continues to use observer, stranding and other available data to monitor and assess protected species interactions with this fishery. The ACCSP bycatch module (Alternatives 1 and 3) would further this effort. ACCSP requires mandatory reporting of protected species interactions for the ACCSP commercial reporting system and for the for-hire vessels (such reporting is currently required for marine mammals under the MMPA). The ACCSP bycatch module also incorporates information from sea turtle and marine mammal stranding and entanglement networks, beach bird surveys and establishes mandatory reports from real time reporting programs. Reporting of protected species interactions and managed species data currently are the highest priorities under the ACCSP bycatch module.

The first phase of Alternative 1 and Alternative 4 would utilize data from a variety of sources including observers, logbooks, grants and states to collect data on protected resources. Paper logbooks would be required for a statistically valid portion of the fishery that would include collection of effort data as well as information on the take of protected resources. Through various grants, funds may become available for the testing and development of electronic logbooks as well as collection of observer data that would not only provide effort information but also data on the take of any protected species.

4.2.3.3 Economic impacts

The no action alternative (Alternative 2) would consider data that currently exists and would not represent any additional economic burden to the shrimp fishery with respect to collecting information on bycatch. Alternatives 1, 3 and 4 would include an at-sea observer program. NOAA Fisheries would absorb the cost of an observer program if Alternatives 1, 3 or 4 is implemented. Selected vessels would require Coast Guard certification that might pose an economic burden if repairs are required for certification. Also fishermen may realize an economic benefit if they are compensated for the food that the observer will consume, offered an economic incentive above what it costs to carry an observer and liability insurance is provided by the observer.

The ACCSP program requires observer coverage on 2 to 5% of all trips or a level that provides a 20-30% proportional standard error in bycatch estimation. The average number of fishing trips on which shrimp were caught in 2000 through 2002 is estimated at 36,516 for the South Atlantic (Table 3.2-1). Hence, observers would participate on 730 to 1,826 trips. An average of 1,898 vessels participated in the South Atlantic shrimp fishery during 2000 to 2002 (Table 3.2-1). Thus, observer coverage would range from 38 to 95 vessels in any given year.

The cost of an observer program ranges from $350 to $2,000 per sea day and averages $1,000/day (NOAA Fisheries 2003c). Assuming one-day trips and a cost of $1,000/day, observer coverage on 2 to 5% of all trips could cost from $730,000 to $1,826,000 per year when the ACCSP discard module is implemented. Costs would probably be higher since there are also multi-day trips.

The first phase of Alternative 1 and Alternative 4 requires that selected shrimp trawl fishermen use logbooks to collect data on bycatch. The time necessary to complete these tasks might be burdensome to some vessel operators.

A shrimp logbook form was developed in the Summer 1998 Gulf Red Snapper/Shrimp Research Program. This form could serve as a template for a logbook program in the South Atlantic shrimp fishery. Based on that form, potential data elements could include, but would not necessarily be limited to: vessel name, vessel identifier, number of nets, type of net, size of net, type of bycatch reduction device, number of tows, length of tows (in hours), location (either in terms of latitude and longitude or statistical area and depth) and an estimate of catch. The form would be completed on a daily basis. According to the Paperwork Reduction Act clearance package for this data collection program, it was anticipated that shrimp fishermen would need 10 minutes to complete each daily logbook form.

With respect to the South Atlantic shrimp fishery, only the Florida trip ticket program collects information on trip length, and such information is only reported for a subset of trips. Nonetheless, based on the available data for 2002, the median length of a shrimp trip on the Florida east coast was 3 days. [The mean value is 5.2 days. However, since the standard deviation is 5.48 days and the trip length data is highly skewed (i.e., not normally distributed), the median value is more representative of the true "average" in this case.] As reported in Table 3.2-6a, in 2002, 573 vessels took 11,771 shrimp trips on the Florida east coast, which yields an average of 20.5 trips per vessel. On a per vessel basis, this yields an average of 61.5 fishing days per year. Given the estimate of 10 minutes per day to complete a logbook form, each vessel's annual reporting burden would be 615 minutes, or 10.25 hours. For the fishery as a whole, given that there were approximately 1,731 vessels in the fishery during 2002 (see Table 3.2-1), the annual time burden for the fishery would be approximately 17,742.75 hours.

From an economic perspective, there is an opportunity cost associated with any time burden created by additional reporting requirements. Typically, opportunity cost is approximated using the average wage or salary of the affected persons. Since vessel owners/captains would be responsible for submitting the logbook forms, it would be most appropriate to use the average wage of first line supervisors/managers in the fishing, forestry and farming industries. As of May 2003, which is the most currently available information, the Bureau of Labor Statistics reported that the mean wage of persons in this occupation group was $18.14.

Therefore, the average annual opportunity cost per vessel of the logbook reporting requirement would be approximately $185.94 ($18.14/hour * 10.25 hours). For the fishery as a whole, the average annual opportunity cost would be approximately $321,862 ($185.94/vessel * 1,771 vessels). This estimate for the fishery as a whole assumes that logbooks would be required for all vessels. If only a sample of vessels is selected to report, the burden estimate would be less and dependent on the chosen sampling rate. For example, if 10% of the vessels were required to report (i.e., approximately 177 vessels), then the annual opportunity cost for the fishery would be approximately $32,911.

A federal shrimp permit will assist in identification of participants in this fishery so that they can be targeted for data collection programs and determination of the number of vessels that would be required to use logbooks. The ACCSP includes an observer training component which could be provided in a manner that would not affect fishing operations or time spent on boat maintenance.

The advantage of logbooks as compared to other sampling methods is that logbooks are usually required of all fishery participants, can provide good estimates of fishing effort and are much less expensive than observer programs. Furthermore, logbooks that are completed at sea may provide better estimates of catch/effort than state collection programs that are completed at the end of a trip. Reliance on catch/effort data when a fisherman returns to port has the potential for greater errors and inconsistencies since the information is dependent upon the memory of an individual after a long trip. The costs of logbooks usually include production and distribution, data entry, database maintenance and analysis. Therefore, the cost of collecting bycatch data via logbooks is marginal and may be limited to costs associated with the entry and analysis of the bycatch data. The cost of electronic logbooks would be greater than that of paper logbooks. For example, Gallaway *et al.* (2003) used an electronic logbook that cost less than $500. If or when an electronic logbook is required, costs could be absorbed by NOAA Fisheries. For the purposes of accuracy, landings of shrimp and bycatch (protected species) data would need to be entered at sea and might require time the crew would otherwise have spent doing routine tasks on the vessel and equipment. However, in most cases, just landings data would be entered since interaction with protected species should be a rare event. Additionally, electronic logbooks are able to capture some data automatically which would reduce the burden on fishermen.

Through funding from the Southeast Science Center, as well as federally funded grants, observer data would be collected along the southeast United States. The first stage of Alternative 1 and Alternative 4 would allocate available Congressional funds in proportion to landings (80% Gulf and 20% Atlantic) as was done in the early years of the program. For example, if Congressional funds allocated for observer coverage on shrimp trawl vessels in the Gulf of Mexico and South Atlantic was $800,000, using the current estimate of at-sea observer rates to be $1,000/day, this would equate to 160 days at sea allocated to the South Atlantic region.

The minimum amount of observer data needed to estimate bycatch is a function of the magnitude of catch/effort data collected via paper or electronic logbooks and temporal/spatial variability in observer bycatch data. Data from observers would be combined with catch/effort data from logbooks and then expanded to estimate bycatch in the whole region. The target precision would be 20-30% proportional standard error (the ACCSP specified level). It will not be possible to estimate a statistically valid number of fishermen needed to participate in logbook and observer programs until the universe of participants is identified and preliminary data are analyzed. However, the minimum observer level (when combined with effort data) could be substantially less than what is proposed when the ACCSP discard module is fully funded (the final phase of Alternative 1 and Alternative 3). A federal shrimp permit will identify the universe of participants in this fishery so that the minimum observer coverage (tied to logbook catch/effort data) can be determined. NOAA Fisheries would cover the costs for the logbook and observer programs. Therefore, the cost to participants and the industry should be minimal.

Alternatives 1, 3 and 4 would provide current data on the composition and magnitude of bycatch in the penaeid and rock shrimp fisheries. Improvements in information could determine if current measures to reduce bycatch are effective and alert the Council to the need for additional or alternative measures to reduce bycatch in the penaeid and rock shrimp fisheries. More effective bycatch reduction measures would probably provide economic and ecological benefits for the fisheries that are affected by this bycatch mortality. Also, collection of bycatch data that improves stock assessments for species that are incidentally caught in shrimp trawls would allow for better-informed management decisions. The latter should also increase economic benefits since regulations would have a higher probability of achieving biological and economic goals. These benefits would not be realized from Alternative 2 since the data on bycatch for the penaeid shrimp fishery are dated and the research results described in Section 3.1.8 are reflective of the shrimp fishery prior to the requirement for BRDs in the penaeid shrimp fishery.

4.2.3.4 Social impacts

Alternative 2 (No Action) would consider data that currently exists and might not contain any direct social impact to the shrimp fishery with respect to collecting information on bycatch. However, as there are few data available on bycatch and available data are not always reliable, this alternative could be detrimental to the fishery. Should there be doubt about the health of the fishery, the damage shrimp trawling may be inflicting on other species or habitat, the Councils and NOAA Fisheries should adopt a precautionary approach. It is conceivable that better data would allow for less onerous restrictions on the fishery, which may have more significant social impacts.

Alternatives 1, 3 and 4 would include an at-sea observer program. While observer programs are an intrusive data collection system, a majority of fishermen interviewed in the past four years (Kitner, personal communication 2004) have expressed a desire to carry observers on their boats. They want to be a part of the research process, show people how they work and demonstrate their knowledge. Fishermen claim that they are frequently ignored by scientists and managers, who fishermen believe should spend more time on the water. However, an observer program, to be successful, should be sensitive to cultural traditions, as well as the type and size of the vessel. Some fishermen may be resentful if an observer program is mandatory. Some of this animosity may be lessened if fishermen are adequately compensated in some form (monetary, social capital, cooperation in research, etc.) for carrying observers and if the observers are well trained, have experience on sea-going vessels, get along with fishermen and are not perceived as a burden. A well designed training program for *both* observers and fishermen would enhance the success of an observer program. It would also enhance data collection in general. Observers could also be trained to gather basic social and economic data and expand the knowledge of this important aspect of fisheries. Outreach and training programs (Alternatives 1 and 3) could engender better working relationships between fishermen, agency and management personnel.

In addition to observer data, Alternatives 1, 3 and 4 could require the use of paper logbooks and/or electronic logbooks to collect data on bycatch. There is a probability that at least some captains and crew would not want to participate in logbook programs. This could result in animosity toward fishery managers for the increased burden could result in the inaccurate reporting of fishing effort or interactions with protected resources. However, the outreach and training component of the ACCSP may lessen this problem.

Even if fishermen are willing to participate in a logbook program, they may not possess the correct information when they fill out logbooks. Fieldwork observations and interviews have shown that many fishermen that are currently required to fill out logbooks do so after they return from fishing, or have the fish house fill out the logbook for them. This practice can lead to poor data collection. Part of this problem could be overcome with an electronic logbook that would automatically collect effort information including vessel location, date and speed.

4.2.3.5 Conclusion

Alternative 2 (no action) would consider data that currently exists and would not initiate new data collection efforts. The BRD AP recommended that the Council/NOAA Fisheries should consider data that exists and not initiate new data collection efforts. From the public comments received it was clear that members of the commercial shrimp industry supported this alternative because they were concerned about: additional and unnecessary paperwork burden from the logbook requirement since the state collects information on catch and effort; the downtime from having observers on board which would be especially onerous for small vessels; and the cost of observers (some respondents failed to realize that NOAA Fisheries would bear the cost of an observer program if either Alternative 1, 3 or 4 is implemented). For the South Atlantic shrimp fishery there are few existing data that can be used to estimate current levels of bycatch. The latest information on bycatch in the penaeid shrimp fishery was collected during 1992-1996. These data may not be reflective of the current conditions within the fishery since there could have been shifts in the composition of species assemblages over time and changes in fishing practices that might alter catch composition. Therefore, this alternative would not allow for long-term monitoring of bycatch. Furthermore, this alternative is not compliant with Section 303(a) of the Magnuson-Stevens Act.

Alternatives 1, 3 and 4 would initiate new collection efforts and methods to measure and monitor bycatch in the South Atlantic shrimp fishery. When compared to Alternative 2, Alternatives 1, 3 and 4 would provide a better understanding of the composition and magnitude of bycatch; enhance the quality of data provided for stock assessments; increase the quality of assessment output; provide better estimates of interactions with protected species; and lead to better decisions regarding additional measures that might be needed to reduce bycatch. There are no direct biological impacts from establishing a standardized reporting methodology to estimate bycatch. However, indirect impacts of Alternatives 1, 3 and 4 would include a better understanding of the composition and magnitude of bycatch, enhanced data quality for stock assessments, increased quality of assessment output, better estimates of interactions with protected species and better decisions regarding the need for additional measures that might be needed to reduce bycatch.

Alternatives 1 and 3 would adopt the ACCSP Bycatch Module to collect bycatch data, however, it is unknown when funds will be sufficient to fully implement the module. The first phase or pilot study of Alternative 1 and Alternative 4 would utilize bycatch and effort information from a variety of sources including observer coverage on shrimp vessels, logbooks, state data, grant funded projects and federal penaeid shrimp permits to assess and monitor bycatch.

The direct economic costs and social effects to the shrimp industry are expected to be minimal from implementation of the preferred alternative. Indirect economic and social effects would likely accrue from management measures linked to improvements in biological assessments. The Council chose Alternative 1 as the preferred alternative since this would allow for an interim program to monitor and assess bycatch in the South Atlantic shrimp fishery until the ACCSP program can be fully implemented. The ACCSP program is expected to provide comprehensive data on bycatch in the penaeid and rock shrimp fisheries. Public comments that provided support for this alternative indicated that fishery managers should use all means available to characterize discard mortality in these fisheries to assess its impact on finfish populations.

4.2.4 Action 4. Minimize bycatch in the rock shrimp fishery to the extent practicable

The Magnuson-Stevens Act requires the Council identify and implement conservation and management measures that, to the extent practicable: (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided (16 U.S.C. 1853(a)(11)). Section 3.1.12.2.1 summarizes available data on the composition and magnitude of bycatch in the South Atlantic rock shrimp fishery. The analysis in Section 3.1.12.2.2 concludes that existing regulations in that fishery do not minimize bycatch to the extent practicable. A number of factors, including the sheer volume of the bycatch, species variability, low value of most of the bycatch and the marketability of the bycatch fish, make it unprofitable to retain and utilize bycatch taken in the shrimp fishery. Consequently, the preferred solution of NOAA Fisheries is to avoid bycatch (Nance 1998). The following alternatives are based on this policy.

Alternative 1 (Preferred). Require a NOAA Fisheries-approved BRD be utilized on all rock shrimp trips in the South Atlantic.

Alternative 2. No action. Do not adopt additional measures to reduce bycatch in the rock shrimp fishery.

Alternative 3. Implement a seasonal closure in the rock shrimp fishery.

Subalternative a. Fall (September, October, November)
Subalternative b. Winter (December, January, February)
Subalternative c. Summer (June, July, August)

Discussion
Alternative 1 would require that all rock shrimp vessels utilize NOAA Fisheries-approved bycatch reduction devices on all trips where rock shrimp are caught. Many of the vessels that operate in the rock shrimp fishery also participate in the penaeid shrimp fishery. Currently, BRDs are required when the proportion of penaeid shrimp in the catch exceeds 1% of the total catch. On trips where rock shrimp are caught the catch of penaeid shrimp may exceed 1% and use of a BRD would be required. In many cases, rock shrimp and penaeid shrimp are targeted on the same trip and some vessel captains may continue to operate nets with BRDs while targeting rock shrimp.

Alternative 2 would not require the Council adopt additional measures to reduce bycatch in the rock shrimp fishery. The Council took action to establish a limited access program for the rock shrimp fishery that went into effect during 2003. To date, 145 limited access endorsements have been issued to vessel owners.

It is expected that the limited access program will reduce effort and bycatch since permits were not issued to low volume producers in this fishery (SAFMC 2002). Previous actions taken to close areas to rock shrimp trawling may have also reduced effort and bycatch in this fishery. These areas, established by Amendment 1 to the Shrimp Plan, the Habitat Plan and the Coral Plan were productive areas for rock shrimp harvesting. Furthermore, compliance with these closed area restrictions is expected to improve with the requirement for vessel monitoring systems in this fishery that took effect in October, 2003.

Instead of the requirement for BRDs, Alternative 3 proposes a seasonal closure for the rock shrimp fishery based on preliminary information from a pilot study conducted in 2002 that included observer coverage (Section 3.1.9). Alternative 3 has three options based on the seasonal classification used in the rock shrimp pilot study report (Appendix C). Alternative 3a would require that the fishery be closed from September through November (fall season). During this fall season finfish comprised 54% of the total catch. Alternative 3b suggests a closure in the winter months when finfish comprised 64% of the total catch. Alternative 3c would close the fishery during the most productive time period when observed finfish catch rates averaged 53% of the total catch.

4.2.4.1 Biological impacts

The requirement for BRDs (Alternative 1) is expected to reduce bycatch in the rock shrimp fishery. Rock shrimp fishermen have reported that some fishermen use BRDs in the rock shrimp fishery. However, there are no data on the number of fishermen who use these devices or the actual number of trips on which these devices were employed. Vessels in the rock shrimp fishery participate in the penaeid shrimp fishery and therefore, by law, would currently utilize BRDs on trips where the catch of penaeid shrimp is expected to exceed 1% of the total catch. Examination of the rock shrimp catch and effort data from 2000 to 2002 reveals that most rock shrimp trips exceed this threshold and it is assumed that BRDs were used on these trips (Table 4.2-1).

Alternative 1 will further reduce bycatch in this fishery because BRDs would now be required on all rock shrimp trips. It is assumed that, because they are not required, BRDs are not used on trips if the penaeid shrimp catch is less than 1% of the total catch. The requirement for the use of BRDs, as proposed by Alternative 1, will reduce bycatch on an estimated 113 shrimp trips annually (Table 4.2-1).

The bycatch reduction capability of currently approved BRDs in the rock shrimp fishery is unknown. The BRD research program described in Section 3.1.10 did not include gear trials in this fishery. It has been demonstrated that approved BRDs can reduce the biomass of finfish bycatch by 30% in the penaeid shrimp fishery (Section 3.1.10). The NOAA Fisheries pilot study on the rock shrimp fishery observed trips where BRDs were used. In the future, this ongoing observer study will include additional trips to determine the effect from utilizing BRDs in the rock shrimp fishery under “standard operating conditions”.

The actual bycatch reduction from the seasonal closure options specified by Alternative 3 will depend on the finfish catch per unit effort and the level of effort in the rock shrimp fishery during the closure period. The highest level of effort in this fishery occurs in the summer and fall seasons (Table 3.2-10c). It is clear that the highest incidental finfish catch rate was observed during the winter season (Section 3.1.9). This observer program was carried out during an atypical year for this fishery when catches of rock shrimp were especially low (Section 3.2.3.2). Finfish catch rates and composition could be dissimilar under “normal” conditions. Future results from this ongoing study will allow for these more realistic comparisons.

Compared to Alternatives 1 and 3, Alternative 2 would not affect any additional reduction in bycatch in the rock shrimp fishery. There would be bycatch reduction from those vessels that keep their penaeid shrimp catch in excess of 1% of their total catch and thus are required to use BRDs.

The biological benefits of bycatch reduction can be evaluated from two different perspectives. The first evaluation criterion would be whether escapement of finfish aids in the recovery of individual species as discussed in Section 3.1.12.2.2.1. Little is known about the status of common finfish species (e.g., dusky flounder, inshore lizardfish, spot and red goatfish) and invertebrate species (e.g., iridescent swimming crab, longspine swimming crab and blotched swimming crab) that are most common in rock shrimp trawl bycatch. None of these species have undergone (or are likely to undergo) formal stock assessments because most, with the exception of spot, are not targeted in commercial or recreational fisheries. Data are inadequate to conduct a formal, coast-wide assessment of spot. But fishery managers believe that a combination of BRD and minimum size limit requirements would be sufficient to protect this stock until such an assessment can be completed (ASMFC 2004d).

The other concern is the ecological effect from reducing this incidental catch. In the case of rock shrimp there are no data or relevant analyses to shed light on the ecosystem effects of changing the species composition from reduction of bycatch mortality. Section 3.1.12.1.3.2 summarizes available information on how bycatch can affect ecological functions, particularly interactions between predator, prey and competitor species.

4.2.4.2 Protected resources impacts

There are no direct impacts on marine mammals or seabirds from Action 4 and its alternatives as bycatch of either of these groups is not known to be a problem in the South Atlantic rock shrimp fishery. Alternative 1, requiring the use of a NOAA Fisheries approved BRD would not affect incidental capture of sea turtles and the smalltooth sawfish as they are not able to escape through a BRD. Though there may be a potential for interaction between rock shrimp trawling and smalltooth sawfish there has been no observed take in the rock shrimp fishery.

Alternative 2, no action, would not have a direct impact on sea turtles. Incidental take and mortality of sea turtles as a result of trawling activities have been documented along the Atlantic Ocean seaboard; however, federal regulations under the ESA require rock shrimp trawlers operating in the South Atlantic to have a NOAA Fisheries approved TED installed in each net that is rigged for fishing to provide for the escape of sea turtles. Data show that smalltooth sawfish can occur in deeper waters (greater than 230 ft) and thus may be potentially affected by rock shrimp trawling activities. However, given smalltooth sawfish are much rarer at such depths and in northern Florida where rock shrimp fishing occurs, interactions are not very likely.

Seasonal closures proposed under Alternative 3 might provide protection for smalltooth sawfish by reducing the amount of trawl gear in the water thus reducing the potential for trawl/smalltooth sawfish interactions though there have been no reports of these interactions in the South Atlantic rock shrimp fishery. Alternative 3 might also provide further protection to sea turtles by reducing the amount of trawl gear in the water, however, the 2002 biological opinion issued on shrimp trawling off the Southeastern United States under the sea turtle conservation regulations (including the Larger TED rule) and as managed under FMPs concluded that the activity is not likely to jeopardize the continued existence of any threatened or endangered species under the ESA. With the new TED rule in place, sea turtle bycatch and bycatch mortality is being minimized to the extent practicable.

4.2.4.3 Economic impacts

Alternative 1 could result in an increased cost to the rock shrimp harvesting sector to purchase BRDs and reduced revenue due to shrimp lost through the use of BRDs. The cost of a BRD ranges from about $20 for a fisheye design to less than $100 for the large mesh extended funnel (SAFMC 1996b). It is assumed that vessels not currently equipped with BRDs would need to make an initial purchase of at least 4 devices since most of the rock shrimp vessels are large and tow four nets (Section 3.2.3.3). Therefore, the cost for purchasing these devices would range from $80 to $400 per vessel. Thus far 145 limited access rock shrimp endorsements have been issued by NOAA Fisheries (Robert Sadler, NOAA Fisheries, pers. comm. 2004). These vessels also participate in the penaeid shrimp fishery where BRDs are required and it is reasonable to assume that many rock shrimp vessels will not have to purchase BRDs if Alternative 1 is implemented. Thus, a BRD requirement will not result in a large financial burden on the industry from the purchase of devices and modification of trawl gear.

There are no data on the actual level of BRDs usage in the rock shrimp fishery. Industry sources indicate that some fishermen use BRDs when targeting rock shrimp. Also, the use of a BRD is required if more than 1% of the total weight of the catch (on board or landed) is comprised of brown, pink or white shrimp (penaeid shrimp). The rock shrimp observer coverage data indicated that on some rock shrimp trips, the penaeid shrimp catch exceeded 1% of total weight. Thus, to be in compliance with existing regulations, BRDs would have been utilized.

Information from the trip ticket database (2000 through 2002) showed that the average penaeid shrimp catch from 113 trips on which rock shrimp was caught was below 1% by weight (Table 4.2-1). In the subsequent analysis it is assumed that this would represent the maximum number of trips affected by a BRD requirement. The calculation of future expected revenue loss assumes a maximum of 3% shrimp loss per trip from the use of BRDs (SAFMC 1996b). A 3% shrimp loss is based on reported losses of penaeid shrimp and may overestimate rock shrimp losses as rock shrimp are more likely to be on the bottom of the net and not actively swimming in the net as do penaeid shrimp. Based on the value of the average rock shrimp landings for those trips likely to be affected in 2000, 2001 and 2002, the expected reduction in revenue for the rock shrimp industry is estimated to be $59,417. It is estimated that 43 vessels would be affected and the average reduction in gross revenue would be $1,382 per vessel annually. This represents 0.6% of the average annual gross revenue of an affected vessel. Thus, it is unlikely that Alternative 1 would result in economic conditions that induce vessels to exit the shrimp industry (Table 4.2-1).

Table 4.2-1. Impacts resulting from loss of shrimp in the rock shrimp sector if BRDs become a requirement in this fishery.

Item	**2000**	**2001**	**2002**	**Average 2000-2002**	**Average 2000-2001**

Rock shrimp trips where penaeid shrimp comprised less than 1% of the catch	128	98	14	80	113
Percent of total rock shrimp trips affected	16%	19%	4%	13%	17%
Revenue from affected trips	$3,316,327	$2,480,074	$145,295	$1,980,565	$2,898,200
Reduction in revenue from use of BRDs	$99,490	$74,402	$4,359	$59,417	$86,946
Number of vessels affected	65	52	12	43	59
Average reduction in revenue per vessel	$1,531	$1,431	$363	$1,382	$1,486
Average annual revenue per affected vessel	$318,790	$248,629	$170,356	$245,925	$209,493
Percent reduction in revenue per vessel	0.5%	0.6%	0.2%	0.6%	0.7%

These estimates likely represent the maximum annual revenue losses from the BRD requirement as vessels may already use BRDs on some rock shrimp trips where the penaeid catch is less than 1% and because a 3% shrimp loss may overestimate the losses of rock shrimp by BRDs. Reports from industry members have indicated that some fishermen use BRDs on all trips whereas others tie off the BRD and make it ineffective on those trips where there is no expectation of harvesting penaeid shrimp. The use of BRDs may reduce sorting time for the crew and enhance product quality as noted in Section 3.1.12.2.2.5. These positive effects would likely increase revenue respectively.

Alternative 2 would not result in additional industry costs or lower revenue as described for Alternatives 1 and 3. However, the possible indirect economic benefits as a result of bycatch reduction (Alternatives 1 and 3) would not accrue to society.

The analysis for Alternative 3 is limited to the effects on the industry since data are not available to quantify the possible indirect economic benefits of bycatch reduction from the various seasonal closures. Data from 2000, 2001 and 2002 were used in the calculations of potential reductions implied by the seasonal closures proposed in Alternative 3. The average ex-vessel value for each season was calculated from data presented in Table 3.2-10b and the average number of affected trips was calculated from data in Table 3.2-10c. The dockside value of South Atlantic caught rock shrimp harvest averaged $7,165,789 in 2000, 2001 and 2002 (Table 3.2-4). These vessels earn revenue from other shrimp fisheries and the average total income from all sources for 2000 through 2002 was $36,834,914 (Table 3.2-4). These revenue statistics were used in calculating the percentage reduction in revenue from rock shrimp landings and the reduction in overall gross revenue (Table 4.2-2).

Estimates of potential revenue losses from the three seasonal closures are presented in Table 4.2-2. Since the peak of the rock shrimp season occurs in the summer months a closure during this period could result in the largest revenue losses (Table 4.2-2). This projected future loss is estimated at $3.8 million annually and represents 53% of annual ex-vessel revenue from the South Atlantic rock shrimp landings. A summer closure would likely reduce overall gross revenue in the rock shrimp industry from all sources by 11% and a closure during the fall would have an associated revenue loss of 8% (Table 4.2-2). Given the current economic situation in the shrimp industry (refer to Section 3.2.3), it is likely that these two sub alternatives would have serious economic consequences and some vessels might exit the industry. The rock shrimp fishery is dominated by large vessels. Cost and earnings studies on the shrimp fishery in South Carolina and the Gulf of Mexico found that large vessels in the shrimp fishery have lower profit margins and are more vulnerable to reduction in revenue (Section 3.2.3.3).

A winter closure would result in a proportionally lower revenue loss compared to closures during the summer and fall (Table 4.2-2). However, the expected reduction in gross revenue from a winter closure, $446,149, is not insignificant and could result in serious consequences considering the current economic state of the industry. Estimated revenue reductions are $5,901 per vessel.

Table 4.2-2. Potential impact from seasonal closures proposed by Alternative 3.

Season	Rock shrimp revenue loss	% of annual rock shrimp revenue	% of total annual revenue	Number of affected vessels (per year)	Average revenue loss per vessel
Winter	$466,149	7%	1%	79	$5,901
Summer	$3,812,659	53%	11%	90	$42,363
Fall	$2,665,167	37%	8%	92	$28,969

In the event of a seasonal closure some vessels could attempt to recoup loss of income by increasing effort in the rock shrimp fishery during the open season. This scenario could lead to congestion effects on the rock shrimp grounds as this fishery is prosecuted in a limited geographic area. Some of these conflicts arose before the Council established a limited access program. Congestion effects could increase operating costs and/or reduce catch per trip, which would also reduce future net revenue in the rock shrimp harvesting sector. Some of this displaced effort could flow into the penaeid shrimp fishery and increase the economic problems in that sector.

The number of vessels that would be affected by these seasonal closures was calculated from participation in the fishery during 2000, 2001 and 2002. As a result of the limited access program, low volume participants who operated sporadically during these years no longer participate in this fishery. It is possible that a seasonal closure could affect all vessels in the rock shrimp fishery since most fish throughout the year. Thus, any of the three seasonal closure options would have some impact on the revenue of the 145 vessels that received limited access endorsements.

Alternative 3 would result in greater losses in ex-vessel revenue to rock shrimp vessels than Alternative 1. It is likely that the effects on behavior and reduction in revenue from any of the seasonal closures proposed by Alternative 3 could result in some vessels leaving the industry. This event is unlikely from the effects of implementing Alternative 1.

There may be some indirect future economic benefits that would accrue to fishery participants and society from reducing bycatch in the rock shrimp fishery. Benefits could accrue from reduced mortality on species that are important to other fishery participants. Although, these gains may be minor since apart from spot there are no other fisheries for the abundant species taken as bycatch in the rock shrimp fishery. There may be some future indirect fishery economic benefits from returning these species to the ecosystem if released species increase populations of other species that are targeted by commercial and recreational participants. Also, future indirect economic benefits would derive from increased populations of species that do not support commercial or recreational fisheries. These benefits fall under the category of non-use value to society.

4.2.4.4 Social impacts

In comparing the alternatives for Action 4, the preferred Alternative 1 is seen as the least onerous of the three proposed alternatives. While there may be some initial resistance to utilizing BRDs in the fishery at first, rock shrimpers will grow accustomed to it and may actually prefer it as it may increase tow efficiency and reduce sorting time for the crews. Although Alternative 2 may seem the alternative to pose the fewest negative social impacts, the impacts to agency and management personnel plus fishermen would come in the form of potential lawsuits and fishery closures in order to be in compliance with the Magnuson-Stevens Act.

Alternative 3 would cause the most hardship for fishermen, as all the proposed closure months (Alternative 3 a, b and c) exhibit relatively high landings for rock shrimp. Alternative 3b poses the least impact of the three, but will still potentially subtract a good deal of landings from the vessels. This loss of income will pose a hardship on vessel owners, captains and crew.

It should also be noted that rock shrimpers might be prohibited from fishing for rock shrimp during a closed season, but may continue to trawl for penaeid shrimp. This may result in regulatory discards of rock shrimp and potential penalties for penaeid shrimp fishermen.

4.2.4.5 Conclusion

When Shrimp Amendment 2 was developed, the Council was assured by the rock shrimp industry that bycatch in the rock shrimp fishery was minimal and there was no need to require BRDs in this fishery. However, a recent pilot study conducted by NOAA Fisheries indicated that finfish bycatch was a large component of the rock shrimp catch (Appendix C). A summary and discussion of the main findings from this preliminary report is contained in Section 3.1.9. The Council was concerned about the level of finfish bycatch because these trials were conducted with nets that utilized BRDs but was aware that these data are preliminary and the study is ongoing. Furthermore, observer trips were conducted during an atypical rock shrimp season where harvest was especially low compared to previous years. It appears from preliminary data for 2003 that rock shrimp harvest has rebounded (Section 3.2.3.1). There were a number of public comments that expressed support for the “no action” alternative because in the opinion of these rock shrimp fishermen the results of this pilot project did not accurately reflect catch composition of the entire rock shrimp fishery.

There was one public comment recommending Alternative 3c on the merit of possible reduction in interactions of the rock shrimp fishery with three species of turtles known to nest on Florida’s east coast beaches. However, in the event of a seasonal closure, there may be little reduction in bycatch or interactions with turtles and smalltooth sawfish if vessels shift effort into the penaeid shrimp fishery during a rock shrimp closed season. Furthermore, the December 2002 biological opinion issued on shrimp trawling off the Southeastern United States concluded that this activity is not likely to jeopardize the continued existence of any threatened or endangered species under the ESA, and with the new TED rule in place, sea turtle bycatch and bycatch mortality is being minimized to the extent practicable.

In earlier deliberations, the Council briefly discussed the concept of area closures to reduce bycatch but eliminated this possibility from further consideration (Appendix A). Currently, there are areas closed to trawling for rock shrimp. These areas, established by Amendment 1 to the Shrimp Fishery Management Plan, the Comprehensive Habitat Amendment and the Coral Fishery Management Plan, formerly yielded high catches for the rock shrimp fishery. Also, it is expected that these closures resulted in reduced bycatch in the rock shrimp fishery. Compliance with these closed area restrictions is expected to improve with the requirement for the use of vessel monitoring systems by rock shrimp limited access vessels which took effect in October, 2003. It was not surprising that there was a lot of opposition from the public to Alternative 3 because of the additional economic losses posed by seasonal closures which could result in some vessels leaving the industry. The Council determined that additional closed areas may not be justified at this time if the cost to the industry (expected to be substantial) is weighed against the uncertainty of expected bycatch reduction. It must be noted that rock shrimp fishermen are also participants in the penaeid shrimp fishery. The continued trend in reduced dockside prices for the penaeid species would have affected this group of fishermen resulting in severe economic hardship. Additional measures that are associated with large reductions in revenue would most likely force some of these fishermen to leave the industry.

The Council considered that Alternatives 1 and 3 would imply higher potential negative economic and social consequences than Alternative 2. However, Alternative 2 (no action) would not provide any additional reductions in bycatch associated with rock shrimp harvest. Even though Alternative 3 would likely result in larger bycatch reductions compared to Alternative 1, the Council chose Alternative 1 because of the serious social and economic consequences that would arise from implementation of Alternative 3. Also, there was a lot of opposition from the public to choosing Alternative 3 because of the substantial economic costs associated with seasonal closures which could result in vessels leaving the industry. Alternative 3 may result in shifting effort to other areas during a seasonal closure. Furthermore, as stated during the public comment period, seasonal fishing patterns can vary from year to year and is dependent on the availability of rock shrimp. There are years when the fishery can begin as early as June and other years as late as October. Thus, establishing a specific closed season may not achieve management goals as seasonal fishing patterns could shift from the expected in response to rock shrimp availability.

The Council considered the possibility that the pilot study findings may not reflect typical conditions in this fishery. As described in Section 3.1.9, results came from six observed trips and the study was conducted during a year when rock shrimp catches were particularly low and the fishery may not have operated under “normal conditions”. The Council was also unsure about the significance of the biological benefits from additional escapement of species comprising the rock shrimp bycatch. As discussed previously, there may be some benefit from protecting spot via the use of BRDs as a precautionary measure until an assessment can be completed (ASMFC 2004d). The majority of the public comments on this action recommended that the Council implement Alternative 1. In summary, the Council weighed the potential biological benefits, the information uncertainty and the need for balancing a precautionary approach with the social and economic costs of these alternatives and public comments and chose Alternative 1 as the preferred.

The bycatch observer program is ongoing and there are plans to analyze data from trips where BRDs were used and compare this information to catches from trips where BRDs were not utilized. As these research efforts are completed, the Council will review the findings and determine if additional measures are necessary to further reduce bycatch in the rock shrimp fishery.

4.2.5 Action 5. Consider the requirement for a federal penaeid shrimp permit in order for a shrimp trawler to fish for or possess penaeid shrimp in the South Atlantic EEZ.

Alternative 1 (Preferred). For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.

Alternative 2. No action. A federal permit would not be required to fish for or possess penaeid shrimp in the South Atlantic EEZ.

Alternative 3. For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to any vessel owner who submits an application.

Alternative 4. For a person aboard a shrimp trawler to fish for penaeid shrimp in the South Atlantic EEZ or possess penaeid shrimp in or from the South Atlantic EEZ, a valid commercial vessel permit for South Atlantic penaeid shrimp must have been issued to the vessel and must be on board. A valid commercial vessel permit for South Atlantic penaeid shrimp is not required if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. A federal penaeid shrimp permit will be issued to applicants who have the necessary state commercial permits to land and sell shrimp.

A vessel is in transit when it is on a direct and continuous course through the South Atlantic EEZ.

A trawl net or try net, is rigged for fishing if it is in the water, or if it is shackled, tied or otherwise connected to a sled, door or other device that spreads the net, or to a tow rope, cable, pole or extension, either on board or attached to a shrimp trawler.

Discussion

The immediate benefit of a federal permit system would be to accurately identify the existing, active (on an annual basis) universe of shrimp vessels fishing in the South Atlantic EEZ. A federal permit system that creates a complete listing of all active vessels fishing in the EEZ is a prerequisite tool for any statistically robust data collection program that intends to canvass or randomly sample the activities of the shrimp fishery in the EEZ. Without this information, sampling programs have depended on non-random sampling. A more robust analysis of the shrimp fishery is only possible through stratified random sampling of the existing fleet and that kind of sampling is only possible where the specific vessels are readily identifiable. In addition, the ability to sanction permits is an enforcement tool and could apply for violations of certain statutes and where there is an unpaid and overdue civil penalty or criminal fine imposed under any marine resource law administered by the Secretary of Commerce.

Alternatives 1, 3 and 4 would set the requirement that a shrimp trawler must obtain a federal penaeid shrimp permit to fish for or possess any of the penaeid shrimp species in the South Atlantic EEZ. Alternatives 3 and 4 would provide an exemption to the permit requirement if the shrimp trawler (1) is in transit in the South Atlantic EEZ and (2) no trawl net or try net aboard the vessel is rigged for fishing. These permits would be renewed annually. Implementation of Alternative 1, 3 or 4 would not establish a limited/closed access program for the South Atlantic penaeid shrimp fishery prosecuted in federal waters. However, Alternative 4 requires that in order to qualify for a federal permit a vessel owner must provide documented proof of possessing a current state permit/license to land and sell shrimp. These permit/licenses can be issued by any state and are not restricted to those issued by the applicant's state of residence or state where the vessel is homeported. Alternatives 1 and 3 do not require that this condition be met. A permit would be issued to a vessel owner without the need to provide any documentation that the vessel is employed in a commercial shrimp fishery. The Gulf of Mexico Fishery Management Council did not stipulate any qualifying criteria for issuing federal shrimp permits to fish in the Gulf of Mexico EEZ. Similar to Alternatives 1, 3 and 4, an applicant must own a vessel to be issued a Gulf of Mexico Shrimp Permit. Also, Amendment 1 to the South Atlantic Shrimp Plan established the rock shrimp open access permitting process without any qualifying criteria. A vessel that obtains a federal permit for the South Atlantic penaeid shrimp fishery that is not currently permitted in some other fishery would be required to display and maintain its official number in the manner prescribed at 50 CFR 622.6(a).

The permit requirement for the penaeid shrimp fishery proposed by Alternatives 1, 3 and 4 does not replace or modify existing permit requirements for the rock shrimp fishery. There is an existing limited access endorsement for qualifying vessels to participate in the rock shrimp fishery off Georgia and the east coast of Florida where the majority of the rock shrimp harvest is taken. Vessels that participate in the open access rock shrimp fishery off North Carolina and South Carolina are required to purchase an open access rock shrimp permit if they do not possess a limited access rock shrimp endorsement.

Alternative 1 differs from Alternative 3 in that Alternative 1 removes the exemption from the permit requirement for shrimp trawlers transiting the EEZ with their gear not rigged for fishing. Alternative 2 (no action) would not require a vessel permit for participation in the penaeid shrimp fishery in the South Atlantic EEZ.

4.2.5.1 Biological impacts

There will be no direct biological impacts from this action. Alternatives 1, 3 and 4 propose the establishment of a permitting process for the penaeid shrimp fishery operating in the South Atlantic EEZ. This program would provide a more accurate and efficient means of identifying participants in this fishery and allow for the collection of more detailed information on gear type and area fished.

As described in Section 4.2.3, this federal permit could be tied to mandatory cooperation with observer programs in the shrimp fishery and mandatory reporting of information on catch and effort that assists in the assessment of bycatch in the penaeid shrimp fishery. The ability to sanction permits is an enforcement tool and could apply for violations of certain statutes and where there is an unpaid and overdue civil penalty or criminal fine imposed under any marine resource law administered by the Secretary of Commerce. Improved obeyance of fishery regulations will have biological benefits by better maintaining long-term sustainability to fishery resources, including species protected under ESA and the MMPA.

Alternative 2 (no action) would not allow for the more efficient identification of participants in the penaeid shrimp fishery. Thus, this alternative would not provide the data collection benefits that are described for the other two alternatives. The benefits of collecting more accurate information on bycatch in the penaeid shrimp fishery were described in Section 4.2.3.1.

4.2.5.2 Protected resources impacts

There are no direct impacts on protected resources from establishing a federal penaeid shrimp permit in Alternatives 1, 3 and 4. However, beneficial indirect impacts of these alternatives may occur through identification of participants in the fishery so that they can be selected for data collection programs and allow for the collection of more detailed information on gear type and areas fished. The permit requirement will also ensure a higher level of compliance with data collection initiatives and applicable law. Shrimp vessels are required to use TEDs pursuant to regulations promulgated under the ESA, 50 CFR § 223.206, and a permit issued to a shrimp vessel would be subject to sanction from violations of these regulations addressing protected resources.

Alternative 2 (no action) would not allow for the identification of fishery participants, thus would not initiate their participation in comprehensive data collection programs that may provide detailed information on protected species interactions in the penaeid shrimp fishery.

4.2.5.3 Economic impacts

Alternatives 1, 3 and 4 would impose the cost for a penaeid shrimp permit on the industry. A fee is charged to cover the cost of administering this permitting process. This fee is currently $50 per application. However, if the vessel owner holds another federal permit issued by NOAA Fisheries Southeast Regional Office the cost of this shrimp permit would be $20 per vessel. Also, the opportunity cost of time for the completion of the permit application form is another cost consideration. The opportunity cost (time spent completing the application) is estimated at $5 (corresponding to 0.33 hours) per application per year for Alternatives 1 and 3. Under Alternative 4, applicants would have to submit a copy of their state commercial permits (taking another 0.33 hours for retrieval and copying of that permit). Therefore, the opportunity cost would increase under Alternative 3 to a total of 0.66 hours (i.e., a total of $10 per application). It is assumed that all shrimp vessels currently operating in the South Atlantic EEZ shrimp fishery would have the necessary permits to land and sell shrimp. Thus, Alternative 4 would only impose additional costs (for the purchase of state permits to land and sell shrimp) on vessel owners not currently in the shrimp industry or those who would purchase this permit for "speculative reasons".

At this time the number of individuals who will apply for a vessel permit is unknown since the universe of vessels that fish in the EEZ cannot be determined with any degree of certainty. Several data sources were used to estimate the number of vessels that may apply for a federal shrimp permit. These data sources are listed as follows:

1. Data from the state trip ticket programs in North Carolina, Georgia and Florida provided information on the number of vessels that are active in a given year. However, there is concern about the accuracy of these vessel counts since there is a substantial level of landings with no associated vessel identification information (Table 4.2-3).
2. Verified data from South Carolina's trip ticket program were not available for this analysis. Information from applicants for the recent disaster relief reimbursements was used to derive an estimate of active vessels in South Carolina. These applicants provided data on their highest level of income for 1 out of the three years during 2000-2002.
3. A subset of the Gulf Shrimp database that included vessels fishing in the South Atlantic during the period 2000-2002. Because they are highly mobile, it is assumed that all of these vessels will apply for a federal shrimp permit.

At least an average of 1,898 vessels operated in the penaeid shrimp fishery during the period 2000 through 2002 (Table 4.2-3). It is not expected that all of these vessels fished in federal waters for shrimp. The fishing location information contained in the various data sources used in this analysis does not provide sufficient detail that allow for identification of all areas fished on a given trip. These reporting systems only allow for one location to be identified per fishing trip. One tow on a shrimp trip could traverse several areas that would not all be identified on the completed trip ticket. Thus, it is not possible to accurately determine the number of vessels that fished in federal waters. Reports from fishermen in Georgia indicated that since the various sounds and bays are closed to commercial shrimp trawling most vessels fish in federal waters during some portion of their trip. As a result, in the opinion of these fishermen, almost all commercial shrimpers in Georgia will apply for a federal shrimp permit.

To provide a lower bound estimate on the number of permit applicants, an assumption was made that shrimp vessels that only fished in state inshore areas will not apply for this federal shrimp permit. These vessels (inshore vessels) tend to be smaller than vessels that operate in state offshore and federal waters (offshore vessels). On average 81% of inshore vessels were less than 40 feet while only 17% of the offshore vessels fall into this length category (Table 4.2-3). Also, the average income for inshore vessels ($24,092) was much lower than the average income for offshore vessels ($81,362). If inshore vessels are excluded from the estimate of potential applicants, it is expected that 1,380 individual vessel owners would apply for this federal shrimp permit.

Thus, if Alternative 1, 3 or 4 is chosen, it is expected that the number of permit applications could fall somewhere in the range of range of 1,380 to 1,898 each year. The expected cost to the industry could range from $27,600 to $94,900 annually. This cost will depend on the number of vessels that apply for the federal permit and whether the vessel owner incurs a $50 or $20 fee. These figures were calculated based on the assumption that vessel owners who currently fish for shrimp would be the only permit applicants. However, this alternative would allow the issuance of a permit to any vessel owner who applies. There could be some speculative interest and thus other commercial vessel owners could apply for this permit. In contrast, if Alternative 4 is chosen, it is expected that vessel owners who have no interest in fishing for shrimp may be deterred from submitting an application since they would also have to incur additional costs for permits from at least one state to land and sell shrimp. The cost of these state permits or licenses could be as high as $600. It is possible that Alternative 1 may result in a larger number of permits issued compared to Alternatives 3 and 4 because of the removal of the transiting and not rigged for fishing exceptions. Under Alternative 1 shrimp trawlers that do not operate in the EEZ but upon occasion transit the EEZ with shrimp on board would now have to be federally permitted. The exceptions in Alternatives 3 and 4 would create “loopholes” for shrimp trawlers that operate in the EEZ who do not want to obtain a permit.

There would be some increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms.

Vessel permits will enable a more accurate and efficient means of identification of commercial business entities harvesting shrimp in the South Atlantic EEZ. It is somewhat difficult to track vessels across states because the vessel identification information can be coded in different ways among the various states. This is especially important because vessels that fish in federal waters are highly mobile and participate in the shrimp fishery in more than one state (Liao 1979).

Table 4.2-3. Information on vessels that participate in the South Atlantic shrimp fishery

	2000	2001	2002	Average 2000-2002	Industry cost $50 permit fee	Industry cost $20 permit fee
Vessels operating in the South Atlantic shrimp fishery*	2,129	1,835	1,731	1,898	$94,900	$37,960
Average annual revenue per vessel	$76,879	$67,706	$66,853	$70,749		
Proportion of vessels under 40 ft.	48%	45%	43%	45%		
Vessels that only operate in inshore waters**	599	468	488	518		
Average annual revenue per vessel	$25,722	$24,023	$22,531	$24,092		
Proportion of vessels under 40 ft.	82%	81%	80%	81%		
Vessels that operate in state offshore and or federal waters	1,530	1,367	1,243	1,380	$69,000	$27,600
Average annual revenue per vessel	$91,509	$80,578	$72,000	$81,362		
Proportion of vessels under 40 ft.	20%	17%	15%	17%		
Revenue not associated with a vessel***	$5,279,037	$2,951,607				

*Vessels that harvest shrimp in the South Atlantic.
** These vessels only operated in inshore areas within the South Atlantic.
*** There was a fair amount of reported landings without associated vessel identification.

Apart from identification of vessels, the permit application can be used to obtain data on a vessel that are not currently collected by the various state agencies or by the Coast Guard through their vessel information system (Section 1.2). The current application form for the Gulf of Mexico Shrimp Permit is attached as Appendix K. Standard information collected include the vessel’s name, hull identification number, hull type, gross tonnage, net tonnage and state registration or U.S. Coast Guard (USCG) documentation number; name, address, telephone number and other identifying information of the vessel owner and of the applicant, if other than the owner; and any other information concerning the vessel, gear characteristics, principal fisheries engaged in or fishing areas, as specified on the application. These are all standard data elements requested from applicants for all federal fishing permits.

To improve the information necessary to measure capacity in the shrimp fishery of the Gulf of Mexico and to better meet the requirements of the Regulatory Flexibility Act of 1980 (5 U.S.C. 601-612), NOAA Fisheries modified the application by adding several data elements described as follows:

1. Gross tonnage and net tonnage data for all vessels to better identify vessels and to allow analysis of fleet size/capacity, over time;
2. Hull identification numbers and hull type (such as wood, fiberglass, etc.) for the purpose of better determining unique fishery vessels and complying with the Atlantic Coast Cooperative Statistics Program (ACCSP);
3. County information on all vessels to allow agency response to constituent/fishery management council data requests and to allow accurate queries of the permits data base. Although city information is currently being collected, that information cannot be used to discern counties (since cities may include several counties);
4. Fuel capacity, shrimp storage method (either freezer or ice) and the year that the vessel was originally built. These parameters affect the geographical range of a given vessel and in turn, the vessel's fishing capability. These data need to be collected to partition the fleet for fisheries economics/management assessments of harvest capacity and efficiency. Compilation of a historical database for these parameters will indicate changes to the individual vessels or to the fleet over time and therefore need to be periodically collected for tracking purposes via the application form; and
5. Shareholder/partner identifying information for vessel permits owned by corporations/partnerships, respectively (that information is already being collected for vessels with swordfish or shark permits). Collection of shareholder/partner data will allow individual participation within partnerships and corporations to be tracked over time, regardless of changes to business name, vessel name, state registration number or USCG documentation number. This type of information will assist in analyses of effects on small businesses.

Collection of these data from the South Atlantic permit application form will provide benefits through improved economic analyses. Vessels that are identified in the universe of total vessels can be selected for additional biological, economic and social data collection programs. In addition to the items listed above, annual vessel operating and fixed costs data could be collected on the permit application/renewal form. Thus, it is expected that Alternatives 1, 3 and 4 will increase future economic benefits by developing a management strategy based on data that better represents the known universe of participants.

The ability to sanction permits is an enforcement tool and could apply for violations of certain statutes and where there is an unpaid and overdue civil penalty or criminal fine imposed under any marine resource law administered by the Secretary of Commerce. Improved obeyance of fishery regulations will have economic as well as biological benefits by better maintaining long-term sustainability to fishery resources.

There would be no time or monetary costs to owners of vessels from the purchasing of a vessel permit if Alternative 2 (no action) is chosen. There would also be no imposition of new costs associated with data reporting. However, this situation would not allow for additional information to be collected from the vessels harvesting shrimp in the South Atlantic EEZ which would not help improve analyses and management in the future.

4.2.5.4 Social impacts

One of the greatest difficulties facing the penaeid shrimp industry fishing in federal waters is that it cannot be defined in its current state. As noted at the beginning of the Discussion section, there is no mechanism by which to specifically identify the boats that fish in federal waters. The problems of this came to light when the shrimping industry received federal aid in light of the domestic market price decline of the past few years. Not being able to clearly document who was participating in the industry, some of the monies were contested and surely some fishermen deserving of relief did not receive any.

Being permitted in a fishery has always caused some participants to be concerned about the government intruding into their lives. However, being invisible can be just as detrimental. Although having shrimpers obtain a permit may work against them (if it is deemed there is excess capacity in the industry), it also serves to work for the fishermen. There will be a positive impact in knowing which states and which ports have the most shrimping activity, allowing for programs to be targeted appropriately. Outreach information can be sent to permit holders when there are, proposed changes in regulations. Permit information could be used by shrimpers to locate other members of the industry and to form constituencies. Permit information will also provide scientists, port agents and law enforcement personnel with a better means of contacting fishermen for research, outreach and information transfer.

Implementing a federal shrimp permit system has far more positive impacts than negative ones. Alternative 1 would allow any vessel owner to obtain a permit, thus there are limited exclusionary negative social impacts. Alternative 3 is somewhat more precautionary in that it attempts to define what would be considered “shrimping” and who would be exempt from permits. However, this alternative may offer a loophole for those who may not want to obtain a commercial permit. This “exception” would also pose problems for law enforcement by complicating regulations. Alternative 4 is the most restrictive of all the alternatives except for the preferred, and the most problematic for law enforcement. While this alternative would allow any state licensed shrimp vessel to obtain a permit, and it may be assumed that most vessels that fish in the South Atlantic EEZ would have those licenses as well, it allows for an exemption. According to recent discussions with law enforcement personnel, regulations are easiest to enforce when they are written with few exceptions and as little complexity as possible. Leaving the situation as it is - status quo - would not benefit the shrimp fishery and is not consistent with managers being good stewards of the resource or the fishery itself.

4.2.5.5 Conclusion

The Council chose Alternative 1 as their preferred alternative for several reasons. One of the most important considerations is to provide an accurate and efficient method to identify and quantify vessels that fish in federal waters for penaeid shrimp species. Alternatives 3 and 4 would also provide this benefit, and Alternative 4 may deter vessel owners who are not commercial shrimpers from applying for this permit. Alternative 2 (no action) would not allow for the more efficient identification of participants in the penaeid shrimp fishery. Currently, there are no consistent and efficient means to identify vessels in the penaeid shrimp fishery in the South Atlantic EEZ. State trip ticket programs and license files collect information that can provide overall estimates of shrimp vessels, but this does not specifically identify shrimp fishing vessels that are actively operating in the EEZ. Additionally, as noted in the information presented in Section 3.2.3, it is not always possible to associate all of the shrimp landings data with the vessel identification information on the trip tickets. It is strongly suggested that should Alternative 1 be approved and implemented the permit should be designed by a team of both statisticians and economic and social scientists so that the appropriate information might be gathered to assist in future analyses. Public support for a federal permit requirement in this fishery arose from the need to identify vessels in the fishery with the intention of facilitating the observer program and to allow for “a better paper trail” if a limited access program is developed for the penaeid shrimp fishery.

Alternatives 1, 3 and 4 would address current database deficiencies, and thereby provide for better shrimp fleet monitoring and a more precise determination of incidental bycatch. The permit system will serve as a source to identify a representative, stratified, random sample of shrimp vessels. Once NOAA Fisheries has more accurately determined the number of fishery participants through the permit system, sample groups can be contacted to collect biological, social and economic data on the fishery. Data collection can occur by using observers, phone or written surveys, or other data collection methods. Anticipated improvements from the permitting and subsequent sampling procedures would include more precise bycatch estimation and more accurate determinations of economic and community impacts. Information collected under such future programs would aid in the formulation of sound management measures for the shrimp fishery and those finfish fisheries that are affected by bycatch and bycatch mortality arising from the shrimp fishery.

An additional benefit of precisely determining the universe of vessels participating in this fishery is to inform them of changes to other regulatory requirements such as those affecting gear and protected resource criteria. In addition, permit revocation can be an effective enforcement tool to increase compliance in the fishery.

Public comments from some members of the shrimp industry recommended Alternative 2 (no action). The main reasons for their choice was: concern that a permit requirement would lead to development of a limited access program for the shrimp fishery; a belief that data on the shrimp fishery exists within the states’ trip ticket databases and enforcement of current data collection requirements would provide necessary information for management; the federal permit would not capture information on the large number of small inshore vessels in the shrimp fishery that operate primarily in state waters; and increased law enforcement would result in better compliance with existing regulations as opposed to the future threat of federal permit sanctions.

Compared to the Council’s preferred alternative, Alternative 3 and Alternative 4, if the no action alternative is chosen, there would be no permit fee for vessel owners or the time cost from completing permit application and renewal forms. However, in the Council’s opinion the benefits of having a federal permit in this fishery outweighed these costs, and the Council chose to recommend Alternative 1 to the Secretary of Commerce.

The Council chose Alternative 1 as the preferred alternative since implementation of either Alternative 3 or 4 would lead to an inconsistency as there are no other Federal permit requirements in the Southeast region that exempt a vessel that (1) is in transit and (2) is not rigged for fishing. This would open loopholes in the administration of, and compliance with regulations. Shrimp trawlers that operate in the EEZ who do not want to obtain a permit would be less likely to comply with the permit requirement if Alternative 3 or 4 is chosen because of the loopholes presented for enforcement of these regulations. For example, if a trawler is not fishing or anchored when observed with shrimp in or from the South Atlantic EEZ, investigation will be needed to determine whether the vessel is simply in transit, and if so, whether it was on a direct and continuous course through the South Atlantic EEZ. Determining the answers to these questions may be difficult, time-consuming and perhaps considered a waste of resources if either the answers cannot be determined or if it is determined that the trawler met the elements of the exception. The same holds true if a vessel is not rigged for fishing. To the extent that trawlers that otherwise are required to have the permit are able to avoid this requirement through the exception, the permit requirement will fail to fulfill the benefits of a permit as previously described in this section.

Alternative 1 was recommended to the Council when the law enforcement loopholes associated with Alternatives 3 and 4 were identified, which occurred after the first round of public hearings on Shrimp Amendment 6 was completed. Since Alternative 1 is a more restrictive management measure compared to the alternatives that were originally presented for public comment, there were two additional public hearings conducted to obtain public comment on this new alternative. There was very little input at the two additional public hearings. One individual spoke and he did not support the permit requirement. The Council concluded the benefits from the permit outweight any negative concerns and did not change their preferred alternative.

4.2.6 Action 6. Revise, establish and/or retain status determination criteria for penaeid shrimp stocks.

Alternative 1. (Preferred). Using the established MSY and OY values, revise or establish overfishing and overfished definitions for penaeid shrimp based on an MSY control rule. Overfishing (MFMT) for all penaeid species is a fishing mortality rate that diminishes the stock below the designated MSY stock abundance (B_{MSY}) for two consecutive years and MSST is established with two thresholds: (a) if the stock diminishes to ½ MSY abundance (½ B_{MSY}) in one year, or (b) if the stock is diminished below MSY abundance (B_{MSY}) for two consecutive years. In addition, white shrimp would be considered overfished when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures.

A proxy for B_{MSY} would be established for each species using CPUE information from SEAMAP-SA data as the lowest values in the 1990-2003 time period that produced catches meeting MSY the following year (Table 4.2-5).

Brown shrimp =	2.000 individuals per hectare
Pink shrimp =	0.461 individuals per hectare
White shrimp =	5.868 individuals per hectare.

Alternative 2. No action. Retain the current status determination criteria definitions for penaeid shrimp.

Currently, the Council has the following approved stock status criteria:

Table 4.2-4. Current stock status determination criteria for penaeid species.

BRP/SDC	Shrimp species	Designation
MSY	White	14.5 million pounds.
	Brown	9.2 million pounds.
	Pink	1.8 million pounds.
OY	White	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.
	Brown Pink	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 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp].
Overfishing and Overfished Level	White	Overfishing is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. (Note: This overfishing definition actually describes the overfished status rather than overfishing.) No overfished definition.
	Brown Pink	Brown and pink shrimp are overfished when the 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]. No overfishing definitions for either species. (Note: It is assumed that overfishing is occurring when the overfished threshold is met.)

Alternative 3. Revise or establish consistent overfishing and overfished definitions for penaeid shrimp based on the established MSY and OY catch values. Overfishing (MFMT) for brown and pink shrimp would be defined as a fishing mortality rate that led to annual landings larger than two standard deviations above MSY for two consecutive years, and the overfished threshold (MSST) for brown, pink and white shrimp would be defined as annual landings smaller than two standard deviations below MSY for two consecutive years.

Brown shrimp:	MSST = 3.0 MP	MSY = 9.2 MP	MFMT = 15.5 MP.
Pink shrimp:	MSST = 0.3 MP	MSY = 1.8 MP	MFMT = 3.3 MP.
White shrimp:	MSST = 6.5 MP	MSY = 14.5 MP	

Overfishing (MFMT) for white shrimp is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter weather resulting in prolonged cold water temperatures.

Remedial action if there is a determination of overfishing or overfished for the penaeid shrimp species:

Alternative 1 and 3 and Alternative 2 (only for the white shrimp stock)
If an overfishing/overfished determination is made the following action will be taken:
The Shrimp Review Advisory Panel will evaluate the data upon which this determination was made and other relevant information pertaining to this fishery to determine cause and effect, the geographical extent of the problem and whether management action(s) is required. Nevertheless, any action would then need to be processed through the Council system, most likely culminating in the request for NOAA Fisheries to publish an emergency rule that addressed the overfishing/overfished determination.

This Shrimp Review Advisory Panel will be comprised of a Council staff member, a NOAA Fisheries Southeast Fisheries Science Center scientist, a NOAA Fisheries social scientist with expertise on the shrimp fishery in the South Atlantic, a member of the Council's Scientific and Statistical Committee and a state shrimp biologist from each of the states in the South Atlantic Council's area of jurisdiction.

Alternative 2 (only for brown and pink shrimp stocks)
If an overfishing/overfished determination is made the following action will be taken:
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.

Discussion
Alternative 2, the no action alternative, would maintain the existing stock status determination criteria for each species. As noted under the alternative, overfishing definitions are absent for brown and pink shrimp and an overfished definition is absent for white shrimp. MSY for penaeid stocks is established as the mean total landings for the South Atlantic during 1957 to 1991 adjusted for recreational landings; 14.5 million pounds for white shrimp, 9.2 million pounds for brown shrimp and 1.8 million pounds for pink shrimp (SAFMC 1993). OY for penaeid stocks is distinctly tied to each established overfishing and overfished definition. For white shrimp, OY 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. For brown and pink shrimp, OY is defined as the amount of harvest that can be taken by U.S. fishermen without annual landings falling two standard deviations below the mean landings during 1957 through 1993 for three consecutive years (SAFMC 1996b). This value is 2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp (SAFMC 1996b). These landings thresholds are also the overfished definition for these two species. Overfishing for white shrimp is indicated when the overwintering population within a state's waters declines by 80% 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 for white shrimp is determined by catch per unit effort (CPUE) during standardized assessment sampling by the States of Georgia and South Carolina (SAFMC 1993).

Under Alternative 2, the established overfished definition for brown and pink shrimp is "when landings are 2 standard deviations below mean landings". This is an appropriate estimate assuming that the fishery is operating at maximum capacity and annual landings may be representative of some measure of B_{MSY} or F_{MSY}. However, the current overfished definition for brown and pink shrimp appears to be inconsistent with the rock shrimp stock overfished definition (Section 4.2.7) of "when landings exceed 2 standard deviations above mean landings". This latter definition, representing unusually large harvests, would be more indicative of "overfishing" leading to an overfished condition, not an overfished definition. These intertwined definitions of overfishing and overfished illustrate the close relationship of these criteria for annual crops, yet their apparent inconsistency can be confusing. Except for white shrimp, in all cases, each definition is dependent simply on landings, and none account for the effect of fishing effort on landings. Landings might broach one of the established thresholds only because of low effort, or a combination of low effort and low stock size.

In the event of an overfishing or overfished status determination for brown or pink shrimp 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. For white shrimp, if the States of Georgia and South Carolina make a determination that the overwintering stock of white shrimp has declined by 80% or more, the states close their respective waters for a designated time period and request that the Council do the same for the EEZ.

As noted in Section 3.1.4, the Council has stated in previous portions of the FMP that the fishery may be fishing at near-maximum levels and therefore is operating at or near B_{MSY} and F_{MSY}. The National Standard Guidelines (50 CFR 600.310[c][2][i]) identify alternatives for establishing MSY to include removal of a constant catch each year that allows the stock size to remain above an identified lower level, or to allow a constant level of parent stock escapement each year. A more consistent estimate by which to gauge the status of the stock is to better address the definition of B_{MSY}, which can be done using fishery independent SEAMAP-SA data.

Alternative 1 would establish an MSY control rule based on maintaining a constant level of escapement each year that will produce sufficient recruits to maintain harvest at its historical levels. Alternative 1 would relate MSY in terms of catch to a quantifiable level of escapement in each stock, where a proxy for B_{MSY} is established as the minimum parent stock size known to have produced MSY the following year.

Because of their high sensitivity to certain environmental factors, South Atlantic shrimp demonstrate fluctuating population structure. Annual sampling of shrimp from the southeast region indicate that density per hectare have varied by a factor of 5 to 10, and can more than double from one year to the next (Table 4.2-5). Since MSY is already defined, we can examine the trend of fishery-independent CPUE and catch levels to gain insight into the population size at the end of one season that is capable of producing MSY the following season. B_{MSY} would be established for each species using a CPUE-based proxy from SEAMAP-SA data as the lowest values in the 1990-2003 time periods that produced catches meeting MSY the following year (Table 4.2-5).

This comparison illustrates that a parent stock value that will produce MSY the following year can be identified as a CPUE in individuals per hectare. Brown shrimp achieved MSY from an abundance of 2.000 individuals per hectare in 1992-93. Pink shrimp achieved MSY from an abundance of 0.461 individuals per hectare in 1996, and landings were in excess of the established 1.8 million pound MSY in 1997. White shrimp achieved MSY from a parent stock abundance of 5.868 individuals per hectare in 1990-91. These parent stock densities are considered proxies for MSY abundance levels (B_{MSY}).

Shrimp stock resiliency in recovering from detrimental environmental conditions was also demonstrated in 2001 and 2002 for white shrimp. In 2001, Georgia and South Carolina determined from sampling that unusually cold temperatures resulted in at least an 80% reduction in the white shrimp populations of their respective states' waters. Both states closed their waters to penaeid shrimp fishing, and requested that the Council close the EEZ. At the Council's request, NOAA Fisheries closed the EEZ to penaeid shrimp fishing off these two states from March 13 through June 15, 2001. White shrimp landings for the year were only 8.6 MP; the only year white shrimp landings have been less than 10 MP since 1986 (see Table 4.2-4 and Table 4.2-5). Nevertheless, SEAMAP-SA data indicate that the parent stock for the year was 10.454; just less than the 10.53 shrimp per hectare median value over the 14-yr period, and the 13-yr mean (10.79) that excludes the exceptionally high CPUE data for 1999. Reproduction and recruitment from this parent stock led to catches in excess of MSY the following year in 2002.

Table 4.2-5. Annual densities (number per hectare) of brown shrimp, pink shrimp and white shrimp taken by SEAMAP along the Southeast Coast of the United States compared to commercial landings (pounds) of brown shrimp, pink shrimp and white shrimp from North Carolina, South Carolina, Georgia and East Florida (not including Monroe County). Data from 1979-2000 are General Canvas from the Accumulated Landings System (ALS) at the Southeast Fisheries Science Center in Miami, FL. Pink shrimp and brown shrimp landings from 1993-2001 were adjusted for unclassified shrimp landings in proportion the average proportions of brown shrimp (78.5%) and pink shrimp (21.5%) landed during 1979-1991. Ten percent (recreational catch) added to all white shrimp landings, except SC.

	Brown Shrimp MSY =9.2 million lb		Pink Shrimp MSY = 1.8 million lb.		White Shrimp MSY = 14.5 million lb.	
Year	#/ha	Landings	#/ha	Landings	#/ha	Landings
1990	4.022	8,782,156	0.568	1,648,182	9.028	12,113,579
1991	2.469	10,763,798	0.873	2,691,072	12.880	19,797,678
1992	**2.000**	5,002,502	0.511	2,157,005	**5.868**	16,404,798
1993	5.899	**9,313,990**	0.673	1,639,172	5.665	**15,370,876**
1994	5.568	8,987,076	0.594	1,874,057	10.606	13,320,088
1995	3.104	10,908,183	1.728	2,157,387	17.535	23,691,923
1996	10.277	8,290,098	**0.461**	1,897,802	12.913	11,260,847
1997	2.275	8,356,936	0.948	**2,115,827**	7.447	14,146,372
1998	1.975	5,934,817	0.853	1,545,877	18.256	14,883,054
1999	2.972	8,700,428	**0.450**	1,477,074	34.799	19,966,819
2000	7.697	9,627,576	**0.211**	738,443	13.060	15,793,579
2001	8.637	9,109,913	0.502	757,657	10.454	8,645,567
2002	3.347	9,178,658	0.867	1,386,480	9.186	14,599,972
2003	9.640		0.418		7.372	

The rebound of white shrimp stocks in 2002 clearly indicates the functional nature of the established overfishing definition for this stock. That definition is dependent on measuring abundance and density (i.e. CPUE) of white shrimp in local estuaries of South Carolina and Georgia. Nevertheless, no similar state monitoring program is conducted for brown or pink shrimp. The methodology proposed under Alternative 1, using SEAMAP-SA data, would be applicable across all three species, under a common sampling regime.

Because shrimp stocks are very sensitive to environmental variables, there is a strong likelihood that a parent stock can be reduced below the B_{MSY} threshold during a given year, but that it can rebound quickly. Therefore, a threshold based on only a one-year time frame to require remedial action by the Council may be overly restrictive. Under a single-year threshold trigger, the stock of each species would have been declared overfished or undergoing overfishing on several occasions, even though the stocks rebounded in the second year without management intervention. The only exception would be pink shrimp for the years 1999 and 2000 which is discussed in more detail below. Therefore, it is unreasonable to establish a threshold based solely on a one-year time frame.

The data in Table 4.2-5 clearly indicate that the stock can rebound within two years from very low abundance values. For brown shrimp, the lowest relative abundance number (1.975) occurred in

1998, then increased to 2.972 in 1999 and 7.697 in 2000 (the fourth highest value over the 14 yr period). Landings in 1998 were 5.9 MP, followed by 8.7 MP in 1999 and above MSY at 9.6 MP in 2000. For white shrimp, the low density shrimp per hectare of 5.665 in 1993 was followed by values of 10.606 and 17.535 (3rd highest value over the 14 yr period) in 1994 and 1995 respectively. In this case, landings in 1993 were above MSY at 15.4 MP, followed by landings of 13.3 MP in 1994, and landings were well above MSY at 23.7 MP in 1995. For pink shrimp, the lowest CPUE value (0.211) occurred in 2000, but relative abundance was well above the proposed threshold level at 0.502 individuals per hectare in 2001, and landings of nearly 1.4 MP occurred the following year in 2002.

It is clear that if a penaeid stock drops below MSY abundance for one year, it is capable of producing MSY the following year, and certainly the stock can result in landings at MSY levels within two years. Thus, for a single year below the threshold, remedial action need not be taken (Figure 4.2-1). If, however, the stock drops below the threshold for two or more consecutive years, remedial actions would be appropriate. Using a two-year time period as a threshold would have triggered an overfishing and overfished condition only once: that would be for pink shrimp during the years 1999, 2000 and 2001. For highly variable annual stocks such as shrimp, an MSST that only triggered an overfished determination one time seems appropriate and preferable over a threshold that triggered more frequently, given the uncontrollable non-fishing effects from environmental variables on recruitment.

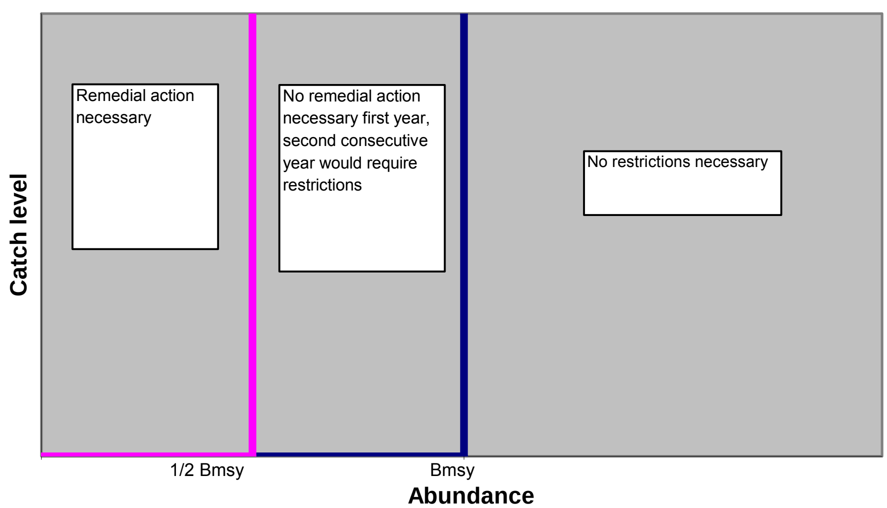


Figure 4.2-1. A schematic diagram showing how management regulations would affect the South Atlantic shrimp fisheries with reference to the MSY abundance level (B_{MSY}) and half of that level (½ B_{MSY})

Nevertheless, a single MSST definition that only triggers a declaration of overfishing or an overfished condition after two years would not safeguard against catastrophic parent stock declines with these annual stocks. Much like the current overfishing definition of white shrimp, where an 80% decline in stock size triggers remedial action, the definition here also establishes a one-year alternative that would address catastrophic declines. If the parent stock diminishes to half the parent stock threshold in one year, it would be considered overfished, and the Council would take action, to convene the Shrimp Review Advisory Panel to address the situation. This situation would have applied to pink shrimp in 2000 when parent stock abundance fell to a low of 0.211.

Alternative 3 would establish consistent and specific overfishing definitions that are lacking for brown and pink shrimp, while maintaining the current overfishing definition for white shrimp, which is in essence, an overfished definition. Under Alternative 3, the overfished definition would be status quo for brown and pink shrimp, except it would shorten the time frame from three consecutive years to two years, which would be more conservative in making a determination regarding the status of a specific stock than the status quo. Additionally, it would provide an overfished definition, which is currently lacking, for white shrimp. Given that MSY is a long-term average of annual landings, catches have an equal probability of being greater or less than MSY on any given year, and as noted above, a one-year trigger would have resulted in each species being overfished or undergoing overfishing on several occasions. Thus, there is merit in establishing a two-year threshold. For brown shrimp, overfishing would occur if landings exceeded 15,453,843 pounds for two consecutive years. Since 1957, landings in excess of this value occurred only in 1985. Pink shrimp landings would have to exceed 3,313,707 pounds for two consecutive years, which occurred in 1987 and 1989. For white shrimp, the existing overfishing definition would be maintained, instead of establishing a concurrent landings definition. The stocks would be overfished if landings for two consecutive years were lower than 2,946,157 pounds for brown shrimp, which occurred once in 1998; 286,293 pounds for pink shrimp, which has never occurred; and 6.52 MP for white shrimp, which occurred in 1977 and again in 1984. In summary, Alternative 3 would require extreme circumstances to trigger a designation of overfishing and overfished.

4.2.6.1 Biological impacts

There are no direct biological impacts from establishing benchmarks by which to assess the health of the stock. Indirectly, the establishment of overfished and overfishing thresholds sets the upper limit on catches, ensuring the biological stability of the resource. For species such as penaeid shrimp, which in essence are annual crops dependent on a minimum parent stock size to produce sufficient recruits for the next fishing year, the concept of overfished and overfishing are distinctly linked. Unlike longer lived species where overfishing may occur without the stock becoming overfished, overfishing of an annual crop can more readily lead to an overfished condition. For example, the established definition of “overfishing” for white shrimp, where the stock size is reduced because of a cold winter kill, is in essence, an MSST, not an overfishing threshold. It is unclear whether restriction of fishing effort would be necessary to allow populations to increase above the MSST. As a result, for Alternatives 1 and 3, should either of these conditions be triggered the Council would convene the Shrimp Review Advisory Panel for additional advice on whether it is necessary to take restrictive management action.

Because of their high sensitivity to certain environmental factors, South Atlantic shrimp demonstrate fluctuating population structure. Annual sampling of shrimp from the southeast region indicate that density per hectare have varied by a factor of 5 to 10, and can more than double from one year to the next (Table 4.2-5). Due to high fecundity and migratory behavior, the three penaeid species are capable of rebounding from very low population sizes in one year to large population sizes in the next, provided environmental conditions are favorable (SAFMC 1996b). Short-term restrictions that are enacted on an as needed basis, such as the fishery closure that protects “overwintering” white shrimp in the event of a “cold kill” (Section 3.1.), are more appropriate for management of these species. These types of restrictions are enacted for a specific geographic area where the shrimp population is negatively affected by extreme environmental conditions.

4.2.6.2 Protected resources impacts

There are no direct impacts on protected resources from defining/establishing stock status determination criteria in the penaeid shrimp fishery. Indirect impacts may occur due to subsequent management action in response to an evaluation of the fishery with respect to these criteria, particularly if the management action results in an increase or a decrease in fishing effort. Such impacts cannot be identified until a specific management action is proposed.

4.2.6.3 Economic impacts

Defining these biological parameters for the penaeid shrimp species would not have any direct economic effects on fishing sectors, communities or society. Also, it is not possible to compare the short-term and long-term indirect economic effects among these three alternatives. The rationale for this conclusion is discussed in more detail in the subsequent paragraphs.

Typically, fishery managers use stock status determination criteria (SSDC) to assess the health of a fishery and management actions such as seasonal closures and quota restrictions are tied to these assessments for longer lived species. Economic effects would arise from the implementation of such management actions and it is usually possible to compare alternative specifications of the SSDC based on their associated indirect short-term economic effects on existing fishing sectors and communities.

Under all three alternatives if there is a determination of overfished or overfishing, for any of the three penaeid shrimp species, it is unclear whether future restrictive management actions would automatically ensue. In the event of an overfishing or overfished determination a review panel will be convened to make recommendations to the Council on whether to take action and if so the geographic extent of such action (small area closures versus regional closures) and its duration. Thus, it is not possible to speculate on the magnitude of the potential short-term effects associated with these three alternatives.

Penaeid shrimp species are annual crops and as discussed in Section 3.1.4 recruitment is closely linked to environmental conditions. Although fishing certainly reduces the population size over the course of a season, the impact of fishing on subsequent year class strength is unknown. Because annual variation in catch is presumed to be due to a combination of prevailing environmental conditions, fishing effort, price and relative abundance of shrimp (SAFMC 1996b), 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. Even in this extreme situation restrictions on fishing effort may result in negative economic effects if forgone fishery benefits (cost) of the closure is greater than the incremental economic benefits from the subsequent year’s/season’s production.

4.2.6.4 Social impacts

Specifying the overfished and overfishing definitions does not directly affect resource use and, therefore has no direct effects on existing fisheries and communities. Direct effects associated with resource use would only accrue to subsequent management action in response to an evaluation of the fishery with regards to these benchmarks. With no direct change in the use of the resource by individuals or communities, there would be no behavioral changes by these individuals or communities and, therefore, no indirect effects attributed to such change. These definitions are statutory requirements of an FMP, and their establishment would provide public satisfaction by recognizing that the Council is effectively managing the resource. Alternatives 1, 2 and 3 may cause indirect impacts on the fishermen and their communities should it be determined that lower allowable catch levels are required to meet more conservative definitions of the SFA Parameters.

It should be noted that such SFA Parameters – their definition and methods for determining criteria – are concepts not well-understood by the public at large. As such, the simple discussion of such scientific parameters has the effect of confusing some sectors of both the fishing and non-fishing public. This confusion is often linked to further dissatisfaction by the public of fishery management and managers, having a negative impact on the amount of confidence the public has in government officials.

4.2.6.5 Conclusion

Alternative 2, the no action alternative, would maintain the existing stock status determination criteria for each species. For white shrimp, the states of Georgia and South Carolina make a determination that the overwintering stock of white shrimp has declined by 80% or more. The states then close their respective waters for a designated time period, and request that the Council do the same for the EEZ. If brown or pink shrimp stocks are determined to be overfished or if overfishing is occurring the Council would convene the Shrimp Stock Assessment Panel, the Shrimp Advisory Panel, and the Shrimp Committee to review the cause of such declines and recommend any appropriate Council action to address the problem. There is no current overfished definition for white shrimp and no overfishing definition for pink and brown shrimp. Alternatives 1 and 3 specify all of the necessary parameters for these three penaeid shrimp species.

The limitation to Alternatives 2 and 3, compared to Alternative 1, is their total dependence on catch as a threshold measure for the status (health) of brown and pink shrimp stocks. For these species these alernatives do not account for external factors, such as economic or social conditions, that might influence the overall annual landings of a particular species. It is possible that the fishery might not target a species to the extent possible during a given year, and low landings could result from a lack of effort instead of a reduced stock size. Or, similarly, a stock might undergo a poor recruitment year, but still be relatively healthy, but reduced catch rates combined with economic or social factors might inhibit fishery effort on that stock, and annual landings would decline. Alternative 1, by directly relating catch to a fishery independent measure of stock abundance and density, provides an immediate indication of the status of the stock. For these reasons the Council indicated a preference for Alternative 1.

It must be noted that Alternative 2 (no action) does not specifically define all the status determination criteria for the penaeid shrimp apecies. Thus, this alternative does not totally fulfill the relevant requirements of the Magnuson-Stevens Act and the national standard guidelines.

The Council received a fair amount of public comments objecting to this action and not specific to any of the alternatives. In fact, it was evident that recommendations of “no action” did not refer to support for Alternative 2 but were concerns expressed about setting SSDC for these species as indicated by the following comments:

1. Shrimp species cannot be overfished since they are annual crops.
2. Loss of marshes and destruction of other inland habitat by developers, use of pesticides in nearshore areas are real problems for the health of shrimp stocks.

3. Unfair to classify low shrimp populations that are due to environmental conditions as overfished.
4. The states are doing a good job with stock management.
5. Water quality issues should be addressed since the effort in the fishery has declined and less shrimp is caught today compared to the harvest 20 years ago.
6. Shrimp stocks should be exempt by law from management based on SSDC.
7. It is unlikely that there would be overfishing since effort in the shrimp fishery has declined. A large number of vessels have exited the fishery and this trend is continuing.
8. Rock shrimp have a short life span and it is impossible to deplete the fishery. Due to limited entry it is unlikely that there would be overfishing in the future. Also, two consecutive years is not enough time to determine if the resource is overfished.
9. It is inappropriate to use MSY and OY for management of an annual species such as shrimp since observed declines in fishery dependent and fishery independent data would be due to environmental conditions such as water temperature and rainfall and unlikely to be attributed to spawning stock abundance.
10. From data observed at the South Carolina Department of Natural Resources spawning stock abundance has to reach extremely low levels to result in poor recruitment. Given the current economic climate it is unlikely that fishing mortality alone would reduce spawning stock to such low levels that results in recruitment failure.

The Council is aware that due to high fecundity and migratory behavior, the three penaeid species are capable of rebounding from very low population sizes in one year to large population sizes in the next, provided environmental conditions are favorable (SAFMC 1996b). Short-term restrictions that are enacted on an as needed basis, such as the fishery closure that protects “overwintering” white shrimp in the event of a “cold kill” (Section 3.1.5), are more appropriate for management of these species. These types of restrictions are enacted for a specific geographic area where the shrimp population is negatively affected by extreme environmental conditions. As a result, the Council determined that if an overfishing/overfished determination is made a Shrimp Review Advisory Panel will evaluate the data upon which this determination was made, and other relevant information pertaining to this fishery, to determine cause and effect, the geographical extent of the problem and whether management action(s) is required. Any action would then need to be processed through the Council system, most likely culminating in the request for NOAA Fisheries to publish an emergency rule that addressed the overfishing/overfished situation.

There was one public comment on whether the SEAMAP data may be useful for monitoring species that are as dynamic in abundance as shrimp. The scientist who provided this comment stated that there is too much day to day and week to week variability in shrimp abundance to use the SEAMAP trawl survey data for generating OY and MSY estimates. In the SEAMAP program individual areas are not sampled sufficiently to come up with an index of annual abundance of a stock in a given year. Scientists at NOAA Fisheries responded that on a day-to-day basis or on a week-to-week basis, the SEAMAP sampling may not be reflective of actual stock abundance, but the data are of value on an annual basis. These annual values are relatively stable across years. They may or may not accurately reflect true shrimp abundance for a specific year, but they still provide a stable, fishery independent index of relative abundance by which to judge yields against parent stock size. The Council intends that the Shrimp Review Advisory Panel will take these comments (on the use of the SEAMAP data) into consideration if they are convened to address an overfished or overfishing determination for one of these penaeid shrimp species.

4.2.7 Action 7. Revise, establish and/or retain status determination criteria for rock shrimp.

Alternative 1 (Preferred). Establish stock status determination criteria consistent with those of penaeid shrimp, where MSY/OY for rock shrimp is the mean total landings for the South Atlantic during 1986 through 2000 (4,912,927 pounds heads on), where overfishing (MFMT) for rock shrimp would be a fishing mortality rate that led to annual landings larger than two standard deviations (9,774,848 pounds heads on) above MSY (4,912,927 + 9,774,848 = 14,687,775 pounds heads on) for two consecutive years, and MSST would be parent stock size less than ½ (Bmsy) for two consecutive years.

Alternative 2. No action. Retain the current status determination criteria definitions for rock shrimp.

Table 4.2-6. Current stock status determination criteria for rock shrimp

BRP/SDC	Shrimp species	Designation
MSY	rock	6,829,449 pounds
OY	rock	OY is MSY 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.
Overfishing and Overfished Level	rock	Rock shrimp are overfished when the annual landings exceed the value which is two standard deviations above mean landings 1986-1994. This level, based on the more accurate state data, is 6,829,449 pounds.

Alternative 3. Using the established 6,829,449 pounds (heads on) MSY/OY values, overfishing (MFMT) for rock shrimp would be landings in excess of MSY for two consecutive years and overfished (MSST) would be landings below ½ MSY (3,464,274 pounds heads on) for two consecutive years.

There are no remedial actions associated with Alternative 2. If either Alternative 1 or 3 is chosen a determination of overfishing or overfished for rock shrimp would trigger the following action: The Shrimp Review Advisory Panel will evaluate the data upon which this determination was made and other relevant information pertaining to this fishery to determine cause and effect, the geographical extent of the problem and whether management action(s) is required. Nevertheless, any action would then need to be processed through the Council system, most likely culminating in the request for NOAA Fisheries to publish an emergency rule that addressed the overfishing/overfished determination.

This Shrimp Review Advisory Panel will be comprised of a Council staff member, a NOAA Fisheries Southeast Fisheries Science Center scientist, a NOAA Fisheries social scientist with expertise on the shrimp fishery in the South Atlantic, a member of the Council’s Scientific and Statistical Committee and a state shrimp biologist from each of the states in the South Atlantic Council’s area of jurisdiction.

Discussion:

Alternative 2 (no action) which describes the current status determination criteria for rock shrimp was established assuming the fishery was fully exploited, MSY is currently established as 6,829,449 pounds (heads on) (SAFMC 1996a). OY is equal to MSY is equal to MSST for the rock shrimp fishery, which represents the estimated harvest that can be taken by U.S. fishermen without reducing the spawning stock below the level necessary to ensure adequate reproduction. There is no overfishing (MFMT) value established for rock shrimp, and the overfished (MSST) definition is when annual landings exceed the value, which is two standard deviations above mean landings during 1986 to 1994 (mean=3,451,132 lb., s.d. =1,689,159), or 6,829,449 pounds (heads on) (SAFMC 1996a). The established definition of "overfished" for rock shrimp is, in essence, "overfishing" leading to an overfished condition, not an overfished definition. As noted in Section 4.2.6 overfishing and overfished are intertwined for these annual crops; however, this definition appears to be the opposite with the overfished definition for brown/pink shrimp, which is "when landings are 2 standard deviations below mean landings."

Unfortunately, more specific data, such as the SEAMAP-SA data available for penaeid shrimp, are not available for the rock shrimp fishery. Only catch and effort information are available, but prior to recent actions by the Council to regulate the rock shrimp fishery (Amendment 5 to the FMP), effort data were limited. Pending the collection of a time series of data regarding the effort component of the fishery, catch data are all that are available by which to monitor the fishery. Alternatives 1 and 3 provide a definition of the stock status determination criteria for rock shrimp that is consistent with the concepts established for the penaeid shrimp fishery. Alternative 3, which relies on an MFMT associated with a harvest level of 6,829,449 pounds heads on is more conservative than Alternative 1 where MFMT , which establishes an MSY of mean annual landings, consistent with the definitions established for penaeid stocks. Alternative 3 does provide a more conservative estimate of MFMT, given that MSY is already established as a value in excess of mean annual landings. The conceptual approach to defining MSST is the same between Alternatives 1 and 3, but because MSY is lower in Alternative 3, the resulting threshold landings value are much higher (more conservative) in Alternative 3.

Table 4.2-7. Annual landings for rock shrimp (Numbers for 1986-1994 are taken from Amendment 1 to the Shrimp Plan. Data for the period 1995-2000 are taken from Shrimp Amendment 5).

Year	Landings	Year	Landings
1986	2,514,895	1995	4,801,565
1987	3,223,692	1996	21,347,989
1988	1,933,097	1997	2,410,821
1989	3,964,942	1998	2,701,545
1990	3,507,955	1999	3,462,200
1991	1,330,919	2000	7,909,599
1992	2,572,727		
1993	5,297,197		
1994	6,714,761		

The data used to derive current estimates of MSY and the MFMT proxy for rock shrimp contained in Table 4.2-7 and other catch based proxies used in Shrimp Amendment 6 will be revised in the future due to updates in the Florida trip ticket program and other data collection programs. It is the Council's intent that any changes to the estimates of MSY, MFMT and other catch based proxies (e.g., MSST) will be based upon the approved methodology described in the Preferred Alternative, using the 1986-2000 time period and will be based on the best available data at that time.

4.2.7.1 Biological impacts

There are no direct biological impacts from establishing benchmarks by which to assess the health of the stock. Indirectly, the establishment of overfished and overfishing thresholds sets the upper limit on catches, ensuring the biological stability of the resource. For species such as rock shrimp, which in essence are annual crops dependent on a minimum parent stock size to produce sufficient recruits for the next fishing year, the concept of overfished and overfishing are distinctly linked. Additionally, as in the definition of OY for penaeid shrimp, the definition of OY for rock shrimp is tied directly to the overfished definition. Unlike longer lived species where overfishing may occur without the stock becoming overfished, overfishing of an annual crop can more readily lead to an overfished condition.

Like the penaeid species it is expected that rock shrimp would be capable of rebounding from very low population sizes in one year to large population sizes in the next, provided environmental conditions are favorable. This would be attributed to the high fecundity and migratory behavior of this species. Should the need arise short-term restrictions in a specific geographic area that are enacted on an as needed basis, such as the fishery closure that protects “overwintering” white shrimp in the event of a “cold kill” (Section 3.1.5), are more appropriate for management of this species.

4.2.7.2 Protected resources impacts

There are no direct impacts on protected resources from defining/establishing stock status determination criteria in the rock shrimp fishery. Indirect impacts may occur due to subsequent management action in response to an evaluation of the fishery with respect to these criteria, particularly if the management action results in an increase or a decrease in fishing effort. Such impacts cannot be identified until a specific management action is proposed.

4.2.7.3 Economic impacts

Defining these biological parameters for the rock shrimp would not have any direct economic effects on fishing sectors, communities or society. Also, it is not possible to compare the short-term and long-term indirect economic effects among these three alternatives. The rationale for this conclusion is discussed in more detail in the subsequent paragraphs.

Typically, fishery managers use stock status determination criteria (SSDC) to assess the health of a fishery and management actions such as seasonal closures and quota restrictions are tied to these assessments for longer lived species. Economic effects would arise from the implementation of such management actions and it is usually possible to compare alternative specifications of the SSDC based on their associated indirect short-term economic effects on existing fishing sectors and communities.

If either Alternative 1 or 3 is implemented and a determination of overfished or overfishing for rock shrimp is made, it is unclear whether future restrictive management actions would automatically ensue. In the event of an overfishing or overfished determination the Shrimp Review Advisory Panel will be convened to make recommendations to the Council on whether to take action, and if so the geographic extent of such action (small area closures versus regional closures) and its duration. Thus, it is not possible to speculate on the magnitude of the potential short-term effects associated with these two alternatives. There are no remedial actions associated with Alternative 2 and thus there would be no short-term loss of revenue to the rock shrimp industry in the event of an overfished or overfishing state.

Like the penaeid shrimp species rock shrimp have a short life span and recruitment is closely linked to environmental conditions. Although fishing certainly reduces the population size over the course of a season, the impact of fishing on subsequent year class strength is unknown. Because annual variation in catch is presumed to be due to a combination of prevailing environmental conditions, fishing effort, price and relative abundance of shrimp (SAFMC 1996b), 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. Even in this extreme situation restrictions on fishing effort may result in negative economic effects if forgone fishery benefits (cost) of the closure is greater than the incremental economic benefits from the subsequent year's/season's production.

4.2.7.4 Social impacts

Specifying the overfished and overfishing definitions does not directly affect resource use and, therefore has no direct effects on existing fisheries and communities. Direct effects associated with resource use would only accrue to subsequent management action in response to an evaluation of the fishery with regards to these benchmarks. With no direct change in the use of the resource by individuals or communities, there would be no behavioral changes by these individuals or communities and, therefore, no indirect affects attributed to such change. These definitions are statutory requirements of an FMP, and their establishment would provide public satisfaction by recognizing that the Council is attempting to effectively manage the resource

4.2.7.5 Conclusion

Alternative 2, the no action alternative, would maintain the existing stock status determination criteria for each species. If Alternative 2 is adopted there is no remedial action associated with a determination of overfishing or overfished. Also, not all criteria were specifically defined for rock shrimp and thus this alternative does not totally fulfill the relevant requirements of the Magnuson-Stevens Act and the national standard guidelines.

Alternatives 1 and 3 specify all of the necessary parameters for the rock shrimp fishery. If an overfishing determination is made the Shrimp Review Advisory Panel will evaluate the data upon which this determination was made and other relevant information pertaining to this fishery to determine cause and effect, the geographical extent of the problem and whether management action(s) is required. Nevertheless, any action would then need to be processed through the Council system, most likely culminating in the request for NOAA Fisheries to publish an emergency rule that addressed the overfishing/overfished situation.

The limitation to all these alternatives is the total dependence on catch as a threshold measure for the status (health) of the stock in question. It does not account for external factors, such as economic or social conditions, that might influence the overall annual landings. It is possible that the fishery might not target a species to the extent possible during a given year and low landings could result from a lack of effort instead of a reduced stock size. Or, similarly, the rock shrimp stock might undergo a poor recruitment year, still be relatively healthy, but reduced catch rates combined with economic or social factors might inhibit fishery effort on that stock, and annual landings would decline. Under such a scenario, the Council would want to further evaluate all the conditions before making a determination regarding the status of the stock.

As detailed in Section 4.2.6.5 the Council received a fair amount of public comments objecting to this action. The Council is aware that rock shrimp are capable of rebounding from very low population sizes in one year to large population sizes in the next, provided environmental conditions are favorable (SAFMC 1996b). Short-term restrictions that are enacted on an as needed basis, such as the fishery closure that protects “overwintering” white shrimp in the event of a “cold kill” (Section 3.1.5), are more appropriate for management of shrimp species. These types of restrictions are enacted for a specific geographic area where the shrimp population is negatively affected by extreme environmental conditions. As a result, the Council determined that if an overfishing/overfished determination is made a Shrimp Review Advisory Panel will evaluate the data upon which this determination was made and other relevant information pertaining to this fishery to determine cause and effect, the geographical extent of the problem and whether management action(s) is required. Any action would then need to be processed through the Council system, most likely culminating in the request for NOAA Fisheries to publish an emergency rule that addressed the overfishing/overfished situation.

Alternatives 1 and 3 provide a definition of the stock status determination criteria for rock shrimp that is consistent with the concepts established for the penaeid shrimp fishery. The Council chose Alternative 1 since it relies on a time series of data that includes more recent landings information compared to Alternative 3. More recent data would better reflect both current effort levels and productivity of this rock shrimp fishery

4.3 Research needs

1. Research to relate the fishery independent SFA parameters with stock health in specific geographic locations.
2. 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.
3. Assess the potential utility of releasing maricultured white shrimp into the environment to supplement natural reproduction, especially following cold kills.
4. Assess the potential of controlled closures and other measures to enhance the production and economics of the South Atlantic shrimp fishery.
5. Determine the effects of beach renourishment projects on subsequent shrimp production.
6. Evaluate the impacts of habitat and water quality alteration on shrimp growth, survival and productivity.
7. Investigate the costs, benefits and utility of limited entry programs in the shrimp fishery of the South Atlantic.
8. 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").
9. 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.
10. Determine the biological, economic and sociological status of the rock shrimp fishery.
11. Research ways to better monitor the shrimp fishery effects on listed species.

Additional research requirements pertaining to the economic and social aspects of the shrimp fishery are contained in the RIR summary section and the SIA summary section.

4.4 Unavoidable adverse effects

Adverse economic effects to the shrimp harvesting sector would arise from the measures to reduce bycatch in the rock shrimp fishery and the requirement for a federal penaeid shrimp permit. At most, the requirement for BRDs in the rock shrimp fishery could reduce revenue by 0.6% annually for an estimated 43 vessels in the rock shrimp fishery (Section 4.2.4). The permit requirement is not expected to result in a substantial incremental cost to the industry (Section 4.2.5). The cost of a federal permit in the Southeast is $50 per vessel. However, if the vessel owner holds other permits issued by NOAA Fisheries Southeast Regional Office this cost drops to $20 per vessel. These measures do have direct and indirect economic benefits as described in Section 4.2.4.3 and Section 4.2.5.3 respectively.

4.5 Relationship of short-term uses and long-term productivity

In this amendment the only measure that directly affects short-term use of the resource is the measure to reduce bycatch in the rock shrimp fishery (Section 4.2.4). For those trips where BRDs are not used in the rock shrimp fishery it is possible that the BRD requirement (Action 4) could reduce the shrimp retained in the catch. However, this measure is expected to reduce the bycatch in the rock shrimp fishery and possibly increase the long-term productivity of these bycatch species. The other measures in this amendment do not pose any use restriction or prohibitions on fishery participants.

4.6 Irreversible and irretrievable commitments of resources

There are no irreversible commitments of resources other than the costs of administering the permit requirement and enforcing the proposed rule resulting from implementation of this amendment.

4.7 Effects of the fishery on the environment

4.7.1 Damage to ocean and coastal habitats

The proposed actions and their alternatives are not expected to have a negative effect on ocean and coastal habitats including those identified as EFH.

4.7.2 Public health and safety

The proposed actions and their alternatives are not expected to have any substantial adverse impacts on public health or safety. In addition, it is not expected that the shrimp fishery in the South Atlantic will have any substantial adverse impacts on public health and safety.

4.7.3 Endangered species and marine mammals

On December 2, 2002, NOAA Fisheries completed a section 7 consultation and issued a biological opinion on shrimp trawling in the Southeastern United States, under the sea turtle conservation regulations and as managed by the FMPs for Shrimp in the South Atlantic and the Gulf of Mexico. That opinion concluded that shrimp trawling in the Southeastern United States, under the sea turtle conservation regulations and as managed by the FMPs for Shrimp in the South Atlantic and the Gulf of Mexico is 1) not likely to adversely affect sperm, blue, fin, sei, humpback and northern right whales and 2) not likely to appreciably reduce the likelihood of the survival and recovery of Kemp's ridley, green, loggerhead, hawksbill, or leatherback sea turtles in the wild by reducing their reproduction, numbers, or distribution (NOAA Fisheries 2002).

Reinitiation of consultation is required if:

1. The amount or extent of taking specified in the incidental take statement is exceeded,
2. New information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered,
3. The identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or
4. A new species is listed, the identified activity is subsequently modified, or critical habitat is designated that may be affected by this activity.

Preliminary assessment indicates that reinitiation of consultation is not necessary on the South Atlantic shrimp fishery, as proposed and its effects on listed marine mammals and sea turtles.

However, the smalltooth sawfish was listed after the consultation was concluded and may be adversely affected by the South Atlantic shrimp fishery. The Southeast Regional Office's Division of Protected Resources will conduct an ESA Section 7 consultation on the impacts of the actions in this amendment.

4.7.4 Cumulative effects

As directed by NEPA, federal agencies are mandated to assess not only the indirect and direct impacts of alternatives, but the cumulative impacts as well. NEPA defines a cumulative impact as "*the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*" (40 C.F.R. 1508.7).

The purpose of analyzing cumulative effects is to ensure that an agency considers the full range of effects of their actions. Federal agencies make thousands of incremental, project-level decisions without considering the effect on regional resources. As a result, effects may accumulate over time, causing serious harm to invaluable resources.

In assessing the cumulative impacts, agencies may conduct what is known as a cumulative effects analysis (CEA). The basic philosophy behind a cumulative effects analysis is to consider the multitude of federal and non-federal actions, in addition to natural-occurring events, on resources, ecosystems and human communities. The cumulative effects analysis supplements the more common environmental analysis that examines the effects of a particular project or management action on the environment.

Various approaches for assessing cumulative effects have been identified, including checklists, matrices, indices and detailed models (MacDonald 2000). The Council on Environmental Quality (CEQ) offers guidance on conducting a cumulative effects analysis in a report titled Considering Cumulative Effects under the National Environmental Policy Act. The report outlines 11 steps for consideration in drafting a cumulative effects analysis for a proposed action:

1. Identify the significant cumulative effects/issues associated with the proposed action and define the assessment goals.
2. Establish the geographic scope of the analysis.
3. Establish the timeframe for the analysis.
4. Identify the other actions affecting the resources, ecosystems and human communities of concern.
5. Characterize the resources, ecosystems and human communities identified in scoping in terms of their relation to regulatory thresholds.
6. Characterize the stresses affecting these resources, ecosystems and human communities and their relation to regulatory thresholds.
7. Define a baseline condition for the resources, ecosystems and human communities.
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems and human communities.
9. Determine the magnitude and significance of cumulative effects.
10. Modify or add alternatives to avoid, minimize or mitigate significant cumulative effects.
11. Monitor the cumulative effects of the selected alternative and adapt management.

Cumulative effects on the biophysical environment and the socio-economic environment will be analyzed separately. The cumulative effects analysis for the biophysical environment will follow these 11 steps.

For the purposes of focusing the cumulative effects analysis onto important issues, the biophysical environment will be separated into three categories: 1) the three penaeid species of shrimp (white, brown and pink) and rock shrimp, 2) essential fish habitat (EFH) and EFH-Habitat Areas of Particular Concern (EFH-HAPCs) for penaeid and rock shrimp, and 3) species most commonly caught as bycatch from shrimp trawls. Due to the variety of species obtained as a result of bycatch, the cumulative effects analysis will focus on two species with the highest level of bycatch (blue crab and cannonball jellyfish) in terms of weight (kg) per hour from catch data collected from NOAA Fisheries-trained observation of trawl haul subsamples between February 1992 through 1996 in the waters off the southeast Atlantic coast of the United States.

4.7.4.1 Cumulative effects on the biophysical environment

SCOPING FOR CUMULATIVE EFFECTS

1. Identify the significant cumulative effects/issues associated with the proposed action and define the assessment goals.

The CEQ cumulative effects guidance states that this step is done through three activities. The three activities and their location in the document are as follows:

I. The direct and indirect effects of the proposed actions **(Section 4.0)**;
II. Which resources, ecosystems and human communities are affected **(Section 3.0)**; and
III. Which effects are important from a cumulative effects perspective **(this CEA)**.

2. Establish the geographic scope of the analysis.

The proposed actions in this amendment do not contain an immediate impact area or what CEQ refers to as a “project impact zone”. Therefore, to identify the geographical boundaries for the cumulative effects analysis, the analyst must identify the spatial limits of the affected resources.

A. Penaeid and rock shrimp

Shrimp utilize different habitats at different stages of their life history. As a result, the latitudinal and longitudinal scope of the four species in the fishery management unit (FMU) includes a large portion of the eastern seaboard (Table 4.7-1 and 4.7-2).

Table 4.7-1. The northern and southern limits of the four shrimp species in the FMU (SAFMC 1998a,b).

	northern limit	**southern limit**
white shrimp	Fire Island, New York	St. Lucie Inlet, Florida
brown shrimp	Martha Vineyard's, Massachusetts*	Florida Keys
pink shrimp	Southern Chesapeake Bay	Yucatan Peninsula south of Cabo Catoche
rock shrimp	Virginia	Cuba

*The breeding populations do not range north of North Carolina

Table 4.7-2. The longitudal distribution of the four shrimp species in the FMU (SAFMC 1998a,b).

	minimum depth	**greatest abundance**	**maximum depth**
White shrimp	estuarine habitat (postlarvae)*	≤27 m (89 ft)	82 m (270 ft)
brown shrimp	estuarine habitat (postlarvae)*	<55 m (180 ft)	110 m (361 ft)
Pink shrimp	estuarine habitat (postlarvae)*	11-37 m (36-121 ft)	65 m (213 ft)
Rock shrimp	few meters	25-65 m (82-213 ft)	183 m (600 ft)

*The Habitat Plan (SAFMC 1998b) contains maps showing the relative abundance of white, brown and pink shrimp in the estuaries of the four South Atlantic states.

B. Shrimp EFH and EFH-HAPC

Basing the geographic scope of the cumulative effects analysis solely on shrimp distribution would be insufficient. By definition, shrimp essential fish habitat is integral to shrimp survival and should be used to develop the scope. Under Shrimp FMP Amendment 3, Essential Fish Habitat for the South Atlantic shrimp resource was defined as follows [Note: Detailed information is presented in the Council's Habitat Plan and Comprehensive EFH Amendment (SAFMC 1998a,b)]:

Penaeid shrimp: inshore estuarine nursery areas, offshore marine habitats used for spawning and growth to maturity, and all interconnecting water bodies as described in the Habitat Plan (SAFMC 1998b). Inshore nursery areas include tidal freshwater (palustrine), estuarine and marine emergent wetlands (e.g., intertidal marshes); tidal palustrine forested areas; mangroves; tidal freshwater, estuarine and marine submerged aquatic vegetation (e.g., seagrass); and subtidal and inter-tidal non-vegetated flats. This applies from North Carolina through the Florida Keys.

Rock shrimp: offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 34 and 55 meters. This applies for all areas from North Carolina through the Florida Keys. Essential fish habitat includes the shelf current systems near Cape Canaveral, Florida, which provide major transport mechanisms affecting planktonic larval rock shrimp. These currents keep larvae on the Florida shelf and may transport them inshore in spring. In addition, the Gulf Stream is an essential fish habitat because it provides a mechanism to disperse rock shrimp larvae.

Shrimp Amendment 3 also established Essential Fish Habitat-Habitat Areas of Particular Concern (EFH-HAPCs) for penaeid shrimp in the South Atlantic. Areas that meet the criteria for EFH-HAPCs for penaeid shrimp include all coastal inlets, all state-designated nursery habitats of particular importance to shrimp and state-identified overwintering areas.

C. Species most commonly caught as bycatch from shrimp trawls

Actions proposed in this amendment target the efficiency of bycatch reduction through: 1) the installation of a regular monitoring program; 2) amendments to the BRD certification criteria; and 3) implementation of measures to reduce bycatch in the rock shrimp fishery. As a result of the nature of the proposed actions, the geographical scope of the cumulative effects analysis should include the spatial limits of the species identified as bycatch of the shrimp trawls. Past catch estimates reveal that this would include a significant number of species (Table 4.7-3). It must be noted that these study results were based on observer coverage conducted during a period when BRDs were not required in this fishery and these findings may not accurately reflect the current composition and relative abundance of the bycatch species in the shrimp fishery. However, as more recent data on bycatch in the South Atlantic shrimp fishery is not available, the cumulative effects analysis utilizes this information to discuss the potential cumulative effects of shrimp trawling on two species: the blue crab (*Callinectes sapidus*) and the cannonball jellyfish (*Stomolophus meleagris*). The blue crab and cannonball jellyfish were chosen as they represented the greatest portion of shrimp bycatch, in terms of weight (kg) per hour for the Atlantic Northern Area (>34° N) and the Atlantic Middle Area (30-34° N), respectively. In addition, the cannonball jellyfish represented the greatest catch by weight for the entire South Atlantic in the same study (Figure 3.1-3). The blue crab resource and cannonball jellyfish population also represent appropriate species for the analysis of cumulative effects for other reasons as well. Landings of blue crabs have been lower in recent years from Georgia and North Carolina waters, partially due to drought conditions. Also, cannonball jellyfish are currently harvested in the South Atlantic in order to supply the Asian culture with dried jellyfish; some believe that this harvest could expand, especially in light of new research that shows cannonball jellyfish may contain a collagen to treat rheumatoid arthritis. Therefore, it would be beneficial to measure the cumulative impacts, including impacts from shrimp trawling, on the blue crab and cannonball jellyfish resource.

Table 4.7-3 Composition of catch recorded by NOAA Fisheries-trained observers on penaeid shrimp trawls between February 1992 and 1996 in the waters off the southeast Atlantic coast of the United States (Nance *et al.* 1997). Species are ranked according to the frequency of catch in terms of weight (kg) per hour.

	Atlantic Northern Area (>34° N)	**Atlantic Middle Area (30-34° N)**	**Atlantic Southern Area (<30° N)**
1	Blue Crab	Cannonball Jellyfish	Brown Shrimp
2	Pink Shrimp	Atlantic Menhaden	Star Drum
3	Spot	White Shrimp	Southern Kingfish
4	Brown Shrimp	Spot	Spot
5	Atlantic Croaker	Star Drum	Lady Crab
6	Pinfish	Jellyfish (Carbdeidae)	Lesser Blue Crab
7	Pigfish	Brown Shrimp	White Shrimp
8	Atlantic Thread Herring	Atlantic Croaker	Spanish Mackerel
9	Summer Flounder	Southern Kingfish	Northern Searobin
10	Southern Hake	Cutlassfish	Striped Searobin

As in the penaeid fishery, at-sea observation of rock shrimp fishery trawls have revealed an assortment of animals (Table 4.7-4).

Table 4.7-4 Weight extrapolations from the species composition samples for 2001 and 2002: all areas, seasons and depths from the at-sea observation of 177 tows on six rock shrimp trips (NOAA Fisheries 2003c).

Species	**Weight (kg)**	**Percent weight**
Dusky flounder, *Syacium papillosum*	2761	13
Iridescent swimming crab, *Portunus gibbesii*	2167	10
Rock shrimp, *Sicyonia brevirostris*	2066	10
Inshore lizardfish, *Synodus foetens*	1917	9
Longspine swimming crab, *Portunus spinicarpus*	1621	8
Spot, *Leiostomus xanthurus*	1338	6
Blotched swimming crab, *Portunus spinimanus*	1011	5
Brown shrimp, *Farfantepenaeus aztecus*	778.6	4
Red goatfish, *Mullus auratus*	490.6	2
All other species combined	7090.3	33

In light of the number of affected resources, the cumulative effects analysis cannot identify geographical boundaries in terms of latitudinal and longitudinal coordinates, but recognize that the proper geographical boundary to consider the cumulative effects on the biophysical environment is quite large and would most likely encompass a large portion of the South Atlantic EEZ.

3. Establish the timeframe for the analysis.

Establishing a timeframe for the cumulative effects analysis is important for Step 4, when the past, present and reasonably foreseeable future actions are discussed. Many feel that the cumulative effects analysis should return to a time period when there was a natural, or some modified (but ecologically sustainable) condition. For precautionary reasons, it is wise to be conservative and began analysis with data from the early 1970s (the beginning of data collection). In terms of the future, the agency must separate reasonably foreseeable impacts from remote or speculative ones. In fishery management, reasonably foreseeable actions and impacts, one that can be reasonable to predict or anticipate, could be estimated at 10 years or less.

4. Identify the other actions affecting the resources and ecosystems of concern.

Listed are other past, present and reasonably foreseeable actions occurring in the geographic scope identified in Step 2. These actions, when added to the proposed actions within this amendment, may result in cumulative effects on the biophysical environment.

I. Management and other fishery-related actions on: 1) the three penaeid species of shrimp (white, brown and pink) and rock shrimp, 2) essential fish habitat for shrimp, and 3) species most commonly caught as bycatch from penaeid shrimp trawls.

A. Penaeid and rock shrimp

Shrimp landings are contained in Tables 3.2-1 and 3.2-4.

The reader is to refer to **Section 1.3 History of Shrimp Management in the South Atlantic** for a detailed account of the past regulatory activity for the shrimp species. In summary, the Council/NOAA Fisheries has required the use of VMS on rock shrimp vessels and BRDs on those vessels trawling for white, brown and pink shrimp. Areas have been closed to trawling for rock shrimp to minimize the impacts of the fishery on essential fish habitat, while temporal closures are in effect for white, brown and pink shrimp in federal waters following severe cold weather that may cause depletion of the spawning stocks.

Proposed actions contained in this amendment seek to reduce bycatch, either directly or indirectly, by amending the bycatch reduction device (BRD) Testing Protocol system, adjusting the criteria for the certification of new BRDs, establishing a method to monitor and assess bycatch in the South Atlantic rock shrimp and penaeid fishery and minimizing bycatch in the rock shrimp fishery to the extent possible. Other proposed actions include the requirement for a federal penaeid shrimp permit, in addition to a revision or establishment of status determination criteria for penaeid shrimp stocks.

B. Shrimp EFH and EFH-HAPC

Section 303(a)(7) of the Magnuson-Stevens Act directs the Council and NOAA Fisheries to describe EFH and identify EFH in each FMP, minimize to the extent practicable the adverse effects of fishing on EFH, and identify other actions to encourage the conservation and enhancement of EFH. The areas designated as Shrimp EFH and EFH-HAPCs are outlined in Step 2. Action taken by the Council to protect penaeid and rock shrimp habitat, including designation of the *Oculina* Experimental Closed Area, are outlined in **Section 1.3 History of Shrimp Management in the South Atlantic.**

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

Blue crab represents a substantial commercial and recreational fishery in the South Atlantic (Figure 4.7-1).

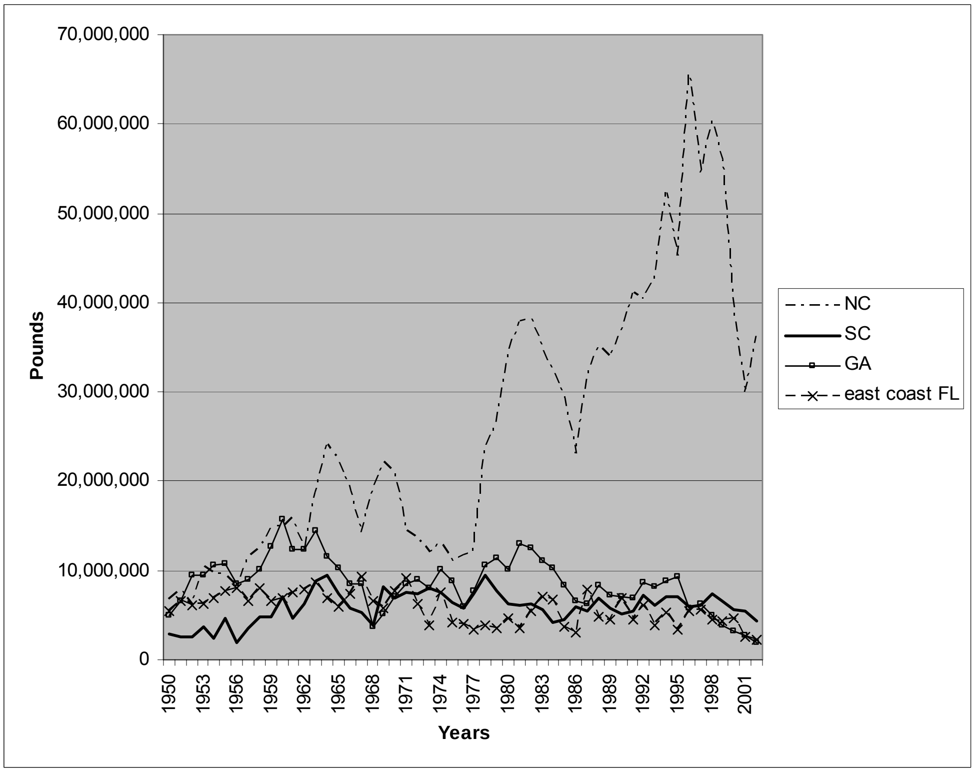


Figure 4.7-1. Blue crab landings off the coasts of North Carolina, South Carolina, Georgia and Florida (source: http://www.st.nmfs.gov/st1/commercial/).

Blue crab is managed by the states. North Carolina has established a 5 inch minimum carapace width as a minimum size limit. In addition, harvest is limited to 50 crabs per day not to exceed 100 crabs per vessel per day.

South Carolina regulations restrict recreational harvest to two pots or traps per person. Crab pots may not be left unattended for more than five days and must be constructed in a specific manner. Harvest of female blue crabs with egg masses is prohibited.

In Georgia, regulations for commercial blue crab harvesters have included: 1) a ban on the harvest of egg-bearing females, 2) a controlled access program that limits commercial blue crab licenses, 3) use of escape rings in crab traps, and 4) a maximum limit on the number of traps.

The commercial and recreational harvest of all adult female blue crabs was prohibited in Georgia's waters from March 1 to March 31, 2004 in response to record low abundance. In addition, the commercial and recreational harvest of peeler female blue crabs was prohibited from March 1 to March 21, 2004.

The Florida Marine Fisheries Commission limit blue crab bycatch in shrimp trawls to 200 pounds per vessel per trip. Harvest with blue crab traps is prohibited in federal waters. Other regulations include restrictions to trap construction and the use of traps (e.g., prohibition on working traps during non-daylight hours).

2. Cannonball jellyfish, *Stomolophus meleagris*

The following taken verbatim from Murphy (2002):

> *In 2001, four shrimp trawlers participated in jellyball harvesting in S.E. Atlantic Federal waters. Vessels used two 60 ft (maximum) crab nets with a minimum of 4" stretch meshed webbing. One trip carried an observer who recorded only minimum bycatch that included finfish species known to associate with jellyfish (e.g. butterfish, harvestfish). One loggerhead sea turtle was also captured and released alive. Tows times were short (less than 30 minutes) with the head rope visible at all times during the tow. Trawlers were not required to pull turtle excluder devices (TEDs) while in Federal waters.*
>
> *Presently, three shrimp trawlers are permitted to fish for jellyballs in Georgia State waters. Permits are required due to state waters currently being closed to food shrimping and the use of non-authorized gear. Trawl fishing is allowed by permit from the Beach/Sound boundary out to the three-mile limit beginning May 18, 2002 and can be continued through the food shrimp season or to which time state waters become closed to trawling. To date, only one trip has been documented (on June 1st) and approximately 90 pounds were caught. The gear is towed in the surface to mid-water range with the head rope remaining buoyant and visible at the surface during all trawling operations. Tow times cannot exceed 30 minutes. The power-drawn trawls have 4-5" stretched mesh webbing for the body and bag. Nets are also equipped with an approved Flounder TED, which must be used in conjunction with a Leatherback Opening. Notification must be given to the Georgia Department of Natural Resources, Coastal Resources Division 24 hours in advance of trawling for jellyballs to allow for the opportunity to place an observer on board the vessel.*
>
> *In addition, 12 individuals were given a Letter of Authorization to test the use of castnets and dip nets in the harvest jellyballs. Harvesting began May 28, 2002 and continued through June 11, 2002. Observers from the Georgia Department of Natural Resources, Coastal Resources Division must be permitted to accompany a trip when requested. If a castnet is used, the net may have a maximum radius of 12' with a mesh size ranging from 2" stretch to 4" stretch. Castnet and dip net jellyball fishing are allowed anywhere in state waters including the sounds. If a holding pen is used, the pen may not be left unattended or anchored and cannot exceed 500 cubic feet.*
>
> *Since dried jellyfish are highly desired in Asian cultures, the hope is cannonball jellyfish will have the potential to be an alternative, seasonal fishery for coastal fishermen. Georgia is looking at a March to September window for harvesting. The Coastal Resources Division is collecting data on these fisheries via observers and logbook reports.*

II. Past, present and reasonably foreseeable future non-Council and other non-fishery related actions, including natural events and anthropogenic activities affecting: 1) the three penaeid species of shrimp (white, brown and pink) and the rock shrimp, 2) EFH and EFH-HAPC for shrimp, and 3) species most commonly caught as bycatch from shrimp trawls.

A. Penaeid and rock shrimp

1. Environmental Conditions

Environmental conditions affect shrimp spawning, growth, habitat selection, osmoregulation, movement, migration and mortality (Muncy 1984). The reader is to refer to Section 3 of this amendment, Muncy (1984) and SAFMC (1993) for more detailed accounts on the response of shrimp populations to environmental variables.

B. Shrimp EFH and EFH-HAPC

1. Habitat degradation/loss

The coastal human population in the southeastern United States will have increased 181% from 1960 to 2010 (Culliton *et al.* 1990). In the wake of population growth along the coast comes increased development. Anthropogenic activities have resulted in the loss of productive areas of fishery habitats in the southeast through the degradation and loss of habitats (see SAFMC 1993 for a more detailed account). The Shrimp FMP identifies anthropogenic activities resulting in degradation and loss of habitats essential for shrimp. Dredge and fill operations may have affected shrimp populations through the elimination of sea grass beds in North Carolina and Florida. In South Carolina and Georgia, the same trends are evident for salt marsh and estuarine systems. Other human actions potentially effecting the quality and quantity of shrimp habitat include plastic pollution (persistent marine debris), upland flood control, hydroelectric power development, oil and gas exploration, atmospheric nitrogen and sulfur deposition (acid rain), ocean dumping, increased harvest due to trends in human population and recreational boat registration in the South Atlantic region (Nance 1998; SAFMC 1993).

The use of otter trawls towed over the seabed may cause impacts through interactions between the seafloor and trawl equipment (trawl doors, footrope, etc.). The reader is to refer to Barnette's (2001) review of the literature for a synopsis of the impacts to the sea floor caused by otter trawls. EFH potentially affected by shrimp trawls include estuarine and marine emergent wetlands (e.g., intertidal marshes) and estuarine and marine submerged aquatic vegetation (e.g., seagrass).

In general, the two major direct effects of trawls include resuspension of sediments and physical habitat destruction. Trawls may disturb bottom and release nutrients into the water column, eventually leading to a decreased seagrass production and decreased light penetration as a function of algal blooms. In the Gulf of Mexico, leaf damage and complete excavation of seagrasses have been reported from shrimp trawling activities (Eleuterius 1987).

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

Environmental Conditions

Drought conditions cause higher salinities of coastal waters and subsequent blue crab migration further inland. In Georgia, during 2003, adult blue crab catches were 60% lower than 2002 and 95% below the long-term average (1976-2002). Prolonged drought from 1998 to 2002 creating unfavorable conditions for blue crabs in addition to high levels of a disease caused by a blood parasite are probable causes for the decline.

In recent years, a similar trend in declining blue crab numbers has been evident in the waters off North Carolina. The following is taken verbatim from North Carolina Division of Marine Fisheries website:

> *Significantly reduced landings of "hard" blue crabs during 2000 - 2002, following the historically record high landings observed during 1996 - 1999, has caused increased industry concern for the health of the resource and fishery. Overall landings increased slightly from the 2001 levels. "Peeler/soft crab" landings were the lowest since 1994. Abnormally low rainfall associated with the summer drought of 2002 led to increased salinities and influenced crab distribution and promoted increased harvest in some of the more inland waters (i.e., Chowan, Perquimans and Pamlico rivers). The majority of the 5 million pound increase from 2001 to 2002 came from the Albemarle area, which includes Albemarle and Currituck sounds and Alligator, Pasqoutank, Perquimans, Roanoke and Chowan rivers. A significant increase in crab pot effort was also evident in the Albemarle area. During 2002, many areas (i.e., Pamlico, Core, Bogue, Stump and Topsail sounds; Neuse, Bay and Newport rivers) yielded the lowest landings on record for the period from 1994-2002. Hard crab pot effort was also at a record low in the Pamlico, Core and Croatan sounds and in the Pamlico, Neuse, Bay and Newport rivers. Although overall landings and/or trips were down in the noted areas for 2002, catch-per-trip (CPUE) increased from 2001 to 2002 in Pamlico, Core, Croatan, Roanoke and Masonboro sounds; Neuse, Bay, Newport, White Oak and Cape Fear rivers, Inland Waterway and Lockwood Folly. Landings and effort in the Southern coastal area have remained relatively stable throughout the 1994-2002 period.*

Diseases

Diseases affecting blue crabs in South Atlantic waters are listed in Table 4.7-5.

Table 4.7-5 Select pathogenic agents of the blue crab, *Callinectes sapidus* (adapted from Shield 1997).

Disease agent	Location	Major tissue affected	Outbreaks	Relation to Mortality
Rhabdolike virus A (virus)	Atlantic, Gulf of Mexico	Nerve cells, endothelial cells, hemocytes, connective tissue	Unknown	Stress-related mortality
Lagenidium callinectes (fungi)	Atlantic	Eggs, larvae	Yes	High prevalence, 25-50% of the sponge
Ameson michaelis (protozoa)	Atlantic, Gulf of Mexico	Connective tissue, hemolymph	No	High prevalence, late spring and winter
Hematodinium perezi (protozoa)	Atlantic, NE Gulf of Mexico	Hemolymph	Yes	High prevalence, juveniles up to 100%
Microphallus and pepper-spot disease	Atlantic, Gulf of Mexico	Connective tissue	Yes	No mortality
Carcinonemertes carcinophila (worm)	Atlantic, Gulf of Mexico	Eggs	Yes	High prevalence, 5-25% of the sponge

2. Cannonball jellyfish, *Stomolophus meleagris*

Cannonball jellyfish are prey for sea turtles and ocean sunfish, in addition to birds and ghost crabs following beaching of the jellyfish. As described earlier in the cumulative effects analysis, harvest has increased in recent years for exportation and human consumption. In addition, some scientists believe that cannonball jellyfish may contain Collagen Type II, a collagen that is known to have therapeutic effects as a treatment for people with rheumatoid arthritis. Thus, catch may be expected to increase as a result of the potential medicinal market, in addition to the recent decrease in the market price for shrimp and subsequent interest in cannonball jellyfish harvest.

AFFECTED ENVIRONMENT

5. Characterize the resources and ecosystems identified in scoping in terms of their response to change and capacity to withstand stresses concern.

A. Penaeid and rock shrimp

Shrimp are annual crops that fluctuate from year to year depending primarily on environmental factors. 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 level by environmental conditions (SAFMC 1993).

B. Shrimp EFH and EFH-HAPC

Barnette (2001) provides a summarization of habitat recovery from otter trawl. The few studies that are available discuss single impacts and not cumulative impacts. In general, the habitat recovery is dependent on the types of impact and the habitat effected. Barnette's (2001) review concluded that the resiliency of shallow water communities makes for a relatively short recovery time for those habitats.

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

2. Cannonball jellyfish, *Stomolophus meleagris*

As cannonball jellyfish have a relatively short lifespan (3-6 months) and are highly fecund creatures, they most likely are resilient to both natural and anthropogenic stresses.

6. Characterize the stresses affecting these resources and ecosystems and their relation to regulatory thresholds concern.

This step is important in outlining the current and probable stress factors to the three major components of the biophysical environment identified in the previous steps (shrimp populations, EFH and EFH-HAPC for shrimp, and species most commonly caught as bycatch). The goal is to determine whether these three components are approaching conditions where additional stresses will have an important cumulative effect beyond any current plan, regulatory or sustainability threshold (CEQ 1997).

Sustainability thresholds, levels of impact beyond which the resources cannot be sustained in a stable state, can be identified for certain resources. Other thresholds are established through numerical standards, qualitative standards or management goals. The cumulative effects analysis should address whether thresholds could be exceeded because of the contribution of the proposed action to other cumulative activities affecting resources.

A. Penaeid and rock shrimp

Shrimp harvest, though it may reduce population levels during the course of a season, is not believed to have any impact on subsequent year class strength unless the spawning stock has been reduced below a minimum level by environmental conditions (SAFMC 1993). However, regulatory thresholds in the form of biological reference points and status determination criteria were established through implementation of Shrimp Amendment 4 (SAFMC 1998c). Shrimp Amendment 4, included in the Council's 1998 Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and Other Required Provisions in Fishery Management Plans of the South Atlantic Region (SAFMC 1998c), addressed the Sustainable Fisheries Act requirements of the Magnuson-Stevens Act, as amended in 1996 (Table 4.7-6). One proposed action in this amendment seeks to designate and refine regulatory thresholds.

Table 4.7-6. Biological reference points and status determination criteria for the four shrimp species in the fishery management unit currently in place.

BRP/SDC	**Shrimp species**	**Designation**
MSY	White	14.5 million pounds.
	Brown	9.2 million pounds
	Pink Rock	1.8 million pounds 6,829,449
OY	White	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.
	Brown Pink Rock	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 for three consecutive years [2,946,157 pounds (heads on) for brown shrimp and 286,293 pounds (heads on) for pink shrimp]. 6,829,449
Overfishing and Overfished Level	White	Overfishing is indicated when the overwintering white shrimp population within a state's waters declines by 80% or more following severe winter resulting in prolonged cold water temperatures. (Note: This overfishing definition actually describes the overfished status rather than overfishing.) No overfished definition.
	Brown Pink Rock	Brown and pink shrimp are overfished when the 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]. No overfishing definitions for either species. (Note: It is assumed that overfishing is occurring when the overfished threshold is met.) Overfished is mean landings + 2 SDs (6,829,449) – no overfishing definition established

B. Shrimp EFH and EFH-HAPCs

There are currently no regulatory thresholds established for shrimp EFH.

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

2. Cannonball jellyfish, *Stomolophus meleagris*

There are currently no regulatory thresholds for cannonball jellyfish.

7. Define a baseline condition for the resources and ecosystems.

The purpose of defining a baseline condition for the resource and ecosystems in the area of the proposed action is to establish a point of reference for evaluating the extent and significance of expected cumulative effects.

A. Penaeid and rock shrimp

Shrimp are annual crops that fluctuate considerably from year to year depending primarily on environmental factors. 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 level by environmental conditions (SAFMC 1993). Because of this, one could consider the baseline to be reinstated every year.

B. Shrimp EFH and EFH-HAPCs

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

2. Cannonball jellyfish, *Stomolophus meleagris*

DETERMINING THE ENVIRONMENTAL CONSEQUENCES OF CUMULATIVE EFFECTS

8. Identify the important cause-and-effect relationships between human activities and resources and ecosystems.

A. Penaeid and rock shrimp

Shrimp are annual crops that fluctuate from year to year. While fishing certainly reduces the population size over the course of a season, fishing is not believed to have an impact on subsequent year class strength unless the spawning stock has been reduced below a minimum level by environmental conditions (SAFMC 1993).

B. Shrimp EFH and EFH-HAPCs

This section draws upon the results contained in the 2001 National Coastal Condition Report, written by the Environmental Protection Agency in conjunction with the Office of Research and Development/Office of Water. The report, largely drawing upon an EPA Environmental Monitoring and Assessment Program Study, provides a comprehensive assessment on the condition of the Nation’s coasts. More specifically, the report rates the coasts of the United States based upon water clarity, dissolved oxygen, coastal wetlands, eutrophic condition, sediment, benthos and fish tissue. The southeastern estuary boundaries used in the analysis mirrors the latitudinal and longitudinal EEZ boundaries (North Carolina/Virginia border to Key West). The monitoring results of the southeastern estuaries are summarized below:

- In terms of water clarity, 4% of the southeastern estuaries had 10% or less of light reaching one meter (light attenuation is commonly used in gauging water quality).

- Oil was observed in 4% of the sediments while noxious odors were detectable in 24%.

- 2% of the bottom waters had low dissolved oxygen (less than 2 ppm) on a continuing basis in late summer. Most of the 2% is in the Neuse River and Southern portions of Pamlico Sound.

- High eutrophic conditions were observed in 13% of southeastern estuaries. High conditions, while not detected in South Carolina and Georgia, were found in four North Carolina estuarine river systems (Pamlico, Pungo, Neuse and New Rivers) and in St. Johns River in Florida.

- 17% of the estuarine areas had highly degraded benthic resources.

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

Table 4.7-7. Cause and effects of human activities and the blue crab resource.

Actions	**Lifestage most likely affected**	**Observed and/or Expected Effects**
Harvest Commercial	adults	Average commercial landings in the four South Atlantic states (east coast of Florida only) from 2000-2002 was 4.3 million pounds per year.
Recreational	adults	Recreational landings in North Carolina waters in 2002 by license holders were 133,421 pounds (www.ncfisheries.net/stocks/bluecrab.htm). Landings by recreational, non-license holders are unknown. For most the states in the South Atlantic, the recreational harvest remains unquantified.
Incidental harvest in shrimp trawls and subsequent culling	All stages affected, particularly young crabs	36% overall mortality rate of blue crabs captured in trawls (McKenna and Camp 1992)
Habitat degradation/loss Marsh/seagrass	All stages affected	Decline in productivity and carry capacity of blue crabs
Water quality	All stages affected	Decrease in water attenuation results in decreased SAV abundance, less habitat for crabs

2. Cannonball jellyfish, *Stomolophus meleagris*

See Step 4 for a discussion of harvest of cannonball jellyfish. Cannonball jellyfish have not undergone a stock assessment.

9. Determine the magnitude and significance of cumulative effects.

A. Penaeid and rock shrimp

Past, present and reasonably foreseeable actions probably have not had a significant, adverse effect on the shrimp resource. As stated throughout the cumulative effects analysis, the abundance of the shrimp stock in the South Atlantic EEZ is largely determined by environmental variables which have short-term effects (less than 3 years in duration). For example, hard winter freeze have been shown to affect the spawning stock the following year. In addition, the effects of the freeze are mitigated through State and Council action to close the white shrimp fishery in State and Federal waters following a severe winter cold weather.

Habitat loss may have an adverse effect on shrimp landings, however the connection has not been made between the loss and degradation of habitat essential to shrimp survival and shrimp landings in the South Atlantic. Thus, the magnitude of each of these effects is undeterminable without further studies.

B. Shrimp EFH and EFH-HAPC

There have been, as discussed in this cumulative effects analysis, past, present and reasonably foreseeable adverse effects to shrimp EFH and EFH-HAPCs, however, it is not possible to determine the magnitude of these effects. In addition, some of these impacts to EFH and EFH-HAPC may be offset to a degree by beneficial, anthropogenic actions including habitat restoration and water quality improvement.

The current definition for Shrimp EFH and EFH-HAPCs in the South Atlantic is relatively broad. It is anticipated that the Fishery Ecosystem Plan for the South Atlantic (in development), in satisfying the final rule for EFH (67 FR 2343, January 17, 2002), will contain detailed maps clearly identifying EFH. Such information will improve the cumulative effects analysis, as the cumulative effects analysis will be able to better gauge the impacts to a specific region.

C. Species most commonly caught as bycatch from shrimp trawls

1. Blue crab, *Callinectes sapidus*

Past, present and reasonably foreseeable actions probably have had an adverse effect on the blue crab resource. The magnitude of each of these effects is undeterminable without a more comprehensive study. Two actions contained in this amendment - implementing a method to measure and monitor bycatch in addition to reducing bycatch in the rock shrimp fishery - will have a beneficial effect on the blue crab resource. This effect may be cumulative in certain areas in waters adjacent to the South Atlantic coast in conjunction with actions to improve the blue crab habitat (for example, improvements to estuarine water quality, restoration of sea grass beds).

2. Cannonball jellyfish, *Stomolophus meleagris*

The significance and magnitude of cumulative effects on the cannonball jellyfish in the geographic boundaries of the cumulative effects analysis is undeterminable at this time. As cannonball jellyfish are not currently managed, there is a lack of population studies. Two actions contained in this amendment - implementing a method to measure and monitor bycatch in addition to reducing bycatch in the rock shrimp fishery - will have a beneficial effect on the cannonball jellyfish resource. The reasonably foreseeable future effects are important to note. One can anticipate that harvest will increase for exportation, in addition to possible use for medicinal purposes.

10. Modify or add alternatives to avoid, minimize or mitigate significant cumulative effects.

The actions contained within this amendment result in beneficial, cumulative effects to the biophysical environment studied in this cumulative effects analysis. Therefore, avoidance, minimization and mitigation are not applicable.

11. Monitor the cumulative effects of the selected alternative and modify management as necessary.

Proposed actions within this amendment seek to establish a method to regularly monitor and assess bycatch from the penaeid and rock shrimp fisheries. In addition, the establishment of a permit system will act as a prerequisite to a more formal data collection program. Following the implementation of the permit requirement, the opportunity for monitoring cumulative effects will greatly improve through the identification of the full universe of shrimp vessels.

4.7.4.2 Cumulative effects on protected species

Cumulative effects, as defined under the Endangered Species Act, refer to any known unrelated, future, non-federal activities reasonably certain to occur within the action area that are likely to affect listed or proposed species. Future Federal actions requiring separate consultation (unrelated to the proposed action) are not considered in the cumulative effects section.

ESA-listed species that occur within areas where the shrimp fishery operates and that may be impacted by unrelated, future, non-federal activities reasonably certain to occur within the action area include:

<u>Marine mammals</u>

For listed whales occurring within the action area, the potential for adverse effects from the southeast Atlantic shrimp fishery executed within the action area are unlikely. However, these whale species may incur negative impacts from other sources such as disease, vessel strikes, entanglement in other fisheries and habitat degradation due to chemical and noise pollution, as well as marine debris. These impacts may cause adverse effects on a population’s overall recovery. For detailed descriptions on cumulative impacts to listed whale species found in the action area see Waring *et al.* (2002).

Sea turtles

To fully assess the recovery of sea turtles, the full range of human and natural phenomena need to be considered. Hurricanes may have potentially negative effects on the survival of eggs or on nesting habitat itself if the beach is greatly reduced. Human-related activities pose multiple threats such as: entanglement in fishing gear; nesting success due to coastal development and artificial lighting on nesting beaches; degradation of the marine habitat by chemical pollution and marine debris; and the direct (legal or illegal) taking of eggs or individual turtles. The impacts of many of these activities are under-monitored, particularly on the international level. NOAA Fisheries has estimated that thousands of sea turtles of all species are incidentally or intentionally caught or killed annually by international activities (NOAA Fisheries 2001).

Some anthropogenic (human induced) mortality that contributed to the decline of sea turtles has been mitigated since sea turtles were listed under the ESA. Examples include the use of TEDs in shrimp trawlers, reduction or closure of certain fisheries that entangling nets, and prohibiting the harvest of eggs and nesting females in the U.S. as well in as other areas (for further information on sea turtle impacts see NOAA Fisheries 2001; NOAA Fisheries SEFSC 2001).

Fish

Smalltooth sawfish

Smalltooth sawfish are extremely vulnerable to overexploitation because of their tendency to become entangled in nets, their restricted habitat and low rate of population growth. Smalltooth sawfish are vulnerable to incidental capture in various fisheries including gillnet, otter trawl, trammel net, seine and, to a lesser degree, hand line (NOAA Fisheries 2000). Due to this species' dependence on coastal habitat, loss and degradation of coastal habitat by urban development, agriculture and channel dredging have also contributed to their decline. Marine pollutants may also negatively impact the smalltooth sawfish, particularly because of its slow growth and late maturation.

4.7.4.3 Cumulative effects on the socio-economic/human environment

The South Atlantic shrimp fishery generates the most revenue for the commercial harvesting sector in this region. During 2001 and 2002 the average dockside value of shrimp harvested in the South Atlantic amounted to $63.56 million annually (Table 3.2-1). In comparison, the overall ex-vessel revenue from landings of all seafood in the South Atlantic averaged $175 million during those years (NOAA Fisheries 2003b). The relative economic importance of the commercial shrimp industry varies by state. During 2001 and 2002 the proportion of all commercial ex-vessel revenue derived from shrimp landings was 75% in Georgia, 40% in South Carolina, 38% in Florida and 16% in North Carolina (Section 3.2).

Annual ex-vessel revenue and economic performance of the shrimp harvesting sector has been influenced by imports, fuel prices and regulations. Other factors such as environmental conditions and possible habitat loss would have also affected vessel profitability through their relationship with shrimp production (Section 3.1.4). Annual landings of shrimp species vary considerably from year to year (Table 3.2-2a). These fluctuations have been attributed to environmental influences (Section 3.1.4). For example, white shrimp landings are much lower in years following severe winter weather (SAFMC 1993).

It is hypothesized that the impact of non-regulatory factors such as imports, increased fuel prices, coastal development and the closure of fish houses in the South Atlantic may have had more substantial effects on the shrimp industry than shrimp fishery regulations imposed by the states, Council and NOAA Fisheries.

<u>The effect of imports, fuel prices and general market conditions</u>

Shrimp is produced throughout the world with more than 100 countries reporting production in 2003. United States shrimp imports expanded from about 260 million pounds (headless, shell-on basis) in 1980 to 579 million pounds in 1990. Imports continued to steadily increase and reached 721 million pounds in 1996. Subsequently, this growth continued at a more rapid rate and in 2000 imported shrimp products, converted to shell-on headless weight, was estimates at 1.024 billion pounds (Haby *et al.* 2003). The continual trend for increased imports has also resulted in decreased prices for imported shrimp products observed for all product forms in recent years (Table 3.2-3c).

Historical price trend data indicate that the real average domestic ex-vessel prices for all shrimp species increased during the 1950s through to the late 1970s, fluctuated in the 1980s with no discernible trend and dropped substantially in the 1990s. More recently, this trend for reduced prices and revenue has continued. Average ex-vessel revenue from shrimp landings decreased by 34% in 2000 and 2001 (Section 3.2.2.1). Similar price declines were observed for all four states in the South Atlantic during this period. Most of this decline can be attributed to the increased market supply from imports (Vondruska 2001).

In recent years, commercial fishermen have also experienced increased prices for fuel (Table 3.2-14). These conditions are expected to decrease the aggregate profitability of commercial shrimping and reduce fleet size. Changes in vessel level profits would also depend on the number of vessels active in the fishery during a given year and vessel specific differences in landings and cost structures.

As profit margins have declined vessel owners have employed a number of cost cutting measures in an effort to maintain a positive cash flow and continue participation in this fishery. As reported by industry sources vessels owners have reduced the number of crew and restructured crew share arrangements that lower crew wages. Other cost cutting measures include the failure to obtain or renew vessel and personal and indemnity insurance. Repair and maintenance costs have also been reduced. Such actions could jeopardize the future viability of the vessel firm (Section 3.2.3.3).

Even with adoption of these cost cutting measures the economic downturn in this industry has been so severe that at times some shrimpers could not afford the operating costs for a trip and remained at the dock. In extreme situations some vessels have been repossessed by lending agencies and auctioned off (Appendix I). The outlook for the domestic harvesting sector of the shrimp industry will depend on the levels and price of shrimp imports, changes in prices of variable and fixed cost items to shrimp producers and global economic trends (Vondruska 1991).

The declining trend in shrimp prices and ex-vessel revenue in the shrimp harvesting sector, observed across all states, could play a major role in the financial solvency of dealers and fish houses that depend on domestic shrimp production. These businesses would be especially vulnerable if they are not able to transition to alternative sources of revenue from other fisheries. Also, during these tough economic times, harvesters have been selling directly to final purchasers to reduce their costs and obtain higher prices. This removes the traditional “middleman” or the dealer/buyer from the transaction chain. Fish houses provide services to shrimpers that dock at their facilities such as fuel, ice, repair parts, gear and supplies. Fish houses that have extended credit to vessel owners with negative cash flow problems could become economically vulnerable if these accounts remain unsettled. Such a situation would make alternative financial investments more attractive to these fish house owners and perhaps increase the likelihood that they will sell their properties to other enterprises.

Reduced revenues in the shrimp harvesting sector would also result in reduced economic activity to the sectors of the economy that are directly and indirectly associated with the shrimp industry in the South Atlantic. If vessel owners respond to lower revenues by reducing input costs, there would be negative effects on the sectors that supply inputs such as fuel and gear. If there is a reduction in the number of vessels, there would be further direct economic losses to impacted industries since annual and fixed expenditures would not be incurred. Apart from the direct effects there will also be indirect and induced effects on other sectors of the economy (the multiplier effect) which could have far reaching implications in the short-term.

The effect on the domestic processing sector is somewhat more complicated since imports provide a cheap source of raw material. However, increased imports of final demand products will have a negative effect on the processing sector (Kiethely *et al.* 1991). A later study indicated that profit margins for shrimp processors have been declining since the 1980s. The reduction in processors price has been attributed to the increase in imports of value-added peeled products (Keithly *et al.* 2002).

From the point of view of shrimp fishermen, imports decrease benefits by depressing dockside prices as demonstrated by Keithly *et al.* (1989). However, imports increase the aggregate U.S. supply of shrimp leading to lower retail prices for consumers (Anderson 1986). In addition, many U.S. wholesalers and retailers depend on imports for a substantial portion of their sales volume.

<u>The effect of regulations in the penaeid shrimp fishery</u>

Most of the effort in the penaeid shrimp fishery is concentrated in state waters. The states in the South Atlantic have regulated their shrimp fisheries to different levels as indicated in Appendix J.

In 1993, the Council began managing the penaeid shrimp fishery operating in federal waters, implementing regulations under the South Atlantic Shrimp Fishery Management Plan. The most significant measure was the provision for South Atlantic states to request concurrent closure of the EEZ adjacent to closed state waters following severe winter cold weather. These closures would eliminate fishing mortality on over-wintering white shrimp following severe winter cold kills to ensure an adequate fall production the following year. In the event of a closure, it is expected that some or all of the lost revenue resulting from such a closure would be recovered from an increased fall production.

The regulation requiring the use of BRDs in the penaeid shrimp trawl fishery became effective in 1997 and at that time it was estimated that the annual cost (foregone gross revenue) to the industry could vary from $0 annually to $1.8 million annually, depending on the level of shrimp loss. The requirement for the use of BRDs in this fishery was intended to meet the requirements of the Magnuson-Stevens Act. On the one hand these regulations reduced the net revenue to shrimp fishermen; however they were necessary to aid in the recovery of overfished weakfish populations. Use of these devices is also expected to increase net revenue and consumer surplus benefits to commercial and recreational fishermen participating in fisheries that target bycatch species (see Section 3.1.12.1.3.1).

The economic effect of regulations in the rock shrimp fishery

In contrast to the penaeid shrimp fishery, the rock shrimp fishery has been more heavily regulated by amendments to the South Atlantic Shrimp plan as well as by the Coral and Habitat plans. Amendment 1 to the Shrimp Fishery Management Plan (SAFMC 1996a) set the requirement for a vessel permit in the rock shrimp fishery and prohibited trawling for rock shrimp to limit the impact on essential fish habitat, including the fragile coral species existing in the *Oculina* Bank Habitat Area of Particular Concern (HAPC). The economic effects of this closure was estimated at a maximum of $1.41 million for the first year of the closure. It was assumed that the industry would adjust to this closure in subsequent years by shifting effort to other fisheries and other areas thereby mitigating some of this revenue loss. Amendment 4 to the Coral FMP (SAFMC 1998a) established two Satellite *Oculina* HAPCs within which bottom trawling and anchoring by fishing vessels is prohibited. These regulations became effective on July 14, 2000. Amendment 5 to the Shrimp Plan (2002) established additional regulations in the rock shrimp fishery, the most significant of which was the limited access program off Georgia and Florida that went into effect in July, 2003. Vessels that received a rock shrimp limited access endorsement are also required to use a NOAA Fisheries-approved vessel monitoring system when on a trip in the South Atlantic. The use of vessel monitoring systems was necessary to improve compliance with the closed area restrictions and protect essential fish habitat and essential fish HAPCs from illegal trawling.

The measures in Shrimp Amendment 1 were based on recommendations from the South Atlantic Rock Shrimp Advisory Panel (Rock Shrimp AP). The capacity reduction measure was supported in an effort to ensure the continued economic viability of the rock shrimp industry. The immediate cost (forgone revenue from rock shrimp landings) to vessels that did not qualify for a permit was $151,491 in 2002. Given the possibility of continued entry of new vessels into this fishery, the Council determined that the long-term economic losses within the industry could exceed this short-term revenue reduction. The requirement for VMS also imposed a one time cost to the industry of $1,200 per vessel. Considering that 145 vessels were approved for a rock shrimp endorsement the total industry cost was $174,000 for all vessels to be outfitted with the unit. In addition, there is the associated communication cost ranging from $72,500 to $116,000 annually.

It must be noted that rock shrimp fishermen are also participants in the penaeid shrimp fishery. The continued trend in reduced dockside prices for the penaeid species would affect this group of fishermen resulting in severe economic hardship. Additional measures that are associated with large reductions in revenue would most likely force some of these fishermen to leave the industry.

Economic effects of proposed regulations in Shrimp Amendment 6

The actions addressing the BRD protocol and criteria (Actions 1 and 2) will not have any direct economic effects for fishery participants. These management alternatives would result in lower administrative costs and could potentially reduce the research costs associated with testing new BRDs. It is possible that these actions could indirectly have an influence on the magnitude of future economic benefits by facilitating the more timely completion of a BRD evaluation and most likely certification of more effective devices than those currently employed in the fishery (Sections 4.2.1 and 4.2.2).

Action 3 addresses the mandate from the Magnuson-Stevens Act to establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the penaeid and rock shrimp fisheries. Adoption of this monitoring and assessment program would: provide a better understanding of the composition and magnitude of bycatch; enhance the quality of data provided for stock assessments; increase the quality of assessment output; provide better estimate of interactions with protected species; and lead to better decisions regarding additional measures that might be needed to reduce bycatch in these fisheries and improve stocks of finfish.

Collection of information on bycatch in both penaeid and rock shrimp fisheries could represent an additional burden to vessel owners and would increase administrative costs to the agency (Action 3). There would be administrative and research costs associated with Alternatives 1, 3 or 4. It is estimated that the ACCSP program (Alternative 3 and the ultimate goal of Alternative 1) could require observer coverage on 730 to 1,826 trips in a given year and the cost to the agency could range from $0.73 million to $1.8 million. The first phase of Alternative 1 and Alternative 4 would likely result in a cost of $160,000 to the agency for 160 days of observer coverage. Logbooks as specified for Alternatives 1, 3 and 4 would result in some time costs to participants and agency costs from mailing and processing (Section 4.2.3.3). There would be additional research costs from collation and processing of the data collected from observer coverage and any additional information collected through logbooks.

The requirement for BRDs (Alternative 1) would increase costs to the industry by $59,417 annually. It is estimated that 43 rock shrimp vessels would be affected by this alternative and the average reduction in gross revenue would be $1,382 per vessel annually. This represents 0.6% of the average revenue of an affected vessel. There may be some indirect future economic benefits to participants in other fisheries from reducing bycatch in the rock shrimp fishery. Apart from spot there are no other fisheries for the abundant species in the rock shrimp bycatch. There may be some possible benefits from returning these species to the ecosystem. However, most of the future indirect economic benefits would come from species that do not support commercial or recreational fisheries. These benefits fall under the category of non-use value to society.

The action requiring a federal penaeid shrimp permit would increase industry annual costs by either $50 per vessel or $20 per vessel. It is expected that anywhere from 1,380 to 1,898 individual vessel owners would apply for this federal permit. The expected cost to the industry could range from $27,600 to $94,900 annually. There would be some increase in administrative costs associated with the issuance and renewal of permits and the maintenance of a database on information supplied by these permit holders on their application forms. However, vessel permits will enable a more accurate and efficient means of identification of commercial business entities harvesting shrimp in the South Atlantic EEZ. The permit application can be used to collect data on a vessel that is not currently collected by the various state agencies or by the Coast Guard through their vessel information system (Section 4.2.5.3). Collection of this type of data from the South Atlantic permit application form will provide benefits from improved economic analyses. Also, vessels that are identified in the universe of total vessels can be selected for additional biological, economic and social data collection programs.

<u>The effects of other fishing regulations</u>
Many of the larger shrimp vessels in the region are very mobile and may operate in both the South Atlantic and the Gulf of Mexico shrimp fisheries (SAFMC 1996b). Measures enacted in the Gulf of Mexico penaeid and rock shrimp fisheries will therefore have an effect on the economic performance of these vessels.

Another major regulation in this fishery is the requirement for the use of turtle excluder devices (TEDs). Shrimp fishermen have experienced direct costs as a result of the TED requirements. Currently, the cost of a TED typically used for an offshore, larger, vessel runs approximately $320 to $350. For shrimpers whose TED frames were large enough to be compliant with the new rule and only needed to have the opening modified – the cost ran approximately $50. In general, shrimpers will have their TEDs re-worked every year, which if it does not require replacing the TED, will run approximately $100/TED.

In addition, vessels in the South Atlantic shrimp fishery also participate in other fisheries. This is especially the case for small vessels (under 30 feet) and medium sized vessels (31-60 feet) operating in North Carolina and Florida (Section 3.2.3.1.4). Small boats may be involved in virtually any inshore fishery from clamming and oystering to crab trap fishing and a variety of net fisheries. Larger vessels often participate in other trawl fisheries including calico scallop and hook and line fisheries for bottom fishes. Regulations in these fisheries will have an effect on the behavior and profitability of these shrimp vessels.

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 Amendment 6 include:

Council costs of document preparation, meetings, scoping meetings, public hearings and information dissemination	$100,000
NOAA Fisheries administrative costs of document preparation, meetings and review	$25,000
NOAA Fisheries law enforcement costs	?
NOAA Fisheries administrative costs for new permit program	$20,000
NOAA Fisheries administrative cost for bycatch and monitoring and assessment	?
Total	$145,000+

4.9 Effects on small businesses: Initial Regulatory Flexibility Analysis (IRFA)

The Regulatory Flexibility Act requires an assessment of the economic impacts of proposed actions on small entities. It provides for certifying that a proposed rule would not have a significant economic impact on a substantial number of small entities if the factual basis for the certification is provided. If a certification cannot be made, an initial regulatory flexibility analysis (IRFA) must be prepared. The IRFA, using information from the analysis of the economic impacts of the various alternatives contained in the document, should demonstrate that:

1. Reasonable alternatives from among which to select a proposal are identified.
2. The proposal selected reflects a wise choice from among reasonable alternatives.
3. Managers have fair warning whether their proposal will generate loud complaint.
4. The proposal competes well against other socioeconomic goals, regardless of legislative mandates, in light of other administration priorities.
5. The proposal will move rapidly through the regulatory process at OMB and SBA's Office of Advocacy.
6. The proposal is likely to withstand legal challenge.

The definition of a "small entity" is taken from Part 121 of Title 13, Code of Federal Regulation (CFR), which classifies businesses by SIC code as small or large. The established size standards are as follows:

1. Any fish harvesting business is a small entity if it is independently owned and operated and not dominant in its field of operation and if it has annual gross receipts not in excess of $3.5 million.
2. Any for-hire business is a small entity if it is independently owned and operated and not dominant in its field of operation and if it has annual gross receipts not in excess of $6.0 million.

It is estimated that there were at least 2,129, 1,835 and 1,731 commercial entities harvesting shrimp in the South Atlantic during 2000, 2001 and 2002 respectively (Table 3.2-1). There is insufficient data regarding potential ownership affiliation between vessels that might lead to a conclusion that large entities exist in this fishery. As a result, for this analysis it is assumed that each harvesting platform represents a separate business entity (Section 3.2.3.3). Based on all revenue from commercial fishing activities for these entities the average gross revenue per vessel was estimated at $76,879 in 2000, $67,706 in 2001 and $66,853 in 2002 (Table 3.2-15a). Also, the highest gross revenue observed per vessel from all commercial harvesting activities did not exceed $1.0 million in 2000 and 2002 (Table 3.2-15a). Thus, it is assumed that all vessels can be classified as small entities.

Two out of the seven proposed actions in this proposed rule will have a direct impact on the profitability of small entities: the measure to minimize bycatch in the rock shrimp fishery (Action 4) and the action to implement a federal penaeid shrimp permit (Action 5). Also, Action 3 and Action 5 will impose new reporting requirements in the form of logbooks (Action 3) and permit application forms (Action 5).

A sample of vessels that apply for the federal penaeid shrimp permit will be selected for reporting through the logbook program (Action 3). The size of this sample has not been determined and hence it is unknown how many small entities will have to comply with this new reporting requirement.

A shrimp logbook form was developed in the Summer 1998 Gulf Red Snapper/Shrimp Research Program. This form could serve as a template for a logbook program in the South

Atlantic shrimp fishery. Based on that form, potential data elements could include, but would not necessarily be limited to: vessel name, vessel identifier, number of nets, type of net, size of net, type of bycatch reduction device, number of tows, length of tows (in hours), location (either in terms of latitude and longitude or statistical area and depth) and an estimate of catch. The form would be completed on a daily basis. According to the Paperwork Reduction Act clearance package for this data collection program, it was anticipated that shrimp fishermen would need 10 minutes to complete each daily logbook form.

With respect to the South Atlantic shrimp fishery, only the Florida trip ticket program collects information on trip length, and such information is only reported for a subset of trips. Nonetheless, based on the available data for 2002, the median length of a shrimp trip on the Florida east coast was 3 days. [The mean value is 5.2 days. However, since the standard deviation is 5.48 days and the trip length data is highly skewed (i.e., not normally distributed), the median value is more representative of the true “average” in this case.] As reported in Table 3.2-6a, in 2002, 573 vessels took 11,771 shrimp trips on the Florida east coast, which yields an average of 20.5 trips per vessel. On a per vessel basis, this yields an average of 61.5 fishing days per year. Given the estimate of 10 minutes per day to complete a logbook form, each vessel’s annual reporting burden would be 615 minutes, or 10.25 hours. For the fishery as a whole, given that there were approximately 1,731 vessels in the fishery during 2002 (see Table 3.2-1), the annual time burden for the fishery would be approximately 17,742.75 hours.

From an economic perspective, there is an opportunity cost associated with any time burden created by additional reporting requirements. Typically, opportunity cost is approximated using the average wage or salary of the affected persons. Since vessel owners/captains would be responsible for submitting the logbook forms, it would be most appropriate to use the average wage of first line supervisors/managers in the fishing, forestry, and farming industries. As of May 2003, which is the most currently available information, the Bureau of Labor Statistics reported that the mean wage of persons in this occupation group was $18.14.

Therefore, the average annual opportunity cost per vessel of the logbook reporting requirement would be approximately $185.94 ($18.14/hour * 10.25 hours).

The rock shrimp fishery is examined separately since Action 4 would only affect vessels in this sector of the shrimp fishery. The number of active vessels in this fishery during 2000, 2001 and 2002 was 182, 159 and 148 respectively (Table 3.2-4). Since that time a limited access program was implemented, and to date 145 limited access endorsements have been issued. The average revenue per rock shrimp vessel in 2000, 2001 and 2002 calculated from data contained in Table 3.2-4 is $241,079, $239,861 and $192,502 respectively. Also, the highest gross revenue observed per vessel from all commercial harvesting activities did not exceed $1.0 million in 2000, 2001 and 2002 (Table 3.2-15a). Thus, it is assumed that all rock shrimp vessels can be classified as small entities. Action 4, the measure to reduce bycatch in the rock shrimp fishery would affect the profitability of an estimated 43 vessels (Section 4.2.4.3.3) which represents approximately 30% of this subuniverse in the shrimp harvesting sector.

Action 5, the requirement for permits in the penaeid shrimp fishery is likely to affect 1,380 to 1,898 vessels (Table 4.2-3 and Section 4.2.5.3). The first estimate assumes that only those commercial shrimp vessels that operate in state offshore and federal waters in the South Atlantic will apply for the penaeid shrimp permit (calculated as the average for 2000-2002). The second estimate assumes that all commercial shrimp vessels that operate in the South Atlantic will apply for the penaeid shrimp permit (calculated as the average for 2000-2002). It is expected that all rock shrimp vessels would apply for the penaeid shrimp permit. Thus, overall these actions are likely to affect the profitability of 1,380 to 1,898 vessels in the South Atlantic shrimp fishery, and a substantial number of small entities in the population will be affected by the proposed measures.

Evaluation of whether a proposed rule will result in a “significant impact” is less clear. Recent guidelines provided by the National Marine Fisheries Service recommend that the criteria of profitability and disproportionality be used in this determination (NOAA Fisheries 2000):

1. <u>Disproportionality</u>. A comparison must be made of the effect of the proposed rule on small and large entities.
2. <u>Profitability</u>. The analysis should focus on the short and medium-term effect on profits of small entities.

<u>Disproportionality</u>

The industry is composed of small business entities. Hence, there will be no disproportional large versus small effects. However, among the small entities there is a high degree of diversity in terms of vessel length. The variations observed in overall gross fishing income from all fisheries, vessel operating and fixed costs and dependence on income from shrimp harvest are all related to vessel length. A detailed description of the heterogeneity in this fishing fleet is contained in Section 3.2.3.3.

<u>Profitability</u>

The current profitability of vessels in the commercial shrimp fishery that are likely to be affected by the measures in this amendment is unknown. Information contained in Section 3.2.3.3.3 reviews several cost and earnings studies on the South Atlantic shrimp fleet. However, some of these studies are dated and are not reflective of the current conditions in this fishery. As discussed extensively in Section 3.2.3 imports have had a substantial negative effect on the profitability of vessels in the domestic shrimp industry since the 1990s. A study on the penaeid shrimp fishery off South Carolina during 1999 indicated that many vessels were operating on break-even levels of activity (Henry *et al.* 2001). The South Carolina penaeid shrimp fishery was classified into three size categories based on differences in operating costs, profit margins and ability of the vessel owner to make input substitutions. Small vessels (less than 30 feet) had an average annual profitability of $2,533, the average annual profitability for vessels in the medium size range was $10,086 and the average annual profitability for vessels in the large size category was $8,639 (Table 3.2-13). It is unclear as to whether these data are representative of the shrimp fleet in other South Atlantic states. Even if these values were comparable to profitability in other states during 1999, current profit margins are expected to be lower as a result of the subsequent decline in prices since 1999 (Section 3.2.3.3.3) and increases in fuel prices (Table 3.2-14) and other input costs.

The permit requirement (Action 5) would affect vessels that earned an average of $70,749 or $81,362 annually (Table 4.2-3). The expenditure outlay for a permit could be either $20 or $50 annually. The former cost would apply in cases where vessels held another permit issued by the NOAA Fisheries Southeast Regional Office. This fee represents a small portion of the gross revenue of these vessels.

The combined effect of Action 4 (the rock shrimp bycatch reduction measure) and Action 5 (the permit requirement) will affect the profitability of small entities in the subuniverse of the South

Atlantic shrimp fishery that targets rock shrimp. Impacts of the measure to reduce bycatch in the rock shrimp fishery by requiring use of BRDs (Action 4, Alternative 1) was calculated assuming a maximum of 3% shrimp loss on a portion of all trips where a BRD would have to be used. This amounts to a reduction of $1,382 in gross revenue per vessel, which represents a 0.6% reduction in revenue per affected vessel in the rock shrimp fishery (Table 4.2-1). It is assumed that these rock shrimp vessels will need to purchase the federal penaeid shrimp permit (Action 5). Since these vessels already hold a federal permit issued by the NOAA Fisheries Southeast Regional Office, the cost of this new permit would be $20 per vessel. The expected change in near-term profitability per affected business entity on average will be $1,402 for the 43 vessels affected by the BRD requirement. It is not expected that these vessels will forgo making a trip as a result of these measures. Hence, based on data from 2000-2002, future vessel profitability is expected to decrease by a maximum of 0.6% ($1,402/$245,925). It must be emphasized that since 2002 there have been accounts that ex-vessel prices for shrimp have declined and fuel prices continued their upward trend (Table 3.2-14). Thus, this rate of reduction in profitability would be more significant for these business entities in the future.

<u>Description of the reasons why action by the agency is being considered:</u> Refer to Section 1.0, Purpose and need for a detailed account of the purpose and need for all actions contained in this amendment. The reasons for actions that would have a direct effect on the profitability of small entities and increase reporting burden are summarized below:

1. **Establish a method to regularly monitor and assess bycatch in the South Atlantic penaeid and rock shrimp fisheries.** Section 303(a)(11) of the Magnuson-Stevens Act states that any FMP that is prepared by any Council, or by the Secretary of Commerce, with respect to any fishery, shall "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery...". To accomplish the legislative goals and mission of NOAA Fisheries, the Council has recognized the need to establish a standard bycatch reporting methodology for the shrimp fishery. Development of a standardized reporting methodology will ensure the collection and distribution of timely, reliable and standardized bycatch data to the public and policy decision-makers. Currently there is no such methodology for the South Atlantic shrimp fishery.

2. **Implement a measure(s) to reduce bycatch in the rock shrimp fishery.** The Magnuson-Stevens Act requires the Council to identify and implement conservation and management measures that, to the extent practicable and in the following order, (A) minimize bycatch and (B) minimize the mortality of bycatch that cannot be avoided. As a result, all federal fisheries management plans (FMPs) must demonstrate that action has been taken to meet this legal mandate. If previously implemented management measures do not minimize bycatch to the extent practicable, then action has to be taken to bring the fishery into compliance.

3. **Require a Federal penaeid shrimp permit.** A permit is required to efficiently identify and enumerate the number of fishermen in the federal penaeid shrimp fishery and allow for the collection of data that is required to better meet the requirements of regulations including the Regulatory Flexibility Act of 1980 (5 U.S.C. 601-612). All major fisheries that operate in federal waters in the South Atlantic are federally permitted. The penaeid shrimp fishery is the only fishery that is not federally permitted. In light of the current data systems and federal mandates, the Council has recognized that establishment of a commercial vessel permit for fishery participants in federal waters is a prerequisite for a comprehensive data collection program. A permit system would provide the mechanism to obtain accurate numbers on shrimping effort in the South Atlantic EEZ, collect data on ownership and corporate status of each vessel and

facilitate a program to assess and monitor bycatch in the South Atlantic shrimp fishery. This information would be used in biological, economic and social assessments of the resource and fishery participants crucial to sound management.

Statement of the objectives of and legal basis for, the proposed rule: The following are the objectives prompting this action: (1) The need to provide reliable estimates of bycatch in the penaeid and rock shrimp fisheries; (2) The need to minimize bycatch in the rock shrimp fishery to the extent practicable; and (3) The need to more efficiently identify shrimp trawlers fishing for penaeid shrimp species in federal waters so that they can be targeted for data collection in support of fishery management regulations. The Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265) as amended through October 11, 1996 provides the legal basis for the rule.

Description and estimate of the number of small entities to which the proposed rule will apply: The measures will apply to a portion of the commercial harvesting sector active in the penaeid and rock shrimp fisheries as previously discussed in this IRFA. A detailed description of these entities is provided in 3.2.3 of this document.

Description of the projected reporting, record keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records: The proposed rule will require that vessel owners complete permit application and renewal forms (Action 5) and logbook forms (Action 3). Any trawler fishing for or in possession of penaeid shrimp in federal waters will need to possess a federal penaeid shrimp permit and will be subject to the reporting requirements of the permit application. The permit application form for the South Atlantic penaeid shrimp fishery is expected to request the same information as the permit application form used for the Gulf of Mexico shrimp fishery (Appendix K). The time burden to complete this form is estimated at 0.33 hours per application (equivalent to $5 in opportunity costs). Action 3 would require that selected vessels complete logbook forms at the end of each trip which will impose time costs equivalent to $12.50 per hour on those vessels selected for bycatch reporting.

Identification of all relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule: No duplicative, overlapping or conflicting Federal rules have been identified.

Description of significant alternatives to the proposed rule and discussion of how the alternatives attempt to minimize economic impacts on small entities: Section 4.2 contains the detailed analyses of all actions and alternatives considered by the Council. The economic effects are calculated and/or described for each alternative and included in that assessment is an analysis of the economic impact(s) on small entities. Additional alternatives that did not receive detailed consideration are included in Appendix A with an explanation of why these alternatives were eliminated from the final decsionmaking process. The following discussion provides the rationale for the Council's choice of preferred alternatives for Actions 3, 4 and 5 since these are the only measures that have a direct impact on the profitability of small entities or increase the reporting burden of these entities:

Action 3: Section 303(a)(11) of the Magnuson-Stevens Act states that any FMP that is prepared by any Council, or by the Secretary of Commerce, with respect to any fishery, shall "establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery...". Alternative 2 (no action) would not support this mandate since there are no comprehensive sets of data that can be used to estimate current bycatch composition and quantity in the South Atlantic shrimp fishery. Alternatives 1 and 4 would impose logbook reporting requirements on selected entities. There is a possibility that Alternative 3 would have a logbook requirement if existing catch and effort information were insufficient to estimate total bycatch in the fishery. When compared to Alternative 2, Alternatives 1, 3 and 4 would provide a better understanding of the composition and magnitude of bycatch; enhance the quality of data provided for stock assessments; increase the quality of assessment output; provide better estimates of interactions with protected species; and lead to better decisions regarding additional measures that might be needed to reduce bycatch.

Action 4: As stated previously, the Council has to be in compliance with the Magnuson-Stevens Act and take steps to minimize bycatch to the extent practicable. The Council became concerned about the rock shrimp fishery when the findings of a 2002 pilot study on the South Atlantic rock shrimp fishery came to their attention (Appendix C). A summary and discussion of the main findings from this preliminary report is contained in Section 3.1.9. As a result, Alternative 2 (no action) is not a viable alternative for this action. Apart from this alternative and the preferred alternative to require the use of BRDs in the rock shrimp fishery, the Council also considered seasonal closure options (Alternative 3) to reduce bycatch. Alternative 3 would have more serious consequences on the profitability of small entities compared to the preferred alternative. If Alternative 3 was chosen the average reduction in annual gross revenue per vessel would be $5,901 for a winter closure, $42,363 for a summer closure and $28,969 for a fall closure (Table 4.2-2) compared to a maximum loss of $1,382 per vessel per year (Table 4.2-1) associated with implementation of Alternative 1. Also, seasonal closures in the summer and fall would likely force some of these small entities to exit the industry. Even though Alternative 3 would likely result in larger bycatch reductions compared to Alternative 1, the Council chose Alternative 1 because of the serious social and economic consequences that would arise from implementation of Alternative 3.

Action 5: The Council considered four alternatives for Action 5 (Section 4.2.5). Three alternatives would require shrimp trawlers to purchase a federal penaeid shrimp permit. The permit fee (annual cost per vessel) would be the same for these alternatives. Alternative 1 will not restrict any vessel owner from applying for the permit but any shrimp trawler in possession of or fishing for shrimp in the South Atlantic EEZ would be required to have this federal permit. Alternatives 3 and 4 would provide exemptions for the permit requirement if the shrimp trawler is in transit and the gear is not rigged for fishing. Alternatives 3 and 4 could result in law enforcement loopholes that would lower compliance with the permit requirement for vessels that actually operate in the EEZ, and the expected benefits from permitting these vessels would not be realized (Section 4.2.5.5). The "no action" alternative would not impose the annual cost of $50 or $20 on small entities. However, Alternative 2 would not allow for the efficient and accurate identification of vessels in the shrimp fishery and the indirect economic benefits from better data collection and management would not be realized.

5.0 List of preparers

Amendment 6 to the South Atlantic Shrimp FMP was prepared by a team comprised of South Atlantic Council staff and NOAA Fisheries staff. The following individuals served on the Amendment 6 Team:

Dr. Vishwanie Maharaj (Chair), SAFMC
Rick DeVictor, SAFMC
Dr. Kathi Kitner, SAFMC
Myra Brower, SAFMC
Margaret Murphy, SAFMC
Roger Pugliese, SAFMC
Kerry O'Malley, SAFMC
Monica Smit-Brunello, NOAA GC
Connie Sathre, NOAA GC
Dr. Jim Nance, NOAA Fisheries, SEFSC
David Bernhart, NOAA Fisheries SERO
Dr. Steve Branstetter, NOAA Fisheries SERO
Heather Blough, NOAA Fisheries SERO
Dr. Palma Ingles, NOAA Fisheries SERO
Dr. Mike Travis, NOAA Fisheries SERO
David Dale, NOAA Fisheries SERO
Dr. Miles Croom, NOAA Fisheries HQ
Tracy Dunn, NOAA Fisheries SERO
David Keys, NOAA Fisheries SERO
Dr. Jack McGovern, NOAA Fisheries SERO
Dr. Virginia Fay, NOAA Fisheries, SERO
Jennifer Lee, NOAA Fisheries SERO

The following individuals assisted by reviewing drafts of this document:
Gregg Waugh, SAFMC
Robert K. Mahood, SAFMC

6.0 List of agencies, organizations and persons consulted

Responsible Agencies

South Atlantic Fishery Management Council
Contact: Robert K. Mahood
Executive Director
1 Southpark Circle, Suite 306
Charleston, South Carolina 29407-4699
(843) 571-4366; FAX (843) 769-4520
Toll Free: 1-866-SAFMC-10
safmc@safmc.net

National Marine Fisheries Service
Contact: Dr. Roy Crabtree
Regional Administrator
Southeast Regional Office
9721 Executive Center Drive North
St. Petersburg, Florida 33702
(727) 570-5301; FAX (727) 570-5300

<u>List of Agencies, Organizations and Persons Consulted</u>

SAFMC Shrimp Advisory Panel
SAFMC Ad Hoc BRD Advisory Panel
SAFMC Rock Shrimp Advisory Panel
SAFMC Law Enforcement Advisory Panel
SAFMC Scientific and Statistical Committee
North Carolina Coastal Zone Management Program
South Carolina Coastal Zone Management Program
Georgia Coastal Zone Management Program
Florida Coastal Zone Management Program
Florida Department of Environmental Protection
Florida Marine Fisheries Commission
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
North Carolina Department of Environment, Health and Natural Resources
Atlantic States Cooperative Statistical Program
Gulf and South Atlantic Fisheries Development Foundation
Gulf of Mexico Fishery Management Council
National Marine Fisheries Service
- Washington Office
- Office of Ecology and Conservation
- Southeast Regional Office
- Southeast Fisheries Science Center

National Oceanic and Atmospheric Administration
- General Counsel

United States Coast Guard
United States Environmental Protection Agency, Region IV
United States Fish & Wildlife Service
Oceana
Coastal Conservation Association
Union of Commercial Fishermen, Inc.
N.C. Fisheries Association, Inc.
South Carolina Shrimpers Association
Gulf Partners Ltd.
Virginia Department of Environmental Quality
Delawar Department of Natural Resources and Environmental Control, Division of Soil & Water Conservation

7.0 Other applicable law

7.1 Vessel safety

PL. 99-659 amended the Magnuson-Stevens 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 this amendment is an improvement to the federal management measures for shrimp species.

This amendment is consistent with the Coastal Zone Management Plans of Florida, South Carolina, Georgia and North Carolina to the maximum extent practicable.
This determination was 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, Georgia and North Carolina.

7.3 Endangered Species Act

Section 7(a)(1) of the Endangered Species Act (ESA) of 1973, as amended, requires all Federal agencies to participate in the conservation and recovery of listed threatened and endangered species. Section 7(a)(2) states that federal agencies must ensure that any activity they authorize, fund or carry out is not likely to jeopardize the continued existence of listed species or result in destruction or adverse modification of designated critical habitat. To facilitate compliance with Section 7(a)(2), a biological assessment is prepared by the action agency (in the case of fishery management plans, NOAA Fisheries' Office of Sustainable Fisheries is the action agency, although the Council prepares the biological assessment) to evaluate the likely effects of the proposed fishery action(s) on endangered and threatened species and designated critical habitat(s) occurring within the area of the proposed action(s) [Section 7(c)]. The biological assessment aids NOAA Fisheries' Division of Protected Resources (the consulting agency) in determining what further action (informal/formal consultation) is required. Consultations are concluded informally when proposed actions "may affect but are not likely to adversely affect" endangered or threatened species or designated critical habitat. Formal consultations, including a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" endangered or threatened species or designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives.

The Office of Sustainable Fisheries will request the Southeast Regional Office's Division of Protected Resources conduct a consultation under Section 7 of the ESA on the impacts of the actions in this amendment.

7.4 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) (16 U.S.C. 1361 et seq.), originally enacted in 1972, established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas as well as on the importation of marine mammals and marine mammal products into the United States. The term "take" is statutorily defined to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal". Jurisdiction over marine mammals is divided between the U.S. Fish and Wildlife Service and NOAA Fisheries. The former manages sea otters, polar bears, manatees, dugongs and walrus, while the latter manages whales, dolphins, porpoises, seals and sea lions. The primary goals of the two agencies are to ensure that marine mammal stocks are maintained at, or in some cases restored to, their optimum sustainable population (OSP) level within the carrying capacity of the habitat and to maintain the health and stability of the marine ecosystem.

The 1994 reauthorization of the MMPA introduced substantial changes to the provisions of the MMPA of 1972. One of the more notable changes involved the development of a long-term strategy for governing interactions between marine mammals and commercial fishing operations (Sections 117 and 118). Section 118 established the immediate goal of reducing the incidental mortality or serious injury of marine mammals occurring in the course of commercial fishing operations to below the Potential Biological Removal (PBR) level and a long-term goal of reducing significant injury and mortality of marine mammals in commercial fishing operations to insignificant levels approaching a zero mortality and serious injury rate goal (ZMRG).

To aid in achieving these goals, the MMPA Amendments of 1994 mandated the preparation of marine mammal stock assessment reports, a registration and incidental take monitoring program for certain commercial fisheries, a marine mammal incidental injury and mortality self-reporting requirement for all fisheries and the development and implementation of take reduction plans. In addition, NOAA Fisheries instituted a mechanism for issuing permits to incidentally take endangered and threatened marine mammals provided that, together with other restrictions, incidental mortality and serious injury from commercial fisheries will have a negligible impact on the stock and that a recovery plan has been or is being developed for the species [Section 101(a)(5)(E)].

Under the registration and incidental take monitoring program, NOAA Fisheries created a three tier classification for commercial fisheries based primarily on the level of serious injury and mortality of marine mammals that occur incidental to that fishery. Category I includes commercial fisheries determined to have frequent incidental mortality and serious injury of marine mammals, Category II includes commercial fisheries determined to have occasional incidental mortality and serious injury of marine mammals, and Category III includes commercial fisheries determined to have a remote likelihood of or no known incidental mortality and serious injury of marine mammals.

Other factors are also considered when determining the category for a fishery including the type of gear used in the fishery, fishing techniques employed and areas and seasons fished in relation to the distribution and seasonal occurrence of marine mammals within fished areas. Category I and II fisheries are required to register with the Marine Mammal Authorization Program (MMAP) and must comply with take reduction plans and additional MMAP requirements such as carrying an on-board observer when requested. Currently, the southeastern U.S. Atlantic shrimp trawl fishery is listed as Category III fishery in the 2003 List of Fisheries (68 FR 41725).

An over-arching objective of the MMPA, as amended, is to meet the above listed goals while taking into account the economics of the fishery and the availability of existing technology and management strategies already in place under state and/or regional FMPs.

7.5 Migratory Bird Treaty Act and Executive Order 13186

Seabirds are frequent companions to commercial marine fishing vessels as they will feed on fish that escape trawl nets, seines and other fishing gear. They also are known to target baited hooks of hook-and-line fishing gear. In the process of feeding, seabirds can become entangled or hooked on gear and be incidentally killed. The probability of incidental catches of seabirds is a function of many interrelated factors including: the type of fishing operation and gear used, the length of time that fishing gear is at or near the surface of the water, the behavior of the bird (specific feeding/foraging techniques), water and weather conditions, and the time of year and location in which the fishery takes place. The occurrence and density of seabirds in an area can vary greatly depending on breeding activity, migration patterns and foraging needs.

Seabirds, and other migratory birds, are protected under the Migratory Bird Treaty Act (MBTA) of 1918. The MBTA prohibits taking any migratory bird except as permitted by regulations issued by the Department of the Interior. However, conservation law to protect seabirds with regard to fisheries has been lacking until recently. To address on-going concerns with seabird and fisheries interactions, NOAA Fisheries recently initiated an Interagency Seabird Working Group (ISWG). The group includes representatives from NOAA Fisheries, the U.S. Fish and Wildlife Service, regional Councils and coastal states. This new initiative looks to find practicable and effective solutions for reducing or eliminating seabird/fishery interactions.

Another recent initiative, Executive Order 13186, signed January 2001, requires every Federal agency that takes action(s) likely to have a measurable negative impact on migratory birds to enter into a Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service, which is the lead federal agency for managing and conserving seabirds. The MOU is to outline how an agency will promote the conservation of migratory birds and is published in the *Federal Register*. Other obligations under E.O. 13186 include supporting various conservation planning efforts already underway (e.g., Partners in Flight initiative and the North American Waterfowl Management Plan) and incorporating bird conservation considerations into agency planning. The latter includes considering impacts on migratory birds while conducting National Environmental Policy Act (NEPA) analyses and reporting annually on the level of take that is occurring.

NOAA Fisheries is currently drafting an MOU with the U.S. Fish and Wildlife Service. The NPOA and E.O. 13186, together with existing law, provide guidance to NOAA Fisheries in pursuing ways to better measure, monitor and reduce bycatch of seabirds in fishing operations both domestically and internationally.

To date, there have been no documented seabird/gear interactions in the South Atlantic shrimp fishery. This finding is the result of more than 117,000 hours of observer coverage of trawling on 1, 310 trips completed from February 1992 through December 2003 during 12,749 sea days in the U.S. Gulf of Mexico and southeastern Atlantic. A total of 668 trips (1,475 sea days) occurred off the east coast, and 5 trips (127 sea days) targeted waters off both the east coast and in the Gulf of Mexico (E. Scott-Denton, NOAA Fisheries, personal communication).

As part of NOAA Fisheries regional implementation of national seabird directives, the Council has participated in ISWG meetings and has contributed to the progress/status report on seabird bycatch assessments in longline fisheries in the form of providing detailed descriptions of longline fisheries currently managed by the South Atlantic Council.

7.6 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. Several alternatives, including Action 3 Alternatives 1 and 4, and Action 5 Alternatives 1 and 3, will involve changes to the data collections approved by the Office of Management and Budget and therefore, with final Council approval, will require approval under this Act

7.7 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.

7.8 Other Potentially Applicable Laws and Executive Orders

Administrative Procedures Act
Data Quality Act
National Marine Sanctuaries Act
E.O. 12630 Takings
E.O. 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations
E.O. 12962 Recreational Fisheries
E.O. 13089 Coral Reef Protection
E.O. 13158 Marine Protected Areas

8.0 References

Adams, W. F. and C. Wilson. 1995. The status of the smalltooth sawfish, Pristis pectinata Latham 1794 (Pristiformes: Pristidae) in the United States. Chondros 6(4):1-5.

Aldrich, D. V., Wood, C. E. and K. N. Baxter. 1968. An ecological interpretation of low temperature responses in Penaeus aztecus and P. setiferus postlarvae. Bulletin of Marine Science 18(1):61-71.

Aguilar, R., J. Mas and X. Pastor. 1995. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle, *Caretta caretta*, population in the western Mediterranean, pp. 1. *In*: 12th Annual Workshop on Sea Turtle Biology and Conservation, February 25-29, 1992, Jekyll Island, Georgia.

Alsop, III, F. J. 2001. Smithsonian Handbooks: Birds of North America eastern region. DK Publishing, Inc. New York, NY.

Anderson, L. G. 1986. The Economics Of Fisheries Management. Baltimore: Johns-Hopkins. (revised edition).

Antozzi, W. 2002. Recent shrimp market trends. National Marine Fisheries Service, Fisheries Economics Office. SERO-ECON-02-02.

ASMFC (Atlantic States Marine Fisheries Commission). 2004a (date of download). Managed species: weakfish. ASMFC. Available: www.asmfc.org. (April 2004).

ASMFC (Atlantic States Marine Fisheries Commission). 2004b (date of download). Managed species: Spanish mackerel. ASMFC. Available: www.asmfc.org. (April 2004).

ASMFC (Atlantic States Marine Fisheries Commission). 2004c (date of download). Managed species: Atlantic croaker. ASMFC. Available: www.asmfc.org. (April 2004).

ASMFC (Atlantic States Marine Fisheries Commission). 2004d (date of download). Managed species: spot. ASMFC. Available: www.asmfc.org. (April 2004).

Balazs, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. *In*: Shomura, R.S. and H.O. Yoshida (eds.), Proceedings of the workshop on the fate and impact of marine debris, November, 27-29, 1984, Honolulu, Hawaii. July 1985. NOAANMFS-54. National Marine Fisheries Service, Honolulu Laboratory; Honolulu, Hawaii.

Balazs, G.H. 1983. Recovery records of adult green turtles observed or originally tagged at French Frigate Shoals, northwestern Hawaiian Islands. NOAA Technical. Memorandum. NOAA Fisheries-SWFC-36.

Balazs, G.H. 1982. Growth rates of immature green turtles in the Hawaiian Archipelago, p. 117-125 in K.A. Bjorndal, editor. Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Barnette, M.C. 2001. A review of the fishing gear utilized within the Southeast Region and their potential impacts on essential fish habitat. NO AA Technical Memorandum NMFS-SEF SC-44 9, 62pp.

Barrett, B. B. and M. C. Gillespie. 1973. Primary factors which influence commercial shrimp production in coastal Louisiana. Louisiana Department of Wildlife and Fisheries Technical Bulletin 9.

Baisden, V. W. 1983. The shrimp and the shrimp fishery of the southern United States. U.S. Fish Wildlife Service Bureau of Commercial Fisheries. Fishery Leaflet 589.

Bielsa, L.M., W. H. Murdich and R.F. Labisky. 1983. Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (south Florida). Pink shrimp. U.S. Fish and Wildlife Service. FWS/Obs-82/11.17. U.S. Army Corps of Engineers Report No. TR EL-82-4. 21pp.

Bigelow, H. B. and W. C. Schroeder. 1953. Sawfishes, guitarfishes, skates and rays; chimaeroides in Fishes of the Western North Atlantic. Memoirs of the Sears Foundation for Marine Research Yale University. New Haven.

Bjorndal, K. A., J. A. Wetherall, A. B. Bolten, and J. A. Mortimer. 1999. Twenty-six years of green turtle nesting at Tortuguero, Costa Rica: an encouraging trend. Conservation Biology 13:126-134.

Blount, Benjamin, 2000. Marginalization of African-Americans in Commercial Fishing in Georgia. Paper presented at the Southern Division of the American Fisheries Society Midyear Meeting held in Savannah, Georgia.

Bolten, A.B., K.A. Bjorndal, and H.R. Martins. 1994. Life history model for the loggerhead sea turtle (*Caretta caretta*) populations in the Atlantic: Potential impacts of a longline fishery. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SWFSC-201:48-55.

Boulon, R., Jr., 2000. Trends in sea turtle strandings, U.S. Virgin Islands: 1982 to 1997. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SEFSC-436:261-263.

Boschung, H. 1979. The batoids of the Gulf of Mexico. Nature Notebook (5), 12pp.

Breder, Jr., C. M. 1952. On the utility of the saw of sawfish. Copeia 1952(2): 90-91.

Brooke, S.D. 1998. Reproduction and larval biology of the ivory tree coral *Oculina varicosa*. American Zoology 38:100a (abstract).

Brongersma, L. 1972. European Atlantic Turtles. Zoologische Verhandelingen (Leiden), 121:318 pp.

Bumpus, D.R. 1973. A description of the circulation on the Continental Shelf of the east coast of the U.S. Pp.111-157 *in* B. A. Warren, ed. Prog. Oceanogr. 6. Pergamon Co., New York.

Caldwell, D. K. and A. Carr. 1957. Status of the sea turtle fishery in Florida. Transactions of the 22nd North American Wildlife Conference, 457-463.

Campbell, N.A., Mitchell, L. and Reece, J. 1996. Biology: Concepts and connections. Addison-Wesley, NY. 2nd. ed.

Carr, A. 1984. So Excellent a Fish. Charles Scribner's Sons, New York, N.Y.

Castroviejo, J., J.B. Juste, J.P. Del Val, R. Castelo, and R. Gil. 1994. Diversity and status of sea turtle species in the Gulf of Guinea islands. Biodiversity and Conservation 3:828-836.

Chevalier, J., X. Desbois, and M. Girondot, M. 1999. The reason of decline of Leatherback turtles (*Dermochelys coriacea*) in French Guiana: an hypothesis. In 9th extraordinary meeting of the societas Europaea Herpetologica, R. Guyétant and C. Miaud, eds. (Université de Savoie, Le Bourget du Lac: Université de Savoie).

Cobb, S. P., Futch, C. R. and D. Camp. 1973. The Rock Shrimp, *Sicyonia brevirostris*, Stimpson, 1871 (Decapoda, Penaeidae). Memoirs of the Hourglass Cruises. Vol. III, Part I, February.

Compagno, L. J. V. and S. F. Cook. 1995. The exploitation and conservation of freshwater elasmobranchs: status of taxa and prospects for the future in The Biology of Freshwater Elasmobranchs. Journal of Aquariculture and Aquatic Sciences 8:62-90.

Cook, R. 2003. The magnitude and impact of by-catch mortality by fishing gear. Pages 219-233 In M. Sinclair and G. Valdimarsson, editors. Responsible Fisheries in the Marine Ecosystem. Food and Agriculture Organization of the United Nations, Rome, Italy.

Cook, S. F. and L. J. V. Compagno. 1994. Preliminary Thailand field trip notes: November- December 1993. Chondros 5(1):8-13.

Couch, J. A. 1978. Diseases, parasites, and toxic responses of commercial penaeid shrimps of the Gulf of Mexico and South Atlantic coasts of North America. Fishery Bulletin 76(1): 1-44.

CEQ (Council on Environmental Quality) 1997. Considering Cumulative Effects Under the National Environmental Policy Act. Council on Environmental Quality, Washington, DC. 64 pp.

Crouse, D.T. 1999. The consequences of delayed maturity in a human-dominated world. American Fisheries Society Symposium. 23:195-202.

Culliton, T.J., M.A. Warren, T.R. Goodspeed, D.G. Remer, C.M. Blackwell, and J.J. McDonough III. 1990. Fifty years of population change along the nation's coasts, 1960-2010. National Oceanic and Atmospheric Administration Coastal Trend Series, 2nd rep. 41 pp.

Dennis, C. 1992. A summary of rock shrimp landings and effort information off the Florida east coast from 1985-1991. Miami Laboratory Contribution No. MIA 91/92-27. 5 pp.

Department of Commerce. 1988b. Fisheries Grant-in-Aid 1987 Program Activities. U. S. Department of Commerce.

Desfosse, J., H. Austin, L. Daniel, W. Laney, and H. Speir. 2001. 2001 Review of the fishery management plan for Atlantic croaker (*Micropogonias undulatus*).

Dodd, C. K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 88 (14).

Dodd, C. K. 1981. Nesting of the green turtle, *Chelonia mydas* (L.), in Florida: historic review and present trends. Brimleyana 7:39-54.

Doughty, R. W. 1984. Sea turtles in Texas: a forgotten commerce. Southwestern Historical Quarterly 88:43-70.

Durrenberger, E. Paul. 1996. Gulf Coast Soundings: People and Policy in the Mississippi Shrimp Industry. Lawrence, KS: University Press of Kansas.

Dutton, P. H., B. W. Bowen, D. W. Owens, A. Barragán, and S. K. Davis. 1999. Global phylogeography of the leatherback turtles (*Dermochelys coriacea*). Journal of Zoology (London) 248:397-409.

Dwyer, K.L., C.E. Ryder, and R. Prescott. 2002. Anthropogenic mortality of leatherback sea turtles in Massachusetts waters. Poster presentation for the 2002 Northeast Stranding Network Symposium.

Eckert, S.A. 1999. Global distribution of juvenile leatherback turtles. Hubbs Sea World Research Institute Technical Report 99-294.

Eckert, K. L. 1995. Hawksbill sea turtle (*Eretmochelys imbricata*). National Marine Fisheries Service and U.S. Fish and Wildlife Service Status Reviews for Sea Turtles Listed under the Endangered Species Act of 1973. Silver Spring, Maryland: National Marine Fisheries Service.

Eckert, S.A. and J. Lien. 1999. Recommendations for eliminating incidental capture and mortality of leatherback sea turtles, *Dermochelys coriacea*, by commercial fisheries in Trinidad and Tobago. A report to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). Hubbs-Sea World Research Institute Technical Report No. 2000-310, 7p.

Eckert, S. A. and K. L. Eckert, P. Ponganis, and G. L. Kooyman. 1989. Diving and foraging behavior of leatherback sea turtles (*Dermochelys coriacea*). Canadian Journal of Zoology 67:2834-2840.

Ehrhart, L. M. 1989. Status report of the loggerhead turtle in Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham, editors. Proceedings of the 2nd Western Atlantic Turtle Symposium. NOAA Technical Memorandum NOAA Fisheries-SEFC-226:122-139.

Ehrhart, L. M. 1983. Marine turtles of the Indian River Lagoon System. Florida Science 46:337-346.

Ehrhart, L. M. and B. E. Witherington. 1992. Green turtle in P. E. Moler, editor. Rare and Endangered Biota of Florida, Volume III. Amphibians and Reptiles. University Presses of Florida:90-94.

Eleuterius, L. 1987. Seagrass ecology along the coasts of Alabama, Louisiana, and Mississippi. pp. 11-24 in M.J. Durako, R.C. Phillips, and R.R. Lewis III (editors), Proceedings of the Symposium on Subtropical-Tropical Seagrassess in the Southeastern United States. Fl. Marine. Res. Pub. 42. St. Petersburg, Florida. 209 pp.

EPA (U.S. Environmental Protection Agency). 2001. National Coastal Condition Report. EPA, Report 620-R-01-005, Washington D.C.

Epperly, S.P. and W.G. Teas. 2002. Turtle excluder devices-Are the escape openings large enough? Fish Bull. 100:466-474.

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93:254-261.

Epperly, S.P., J. Braun, and A. Veishlow. 1995b. Sea turtles in North Carolina waters. Conserv. Biol. 9:384-394.

Epperly, S.P., J. Braun, A. J. Chester, F.A. Cross, J. Merriner, and P.A. Tester. 1995c. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bull. Mar. Sci. 56(2):519-540.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp fisheries of southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce, NOAA Technical Memorandum NOAA Fisheries-SEFSC- 490, 88 pp.

Ernst, L. H. and R. W. Barbour. 1972. Turtles of the United States. Univ. Kentucky Press, Lexington, Ky.

Etzold, D. J. and J. Y. Christmas. 1977. A comprehensive summary of the shrimp fishery of the Gulf of Mexico United States: a regional management plan. Gulf Coast Research Laboratory Technical Report Series No. 2, Part 2.

Florida Marine Research Institute, Florida Dept. of Environmental Protection. 2001. Florida statewide nesting beach survey data. Florida Department of Environmental Protection. Unpublished data.

Fonseca, M. S., Kenworthy, W. J., and G. W. Thayer. 1992. Seagrass beds: Nursery for coastal species. In Richard H. Stroud, editor. Stemming the Tide of Coastal Fish Habitat Loss. Proceedings of a Symposium on Conservation of Coastal Fish Habitat, National Coalition for Marine Conservation, Inc., Savannah, Georgia.

FPL (Florida Power & Light Co.) St. Lucie Plant. 2000. Annual environmental operating report 1999. Juno Beach, Florida.

Frazer, N. B. and L. M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985:73-79.

Frazer, N. B., C. J. Limpus, and J. L. Greene. 1994. Growth and age at maturity of Queensland loggerheads. U.S. Dep. of Commer. NOAA Technical Memorandum NOAA Fisheries-SEFSC-351.

Fritts, T.H. 1982. Plastic bags in the intestinal tract of leatherback marine turtles. Herpetological Review 13(3): 72-73.

Funk, D. F. 1998. Economic Impacts of License Limitation and Buyback on the Texas Bay Shrimp Fishery. Doctoral Dissertation. Department of Agricultural Economics, Texas A&M University, College Station, TX 77843-2124.

Gaidry, W. J. 1974. Correlations between inshore spring white shrimp population densities and offshore overwintering populations. Louisiana Wildlife and Fisheries Commission, Technical Bulletin No.12.

Gaidry, W. J. and C. J. White. 1973. Investigations of commercially important penaeid shrimp in Louisiana estuaries. Louisiana Wildlife and Fisheries Commission, Technical Bulletin No. 8.

Garduño-Andrade, M., V. Guzmán, E. Miranda, R. Briseno-Duenas, and A. Abreu. 1999. Increases in hawksbill turtle (*Eretmochelys imbricata*) nestings in the Yucatán Peninsula, Mexico (1977-1996): data in support of successful conservation? Chelonian Conservation and Biology 3(2):286- 295.

GAO (U.S. General Accounting Office). 2002. Vessel identification system development needs to be reassessed. Report to the Subcommittee on Coast Guard and Maritime Transportation, Committee on Transportation and Infrastructure, House of Representatives. GAO-02-477, Washington, D.C.

Georgia Department of Natural Resources (GADNR). 1983. Georgia Landings, annual summary 1981. Commercial Fisheries Statistics 81-A. Georgia Department of Natural Resources, Brunswick, Georgia.

Gitschlag, G.R. 1996. Migration and diving behavior of Kemp’s ridley (Garman) sea turtles along the U.S. southeastern Atlantic coast. J. Exp. Mar. Biol. And Ecol. 205:115-135.

Goff, G.P. and J.Lien. 1988. Atlantic leatherback turtle, *Dermochelys coriacea*, in cold water off Newfoundland and Labrador. Can. Field Nat.102(1):1-5.

Graff, D. 1995. Nesting and hunting survey of the turtles of the island of São Tomé. Progress Report July 1995, ECOFAC Componente de São Tomé e Príncipe, 33 pp.

Griffith, David, 1999. The Estuary’s Gift. College Park: Pennsylvania State University Press.

Groombridge, B. 1982. The IUCN Amphibia - Reptilia Red Data Book. Part 1. Testudines, Crocodylia, Rhynchocephalia. International Union Conservation Nature and Natural Resources.

GSAFF (Gulf and South Atlantic Fisheries Development Foundation). 1997. Bycatch and its reduction in the Gulf of Mexico and South Atlantic shrimp fisheries. GSAFF, Tampa, FL. July.

GSAFF (Gulf and South Atlantic Fisheries Development Foundation). 1998. Continued efforts to reduce bycatch in the Gulf of Mexico and South Atlantic shrimp fisheries and disseminate such information to the fishing industry. GSAFF, Tampa, FL. August.

Gunter, G. 1961. Habitat of juvenile shrimp (Family Penaeidae). Ecology 42:593-600.

Gunter, G., Christmas, J. Y. and R. Killebrew. 1964. Some relations of salinity to population distributions of motile estuarine organisms, with special reference to Penaeid shrimp. Ecology 45:181-185.

Guseman, J. L. and L. M. Ehrhart. 1992. Ecological geography of Western Atlantic loggerheads and green turtles: evidence from remote tag recoveries in M. Salmon and J. Wyneken, compilers. Proceedings of the 11th Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NOAA Fisheries. NOAA Fisheries-SEFC-302.

Haby, M. G., R. J. Miget, L. L. Falconer and G.L. Graham. 2003. A review of current conditions in the Texas shrimp industry, an examination of contributing factors, and suggestions for remaining competitive in the global shrimp market. Departments of Agricultural Economics and Wildlife and Fisheries Sciences, Texas Cooperative Extension Sea Grant College Program. TAMU-SG-03-701

Harris, C. D. 1974. Observations on the white shrimp (*Penaeus setiferus*) in Georgia. Georgia. Contribution Series No. 27. Georgia Department of Natural Resources, Brunswick, Georgia.

Henry, M. S., D. L. Barkley, and Q. Vo, 2001. Possible Effects of the Shrimp-Baiting Fishery on the Economic Performance of the South Carolina Shrimp Trawling Industry and Related Economic Impacts. Report to the Marine Resources Division, South Carolina Department of Natural Resources, Charleston, South Carolina.

Henwood, T.A. and L.H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley turtles (Lepidochelys kempii) and green turtles (Chelonia mydas) off Florida, Georgia, and South Carolina. Northeast Gulf Science, 9(2): 153-160.

Herbst, L. H. 1994. Fibropapillomatosis in marine turtles. Annual Review of Fish Diseases 4: 389-425.

Hildebrand, H. 1982. A historical review of the status of sea turtle populations in the Western Gulf of Mexico in K.A. Bjorndal, editor. Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Hildebrand, H. 1963. Hallazgo del area de anidación de la tortuga "lora" Lepidochelys kempii (Garman), en la costa occidental del Golfo de México (Rept., Chel.). Ciencia Mex., 22(a):105-112 .

Hirth, H. F. 1997. Synopsis of the biological data on the green turtle Chelonia mydas (Linnaeus 1758). Biological Report 97(1), Fish and Wildlife Service, U.S. Department of the Interior.

Hirth, H.F. 1980. Some aspects of the nesting behavior and reproductive biology of sea turtles. American Zoologist 20:507-523.

Houston, J. E. and A. Neito. 1988. Regional shrimp market responses to domestic landings and imports. Jour. of Food Distrib. Res. 88(2): 99-108.

Iversen, E.S. and C.P. Idyll, 1959. The Tortugas Shrimp Fishery: The Fishing Fleet and its Method of Operation. State of Florida Board of Conservation, University of Miami, Technical Series Paper No. 29.

Jacobson, E. R. 1990. An update on green turtle fibropapilloma. Marine Turtle Newsletter 49:7-8.

Jacobson, E. R., S. B. Simpson, Jr., and J. P. Sundberg. 1991. Fibropapillomas in green turtles in G.H. Balazs, and S.G. Pooley, editors. Research Plan for Marine Turtle Fibropapilloma, NOAA Technical Memorandum NOAA Fisheries-SWFSC-156.

Johnson, J. and M. Orbach, 1990 . “Migratory Fishermen: A Case Study in Interjurisdictional Natural Resource Management. Ocean and Shoreline Management, 13:231-252.

Johnson, S. A., and L. M. Ehrhart. 1994. Nest-site fidelity of the Florida green turtle in B.A. Schroeder and B.E. Witherington, compilers. Proceedings of the 13th Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NOAA Fisheries-SEFSC-341.

Joyce, E. A., Jr. 1965. The commercial shrimps of the northeast coast of Florida. Florida Board of Conservation, Marine Laboratory Professional Papers Series 6.

Keithly, W. R., K. J. Roberts, and J. M. Ward. 1993. Effects of shrimp aquaculture on the U.S. market: An econometric analysis. In U. Hatch & H. Kinnucan, editors. Aquaculture: Models and Economics. Westview Press.

Keithly, W. R., K. J. Roberts, and J. M. Ward. 1991. Structural changes in the Southeast U.S. shrimp processing industry. Unpubl. Rep., Center For Wetland Research, La. State Univ., Baton Rouge, Louisiana.

Keithly, W. R., K. J. Roberts, and J. M. Ward. 1989. Effects of shrimp aquaculture on the U.S. market: An econometric analysis. Unpubl. Rep., Center For Wetland Research, La. State Univ., Baton Rouge, Louisiana.

Keithly, W. R., H. Diop, R. F. Kazmierczak and M. D. Travis. 2002. An economic analysis of the Southeast U.S. shrimp processing industry. Responses to an increasing import base. Unpubl. Rep., Center For Wetland Research, La. State Univ., Baton Rouge, Louisiana.

Kennedy, F.S., Crane, J. J., Schlieder, R. A. and D.G. Barber. 1977. Studies of the rock shrimp, Sicyonia Brevirostris. A new fishery resource on Florida’s Atlantic Shelf. Florida Marine Research Publications Number 27, Florida Department of Natural Resources.

Kitner, K. R., 2001. Fieldnotes, Scoping for Amendment 6 to the SAFMC FMP for Shrimp.

Koenig, CC., A.N. Shepard, J.K. Reed, R.G. Gilmore, F.C. Coleman, S.D. Brooke, K.M. Scanlon, M.C. Barnette, J. Brusher, and A.W. David. (in press). A deep-water *Oculina* coral ecosystem in the western Atlantic: habitat, fish populations, restoration, and enforcement.

Kraus, S. D., R. D. Kenney, A. R. Knowlton, and J. N. Ciano. 1993. Endangered right whales of the southeastern North Atlantic. Contract Report No. 14-35-0001-30486 for Minerals Management Service, March 1993.

Lageux, C.J., C. Campbell, L.H. Herbst, A.R. Knowlton and B. Weigle. 1998. Demography of marine turtles harvested by Miskitu Indians of Atlantic Nicaragua. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SEFSC-412:90.

Laney, R. W. 1973. A comparison of the critical thermal maxima of juvenile brown shrimp (*Penaeus aztecus* Ives) and white shrimp (*Penaeus setiferus* Linnaeus). Master's Thesis. North Carolina State University, Raleigh, North Carolina.

Larson, S.C., J.J. Van Den Avyle and E.L. Bozeman, Jr. 1989. Species profiles. Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic). Brown shrimp. U.S. Fish and Wildlife Service. FWS/Obs-82/11.90. U.S. Army Corps of Engineers Report No. TR EL-82-4. 14 pp.

Lassuy, D. R. 1983. Species profiles: life histories and environmental requirements (Gulf of Mexico). Brown shrimp. U.S. Fish and Wildlife Service FWS/OBS-82/11.1.

Lefebvre, L. W., T. J. O'Shea, G. B. Rathbun and R. C. Best. 1989. Distribution, status, and biogeography of the West Indian manatee. Biogeography of the West Indies, 1989:567-610.

Leon, Y. M. and C. E. Diez, 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground. Pages 32-33 in Proceedings of the 18th International Sea Turtle Symposium, Abreu-Grobois, F.A., Briseno-Duenas, R. ,Marquez, R., and Sarti, L., compilers. NOAA Technical Memorandum NOAA Fisheries-SEFSC-436.

Lewison, R.L., S.A. Freeman, L.B. Crowder. 2004. Quantifying the effects of fisheries on threatened species: the impact of pelagic longlines on loggerhead and leatherback sea turtles. Ecological Letters 7: 221-231.

Liao, D., 1979. An economic analysis of mobility of shrimp vessels in the South Atlantic states." SC Marine Resources Center, Charleston, SC. Technical Report 35. 38 pp.

Lindner, M. J. and W. W. Anderson. 1956. Growth, migrations, spawning and size distribution of shrimp, *Penaeus setiferus*. Fishery Bulletin 56 (106):555-645.

Loesch, J. 1965. Distribution and growth of penaeid shrimp in Mobile Bay, Alabama. Publications of the Institute of Marine Science, University of Texas 10:41-58.

Low, R.A. 2002. Survey of the South Carolina shrimp baiting fishery, 2001. Data Report 39. South Carolina Department of Natural Resources. Charleston, South Carolina.

Lutcavage, M. and J. A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985(2):449-456.

Lutcavage, M. E. and P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival, Pp.387-409. *In:* P.L. Lutz and J.A. Musick, (eds.), The Biology of Sea Turtles, CRC Press. 432pp.

MacDonald, L.H. 2000. Evaluating and managing cumulative effects: process and constraints. Environmental Management 26(3): 299-315.

Maiolo, J. R. 2004. Hard Times and a Nickel a Bucket: Struggle and Survival in North Carolina's Shrimp Industry. Chapel Hill: Chapel Hill Press, Inc.

Maiolo, J. and R. Faison. 1980. Surveys of fishermen. Volume III: Second year report of the east Carolina Shrimp Research. Dept. of Sociol. and Anthrop., East Carolina Univ., Greenville, NC.

Marcano, L.A. and J.J. Alio-M. 2000. Incidental capture of sea turtles by the industrial shrimping fleet off northwestern Venezuela. U.S. department of Commerce, NOAA Tech. Memo. NMFS-SEFSC-436:107.

Maril, Robert Lee. 1995. The Bay Shrimpers of Texas: Rural Fishermen in a Global Economy. Lawrence, KS: University Press of Kansas.

Márquez, R. 1990. FAO Species Catalogue, Vol. 11. Sea turtles of the world, an annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis, 125.

Mayor, P., B. Phillips, and Z. Hillis-Starr. 1998. Results of stomach content analysis on the juvenile hawksbill turtles of Buck Island Reef National Monument, U.S.V.I. Pp. 230-232 in Proceedings of the 17th Annual Sea Turtle Symposium, S. Epperly and J. Braun, compilers. NOAA Technical Memorandum NOAA Fisheries-SEFSC-415.

McKenna, S. and J. T. Camp. 1992. An examination of the blue crab fishery in the Pamlico River estuary. North Carolina Department of Environmental Health, Natural Resources, Report Number 92-08.

Meylan, A. B. 1999. International movements of immature and adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean region. Chelonian Conservation and Biology 3(2):189-194.

Meylan, A. B. 1999a. The status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean. Region. Chelonian Conservation and Biology 3(2):177-184.

Meylan, A. B. 1988. Spongivory in hawksbill turtles: a diet of glass. Science 239:393-395.

Meylan, A.B. 1982. Sea turtles migration: Evidence from tag returns, in Biology and Conservation of Sea Turtles, Bjorndal,K. (ed.). Smithsonian Institution Press, Washinhton, DC, 91-100.

Meylan, A. B., and M. Donnelly. 1999. Status justification for listing the hawksbill turtle (*Eretmochelys imbricata* as critically endangered on the 1996 IUCN Red List of Threatened Animals. Chelonian Conservation and Biology 3(2):200-204.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the State of Florida 1979-1992. Florida Marine Research Publications 52:1-51.

McFarland, W. N. and B. D. Lee. 1963. Osmotic and ionic concentrations of penaeidean shrimps of the Texas coast. Bulletin of Marine Science Gulf Caribbean 13:391-417.

McKenzie, M. D. and J. D. Whitaker. 1981. A comparative study of shrimp seines and selectivity of various mesh sizes. Unpublished Report. South Carolina Wildlife and Marine Resources Division, Charleston, South Carolina.

Milliman, J. D. 1972. Atlantic Continental Shelf and Slope of the United States- Petrology of the sand fraction of sediments, northern New Jersey to southern Florida. U.S. Geological Survey Professional Paper 529-J.

Milton, S.L., S. Leone-Kabler, A.A. Schulman, and P.L. Lutz. 1994. Effects of Hurricane Andrew on the sea turtle nesting beaches of South Florida. Bulletin of Marine Science, 54(3): 974-981.

MML (Mote Marine Laboratory). Status of smalltooth sawfish in U.S. waters. Available: http://www.mote.org/%7Ecolins/SawfishConservaiton/SmalltoothStatus.htm (March 2004).

Mock, C. R. 1967. Natural and altered estuarine habitats of Penaeid shrimp. Proceedings of the Gulf and Caribbean Fisheries Institute 19: 86-98.

Mrosovsky, N. 1981. Plastic jellyfish. Marine Turtle Newsletter 17:5-6.

Muncy, R. J. 1984. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): White shrimp. U. S. Fish and Wildlife Service, FWS/OBS-823/11.27.

Murphy M. 2002. Cannonball jellyfish (*Stomolophus meleagris*). Report to the South Atlantic Fishery Management Council.

Murphy, T. and Hopkins, S. 1984. Aerial and ground surveys of marine turtle nesting beaches in the Southeast region, U.S. Final report to NOAA Fisheries. Contract no. NA83-GA-C-00021. 73pp.

Murphy, T. and Hopkins, S. 1981. Sonic and radio tracking of nesting *Carretta carretta*. In: Hopkins and Murphy, Reproductive ecology of *Carretta carretta* in South Carolina. Study completion report: SC Wildlife and Marine Resources Department.

Music, J. L. 1979. Assessment of Georgia’s shrimp and crab resources. Georgia Department of Natural Resources Contribution Series 30:1-75.

Myers, R.A. and G. Mertz. 1998. The limits of exploitation: a precautionary approach. Ecological Applications 8:S165-S169.

Nance, J.M. (Editor). 1998. Report to Congress. Southeastern United States Shrimp Trawl Bycatch Program, 154 p. Contributors are listed in alphabetical order: Foster, D., Martinez, E., McIlwain, T., Nance, J., Nichols, S. Raulerson, R., Schirripa, M., Scott, G., Scott-Denton, E., Shah, A. and Watson, J.

Nance, J., E. Scott-Denton, E. Martinez, J. Watson, A. Shah, and D. Foster. 1997. Bycatch in the southeast shrimp trawl fishery. A data summary report, SFA Task N-10.03. June.

NOAA Fisheries, 2004. A Fisheries objectives, protocol, and recommended precision goals for standardized bycatch reporting methodologies (final draft version).

NOAA Fisheries, 2003a. NOAA Fisheries 2002 Report to Congress. NOAA Fisheries, Silver Spring, MD.

NOAA Fisheries, 2003b. Fisheries of the United States, 2002. Current Fishery Statistics No. 2002. NOAA Fisheries, Silver Spring, MD.

NOAA Fisheries, 2003c. Observer coverage of the U.S. Southeastern Atlantic rock shrimp fishery, September 2001 through December 2002 preliminary report. Southeast Fisheries Science Center, Galveston, Texas.

NOAA Fisheries, 2002. Endangered Species Act – Section 7 Consultation. Biological opinion on shrimp trawling in the southeastern United States, under the Sea Turtle Conservation Regulations and as managed by the fishery management plans for shrimp in the South Atlantic and Gulf of Mexico. NOAA Fisheries, Silver Spring, MD.

NOAA Fisheries, 2001. Endangered Species Act section 7 Consultation on reinitiation of Consultation on the Atlantic Highly Migratory Species Fishery Management Plan and its Associated Fisheries. Biological Opinion. June 14.

NOAA Fisheries. 2000. Status review of smalltooth sawfish (Pristis pectinata). December 2000.

NOAA Fisheries, 1998. Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

NOAA Fisheries, 1994. ESA Section 7 consultation on shrimp trawling in the southeastern United States under the sea turtle conservation regulations. Biological Opinion. November 14. 24 pp.

NOAA Fisheries, 1992. Proposed Regime to Govern Interactions Between Marine Mammals and Commercial Fishing Operations. Silver Spring, MD. .

NOAA Fisheries Pascagoula Laboratory, 2002b. An Evaluation of Modified TED Flap Designs on Exclusion of Wild Sea Turtles off the Southeast Atlantic Coast, May 13-17, 2002. Unpublished report. 5p.

NOAA Fisheries Pascagoula Laboratory, 2002a. Trip Report for Testing Modified Flaps for Sea Turtle Exclusion off the Atlantic Coast of Georgia and Florida, August 1-5, 2002. Unpublished report. 5p.

NOAA Fisheries SEFSC, 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, FL, SEFSC Contribution PRD-00/01-08, Parts I-III and Appendices I-V1.

NOAA Fisheries and USFWS (U.S.Fish and Wildlife Service). 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Md.

NOAA Fisheries and USFWS (U.S. Fish and Wildlife Service), 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean, Atlantic Ocean, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Fla.

NOAA Fisheries and USFWS (U.S. Fish and Wildlife Service). 1992. Recovery Plan for the Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. pp. 65

NOAA Fisheries and USFWS (U.S. Fish and Wildlife Service), 1991a. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C.

NOAA Fisheries and USFWS (U.S. Fish and Wildlife Service), 1991b. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

Norman, J. R. and F. C. Fraser. 1937. Giant Fishes, Whales and Dolphins. Putnam, London.

North Carolina Institute of Medicine, 2003. NC Latino Health, 2003: Final Report of the Latino Health Task Force. http://www.nciom.org/pubs/latinohealth.html.

NCDNR 2003. North Carolina recreational use of commercial gear, pilot study. Year 1 progress report. License and Statistics Division. North Carolina Division of Marine Fisheries. North Carolina Department of Environment and Natural Resources.

Odum, W. E. 1970. Insidious alteration of the estuarine environment. Transactions of the American Fisheries Society 99:836-847.

Ogren, L. H. 1989. Distribution of juvenile and sub-adult Kemp's ridley sea turtle: Preliminary results from 1984-1987 surveys, pp. 116-123 in: Caillouet, C.W. and A.M. Landry (Eds), First Intl. Symp. on Kemp's Ridley Sea Turtle Biol, Conserv. and Management. Texas A&M Univ.Galveston, Tex., Oct. 1-4, 1985, TAMU-SG-89-105.

Parker, J. C. 1970. Distribution of juvenile brown shrimp (*Penaeus aztecus* Ives) in Galveston Bay, Texas as related to certain hydrographic features and salinity. Contributions in Marine Science 15:11-12.

Perez-Farfante, I. 1969. Western Atlantic shrimps of the genus *Penaeus*. Fishery Bulletin 67(3):461-591.

Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea*, in Pacific, Mexico, with a new estimate of the world population status. Copeia 1982:741-747.

Rabon, D.R, S.A. Johnson, R. Boettcher, M. Dodd, M. Lyons, S. Murphy, S. Ramsey, S. Roff and K. Stewart. 2003. Confirmed leatherback turtle (*Dermochelys coriacea*) nests from North Carolina, with a summary of leatherback nesting activities north of Florida. Marine Turtle Newsletter No. 10 101, 2003.

Renaud, M. L. 1995. Movements and submergence patterns of Kemp's ridley turtles (*Lepidochelys kempii*). Journal of Herpetology 29:370-374.

Restrepo, V.R., G.G. Thompson, P.M. Mace, W.L. Gabriel, L.L. Low, A.D. MacCall, R.D. Methot, J.E. Powers, B.L. Taylor, P.R. Wade, and J.F. Witzig. 1998. Technical guidance on the use of precautionary approaches to implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. Appendix A of NMFS Technical Guidance Document on Approaches to Implementing National Standard 1 of the MSFCMA. NOAA Technical Memorandum, NMFS-F/SPO-31, August, 1998. 53 pp.

Rhodin, A. G. J. 1985. Comparative chondro-osseous development and growth in marine turtles. Copeia 1985:752-771.

Richardson, J. I., R. Bell, and T. H. Richardson. 1999. Population ecology and demographic implications drawn from an 11-year study of nesting hawksbill turtles, *Eretmochelys imbricata*, at Jumby Bay, Long Island, Antigua, West Indies. Chelonian Conservation and Biology 3(2):244-250.

Sabella, J., H. Hepburn, and R. Dixon, 1979. Aspects of Family and Kinship in a North Carolina Community: A Comparative Study. Maritime Politics and Management 6:2.

SAFMC (South Atlantic Fishery Management Council). 2002. Amendment 5 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, 201 plus appendices.

SAFMC (South Atlantic Fishery Management Council), 1998a. Comprehensive Habitat Amendment for the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council), 1998b. Habitat Plan for the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council), 1998c. Comprehensive SFA Amendment to the South Atlantic Fishery Management Plans. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 1996a. 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, 118 plus appendices.

SAFMC (South Atlantic Fishery Management Council). 1996b. Final Amendment 2 (Bycatch Reduction) to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

SAFMC (South Atlantic Fishery Management Council). 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. 29407-4699. 300 pp.

SAFMC (South Atlantic Fishery Management Council). 1981. Profile of the Shrimp Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, S.C. 29407-4699.

Schelske, C. L. and E. P. Odum. 1961. Mechanisms maintaining high productivity in Georgia estuaries. Proceedings of the Gulf and Caribbean Fisheries Institute 14:75-80.

Schirripa, M.J. and C.M. Legault. 1999. Status of the red snapper in U.S. waters of the Gulf of Mexico: updated through 1998. Contribution: SFD-99/00-75. National Marine Fisheries Service, Southeast Fisheries Science Center, Sustainable Fisheries Division, Miami, Florida.

Schmid, J. R. and W. N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (Lepidochelys kempii): cumulative results of tagging studies in Florida. Chelonian Conservation Biology 2:532-537.

Schroeder, B. A., and A. M. Foley. 1995. Population studies of marine turtles in Florida Bay. in J. I. Richardson and T.H. Richardson, compilers. Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NOAA Fisheries-SEFSC-361:117.

Schultz, J. P. 1975. Sea turtles nesting in Surinam. Zoologische Verhandelingen (Leiden), Number 143:172 pp.

SEAMAP. 2002. Results of trawling efforts in the coastal habitat of the South Atlantic Bight, 2002. SEAMAP -SA Shallow Water Trawl Survey. 85pp.

Shaver, D. J. 1994. Relative abundance, temporal patterns, and growth of sea turtles at the Mansfield Channel, Texas. Journal of Herpetology 28:491-497.

Shaver, D. J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in South Texas waters. Journal of Herpetology. Volume 23. 1991.

Shields, J.D. 1997. The potential effects of outbreaks of parasitic diseases on the blue crab fishery of Virginia. 2nd Virginia Eastern Shore Natural Resources Symposium, The Eastern Shore Institute, Exmore, VA. TESI Publication #4: 23-29.

Shipman, S. 1983a. Survey of Georgia's major marine resources. In Shipman, S., Baisden, V. and H. Ashley, editors. Studies and assessment of Georgia's marine fisheries resources 1977-1981. Chapter I. Georgia. Department of Natural Resources Completion Report P.L 88-309 Proj. 2-319-R.

Shipman, S. 1983b. Mark-recapture studies of Penaeid shrimp in Georgia, 1978-1981. In Shipman, S., Baisden, V. and H. Ashley, editors. Studies and assessment of Georgia's marine fisheries resources 1977-1981. Chapter I. Georgia. Department of Natural Resources Completion Report P.L 88-309 Proj. 2-319-R.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetol. Monogr. 6: 43-67.

Simpfendorfer CA. 2003. Abundance, movement and habitat use of the smalltooth sawfish. Final Report to the National Marine Fisheries Service, Grant number WC133F-02-SE-0247. *Mote Marine Laboratory Technical Report* (929) 20 pp.

Simpfendorfer, C. 2001. Essential habitat of smalltooth sawfish (*Pristis pectinata*). Mote Marine Library Technical Report 786. Mote Marine Laboratory, 1600 Ken Thompsan Parkway, Sarasota, FL 34236. November 2001.

Snelson, F.F. and Williams, S.E. 1981. Notes on the occurrence, distribution, and biology of elasmobranch fishes of the Indian River Lagoon system, Florida. Estuaries 4(2):110 – 120.

Spotila, J. R., A. E. Dunham, A. J. Leslie, A. C. Steyermark, P. T. Plotkin, and F. V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chelonian Conservation Biology 2(2):209-222.

St. Amant, L. S. and M. Lindner. 1966. The shrimp fishery of the Gulf of Mexico. Gulf States Fisheries Commission Information Series No. 3.

St. Amant, L. S., Broom J. G. and T. B. Ford. 1966. Studies of the brown shrimp, *Penaeus aztecus*, in Barataria Bay, Louisiana, 1962-1965. Proceedings of the Gulf and Caribbean Fisheries Institute 18:1-17.

Stender, B.W. and C.A. Barans. 1994. Comparison of the catch from tongue and two-seam shrimp nets off South Carolina. N. Am. J. Fish. Management. 14:178-195.

Temple, R. F. and C. C. Fischer. 1967. Seasonal distribution and relative abundance of planktonic-stage shrimp (*Penaeus* sp.) in northwestern Gulf of Mexico, 1961. Fishery Bulletin 66:323-334.

Travis, M. and W. Griffin. 2004. Economic analysis of the Texas shrimp closure for 2003. NOAA Fisheries. Fisheries Economics Office. SERO.

Truesdale, F. M. 1970. Some ecological aspects of commercially important decapod crustaceans in low salinity marshes. Doctoral Dissertation. Texas A&M University, College Station, Texas.

Turner, R. E. 1977. Intertidal vegetation and commercial yields of penaeid shrimp. Transactions of the American Fisheries Society 106:411-416.

TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. U.S. Dep. Commer. NOAA Tech. Mem. NOAA Fisheries-SEFSC-444, 115 pp.

TEWG (Turtle Expert Working Group). 1998. An assessment of Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Carretta carretta*) sea turtle populations in the Western North Atlantic. NOAA Technical memorandum NOAA Fisheries-SEFSC-409. 96pp.

USFWS (U.S. Fish and Wildlife Service). 2000. Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, on the Coasts of Tamaulipas and Veracruz, Mexico.

van Dam, R. and C. Diez. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata*) at two Caribbean islands. Journal of Experimental Marine Biology and Ecology, 220(1):15-24.

van Dam, R. and C. Diez, 1997. Predation by hawksbill turtles on sponges at Mona Island, Puerto Rico. Pages 1421-1426 in Proceedings of the 8th International Coral Reef Symposium, v. 2.

Vondruska, J. 2001. Southeast shrimp fisheries and global market trends. National Marine Fisheries Service, Fisheries Economics Office. SERO-ECON-01-03.

Ward, J. M. 1992. Modeling entry-exit behavior in the Gulf of Mexico shrimp fishery. Doctoral Dissertation. Department of Resource Economics, Univ. of Rhode Island.

Waring, G.T., J.M. Quintal and C.P. Fairfield, Editors. 2002. U.S. Atlantic and Gulf of Mexico Marine Stock Assessments-2002. NOAA Tech. Memo NMFS-NE-169. Department of Commerce, Woods Hole, Massachusetts. 318p.

Wershoven, J. L. and R. W. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: a five year review in M. Salmon and J. Wyneken, compilers. Proceedings of the 11th Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NOAA Fisheries. NOAA Fisheries-SEFC-302.

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.

Whitaker, J. D. 1983a. Effects of severe winters on white shrimp stocks in the Atlantic Ocean off the Southeastern United States. Presented at the National Shellfish Association. Hilton Head, SC.

White, C. J. and C. J. Boudreaux. 1977. Development of an areal management concept for Gulf penaeid shrimp. Louisiana Wildlife and Fisheries Commission Technical Bulletin 22.

Wiespape, L. M. 1975. Thermal resistance and acclimation rate in young white and brown shrimp, *Penaeus setiferus* Linn. and *Penaeus aztecus* Ives. Texas A&M University Sea Grant 76-202, College Station, Texas.

Williams, B. 1990. A survey of shrimp cast netters in Georgia during 1989. Final report. Georgia Department of Natural Resources. July 1990. 54pp.

Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. Herpetological Review 33(4): 266-269.

Wood, S.J., Gatz, R.N. and Glass, M.L. 1984. Oxygen transport in the green turtle. J. Comp. Physiol. 154:275.

Zein-Eldin, Z. P. 1964. Growth and metabolism. U.S. Bureau of Commercial Fisheries Circular 183:65-67.

Zein-Eldin, Z. P. and D. V. Aldrich. 1965. Growth and survival of postlarval *Penaeus aztecus* under controlled conditions of temperature and salinity. Biological Bulletin (Woods Hole) 129:199-216.

Zein-Eldin, Z. P. and G. W. Griffith. 1970. An appraisal of the effects of salinity and temperature on growth and survival of postlarval penaeids. FAO Fisheries Report. 57:1015-1026.

Zug, G. R.. and J. F. Parham. 1996. Age and growth in leatherback turtles, *Dermochelys coriacea* (Testudines: Dermochelyidae): a skeletochronological analysis. Chelonian Conservation Biology 2(2):244-249.

Zurita, J.C., R. Herrera, A. Arenas, M.E. Torres, C. Calderon, L. Gomez, J.C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pp. 125-127 *In*: Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Tech. Memo. NMFS-SEFSC-503.

Zwinenberg. A. J. 1977. Kemp’s ridley, *Lepidochelys kempii* (Garman, 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of *Lepidochelys olivacea*). Bulletin of the Maryland Herpetological Society, 13(3):170-192.

9.0 Public Hearing Dates and Locations

The following is a list of public hearing dates and locations that were held to obtain comment on all actions and alternatives in the Public Hearing Draft of Shrimp Amendment 6:

Monday, July 26, 2004
Town & Country
2008 Savannah Highway
Charleston, SC 29407
Phone: 843-571-1000

Monday, August 2, 2004
Richmond Hill City Hall
40 Richard R. Davis Drive
Richmond Hill, GA 31324
Phone: 912-756-3354

Tuesday, August 3, 2004
Radisson Resort at the Port
8701 Astronaut Blvd.
Cape Canaveral, FL 32921
Phone: 321-784-0000

Thursday, August 5, 2004
Crown Plaza La Concha
430 Duval Street
Key West, FL 33040
Phone: 305-296-2991

Monday, August 9, 2004
Cooperative Extension
25 Referendum Road, Bldg. N
Bolivia, NC 28422
Phone: 910-253-2610

Tuesday, August 10, 2004
DENR Regional Office
943 Washington Square Mall
Washington, NC 27889
Phone: 252-946-6481

Written comments on the measures contained in Amendment 6 to the South Atlantic Shrimp Fishery Management Plan were accepted until August 13, 2004. Comments were either mailed to Robert Mahood, Executive Director, SAFMC, One Southpark Circle, Suite 306, Charleston, SC 29407-4699, FAX 843/469-4520 or sent via email to: shrimpcomments@safmc.net. In addition, comments on the DSEIS were accepted until September 20, 2004 by the Regional Administrator of NOAA Fisheries, SERO.

Two additional public hearings were held to obtain input on the Council's choice of a new preferred alternative for Action 5 (the federal penaeid shrimp permit requirement) that was voted on at the October 2004 Council meeting in Pawleys Island, South Carolina. This additional alternative is more restrictive than the suite of alternatives for Action 5 included in the first round of public hearings and thus the following additional public hearings were held to obtain public input only on Action 5:

Monday, October 22, 2004
Hampton Inn and Suites
678 Citadel Haven Drive
Charleston, SC 29407

Monday, December 6, 2004
Sheraton Atlantic Beach Hotel
2717 W. Ft. Macon Road
Atlantic Beach, N. C.

The Council also accepted written comments on Action 5 until December 6, 2004. Comments were either mailed to Robert Mahood, Executive Director, SAFMC, One Southpark Circle, Suite 306, Charleston, SC 29407-4699, FAX 843/769-4520 or sent via email to: shrimpcomments@safmc.net.

Public comments were incorporated in different sections of this document. Substantive comments on the DSEIS are addressed in the section titled "Final Supplemental Environmental Impact Statement." New alternatives suggested by the public that were eliminated from detailed consideration are contained in Appendix A together with an explanation of why the Council did not deliberate on these new alternatives. In addition, specific comments on the actions and alternatives that the Council deliberated upon are included in Section 4 under the heading "Council conclusion."

All public comments are contained in a separate document and can be obtained from the Council office upon request. This document includes: minutes of the public hearings; written comments on the Amendment and DSEIS; written comments on the new alternative for Action 5 and transcription of the minutes from these additional public hearings; and responses from state agencies on whether measures in Amendment 6 met the coastal zone consistency requirements.

10.0 Index

11.0 Appendices

Appendices are contained in a separate document