Amendment 9

to the Shrimp Fishery Management Plan of the South Atlantic Region

Draft Environmental Assessment **Initial Regulatory Flexibility Act Analysis** **Regulatory Impact Review**

Fishery Impact Statement

July 2012

Abbreviations and Acronyms Used in the FMP

ABC	acceptable biological catch
ACL	annual catch limits
AM	accountability measures
ACT	annual catch target
B	a measure of stock biomass in either weight or other appropriate unit
B_{MSY}	the stock biomass expected to exist under equilibrium conditions when fishing at F_{MSY}
B_{OY}	the stock biomass expected to exist under equilibrium conditions when fishing at F_{OY}
B_{CURR}	The current stock biomass
CPUE	catch per unit effort
DEIS	draft environmental impact statement
EA	environmental assessment
EEZ	exclusive economic zone
EFH	essential fish habitat
F	a measure of the instantaneous rate of fishing mortality
$F_{30\%SPR}$	fishing mortality that will produce a static SPR = 30%
F_{CURR}	the current instantaneous rate of fishing mortality
F_{MSY}	the rate of fishing mortality expected to achieve MSY under equilibrium conditions and a corresponding biomass of B_{MSY}
F_{OY}	the rate of fishing mortality expected to achieve OY under equilibrium conditions and a corresponding biomass of B_{OY}
FEIS	final environmental impact statement
FMP	fishery management plan
FMU	fishery management unit
M	natural mortality rate
MARMAP	Marine Resources Monitoring Assessment and Prediction Program
MFMT	maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act
MRFSS	Marine Recreational Fisheries Statistics Survey
MRIP	Marine Recreational Information Program
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OFL	overfishing limit
OY	optimum yield
RIR	regulatory impact review
SAMFC	South Atlantic Fishery Management Council
SEDAR	Southeast Data Assessment and Review
SEFSC	Southeast Fisheries Science Center
SERO	Southeast Regional Office
SIA	social impact assessment
SPR	spawning potential ratio
SSC	Scientific and Statistical Committee

Abstract

The South Atlantic Shrimp Fishery Management Plan (Shrimp FMP) includes a process through which a state can request a concurrent closure of the EEZ to penaeid shrimp harvest after a cold weather event. This is a multi-step process, which includes satisfying criteria for a decrease in shrimp abundance, review and recommendation by the South Atlantic Council, followed by a closure notice published by the NOAA Fisheries Regional Administrator. The South Atlantic Council is concerned this administratively burdensome process may unintentionally hinder protections for the overwintering stock affected by cold weather. Therefore, the South Atlantic Council is seeking to explore alternate closure request processes to improve the timeliness and effectiveness of the concurrent closures.

Additionally, the South Atlantic Council will consider modifications to the overfished status determination criteria (B_{MSY}) for pink shrimp. Currently, pink shrimp biomass information is captured through the Southeast Area Monitoring and Assessment Program (SEAMAP) survey program, which may not be the most appropriate survey method for pink shrimp. Unlike brown and white shrimp, larvae produced by overwintering pink shrimp in North Carolina may be carried north beyond the SEAMAP sampling range by prevailing currents, and SEAMAP does not sample south of Cape Canaveral where pink shrimp are also known to exist. B_{MSY} for pink shrimp was last addressed in Amendment 6 to the Shrimp FMP in 2004 (SAFMC 2004). Amendment 6 established a B_{MSY} proxy for pink shrimp based on 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. A proxy for B_{MSY} was established for pink shrimp using CPUE information from SEAMAP data as the lowest values in the 1990-2003 time period that produced catches meeting MSY the following year. In this amendment, the South Atlantic Council will consider other methods of determining B_{MSY} for pink shrimp and revise the overfished proxy value as appropriate.

Actions in Amendment 9 would:

- Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

- Modify the process for a state to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

- Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

This Draft Environmental Assessment (EA) has been prepared to analyze the effects of implementing regulations to achieve the actions listed above. Comments on this amendment will be accepted for 60 days from publication of the Notice of Availability in the Federal Register.

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Action 3. Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

SUMMARY

of
AMENDMENT 9
to the Fishery Management Plan for the Shrimp Fishery of the South Atlantic Region

Why is the South Atlantic Council taking Action?

Currently, the process to request a concurrent closure of the EEZ due to cold weather requires a state to provide data that demonstrates an 80% decrease in abundance of overwintering white shrimp to a review panel, and the panel's recommendations are reviewed at the next South Atlantic Council meeting (usually in March). After approval by the South Atlantic Council, a letter is drafted to the NOAA Fisheries Regional Administrator requesting that the EEZ off the state be closed to penaeid shrimp harvest. The Regional Administrator then publishes an official notice of closure. Although the process takes only a week or so to implement the closure after the South Atlantic Council approves the state's request, it is likely that the severe weather event has occurred weeks or even months earlier. The South Atlantic Council is concerned that the process may not be as helpful in protecting the overwintering stock affected by cold weather and wanted to consider modifications to improve the timeliness and effectiveness of the concurrent closures.

For the action to revise the overfished status determination criteria (B_{MSY}) proxy for pink shrimp, the South Atlantic Council concluded that the biological parameters used in pink shrimp management can be improved through additional surveys and a new B_{MSY} proxy based on those surveys. Currently, the Southeast Area Monitoring and Assessment Program (SEAMAP) survey is the proxy for pink shrimp. According to SEAMAP sampling data, the stock of South Atlantic pink shrimp has been below the threshold (0.461 shrimp/hectare) in recent years, which translates into an overfished status for pink shrimp. However, the Shrimp Review Panel (a group made up of scientists from North Carolina DNR, South Carolina DNR, Georgia DNR, Florida FWC, and NOAA Fisheries Service) reviewed information about pink shrimp and concluded that other factors likely affect the pink shrimp stock rather than fishing mortality. Further, the SEAMAP survey does not have adequate data south of Cape Canaveral, Florida and north of Cape Hatteras, North Carolina. The Shrimp Review Panel has recommended that the inclusion of additional surveys, such as the Pamlico Sound Trawl Survey, be considered in monitoring the pink shrimp B_{MSY} in addition to SEAMAP.

Proposed Actions in Amendment 9

1. Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp fishery in the adjacent EEZ during severe winter weather

2. Modify the process for a state to request a concurrent closure of the overwintering white shrimp fishery in the adjacent EEZ during severe winter weather

3. Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

What Are the Proposed Actions?

There are three actions being proposed in Amendment 9. Each *action* has a range of *alternatives*, including a 'no action alternative' and a 'preferred alternative'.

What Are the Alternatives?

<u>Action 1.</u> Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

Alternative 1. No Action. Currently, as defined under the FMP for the South Atlantic shrimp fishery, states may request a concurrent closure of the EEZ adjacent to their closed state waters following severe winter weather upon providing information that demonstrates an 80 % or greater reduction in the population of overwintering white shrimp.

Alternative 2. A state may request a concurrent closure upon providing information that demonstrates an exceeded threshold for water temperature. Water temperature must be 7°C (45°F) or below for at least one week.

Preferred Alternative 3. A state may request a concurrent closure upon providing information that demonstrates an exceeded threshold for water temperature. Water temperature must be 8°C (46°F) or below for at least one week.

Alternative 4. A state may request a concurrent closure upon providing information that demonstrates an exceeded threshold for water temperature. Water temperature must be 9°C (48°F) or below for at least one week.

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<u>Summary of Effects</u>

Biological:

Economic:

Social:

Action 2. Modify the process for a state to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

Alternative 1. No Action. Currently, the process requires any state requesting a concurrent closure to provide data to demonstrate an 80% decrease in abundance of overwintering white shrimp to a review panel, and the panel's recommendations are reviewed at the next Council meeting. After approval by the Council, a letter is sent to the NOAA Fisheries Regional Administrator requesting that the EEZ adjacent to the state be closed to penaeid shrimp harvest. The Regional Administrator then publishes an official notice of closure in the *Federal Register*.

Preferred Alternative 2. A state requesting a concurrent closure would send a letter directly to NOAA Fisheries Service with the request and necessary data to demonstrate that criterion has been met.

Alternative 3. A state requesting a concurrent closure would send a letter directly to NOAA Fisheries Service with the request and necessary data to demonstrate that criterion has been met. The requesting state would also submit data to the Shrimp Review Panel, who would review data and make a recommendation to NOAA Fisheries Service. This option would require a notice to be published in the *Federal Register* at least 23 days prior to the convening of the Shrimp Review Panel.

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2. Modify the process for a state to request a concurrent closure of the overwintering white shrimp fishery in the adjacent EEZ during severe winter weather

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Summary of Effects

Biological:

Economic:

Social:

Action 3. Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

Alternative 1. No Action. A proxy for B_{MSY} (0.461 individuals per hectare) has been established for pink shrimp 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. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from SEAMAP-SA data during the 2007-2011 time period (.273 individuals per hectare).

Alternative 3. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from SEAMAP-SA during the 2009-2011 time period (.292 individuals per hectare).

Alternative 4. Establish a proxy for B_{MSY} for pink shrimp using the lowest CPUE value from SEAMAP-SA during the 1990-2011 time period (.089 individuals per hectare).

Alternative 5. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from Pamlico Sound Survey data during the 2007-2011 time period (5.143 individuals per hectare).

Alternative 6. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from Pamlico Sound Survey data during the 2009-2011 time period (1.526 individuals per hectare).

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Summary of Effects

Biological:

Economic:

Social:

Chapter 1. Introduction

1.1 What Actions Are Being Proposed?

Fishery managers are proposing changes to regulations through Amendment 9 to the Fishery Management Plan (FMP) for the Shrimp Fishery of the South Atlantic Region (Amendment 9). One action would specify criteria that triggers states' ability to request a concurrent closure of the adjacent EEZ during cold weather events for the overwintering shrimp stock. A second action would modify the process through which states formally request a concurrent closure in the adjacent EEZ. The third action proposes to revise the methodology used to determine the B_{MSY} proxy for pink shrimp.

South Atlantic Fishery Management Council

- Responsible for conservation and management of fish stocks
- Consists of 13 voting members who are appointed by the Secretary of Commerce
- Management area is from 3 to 200 miles off the coasts of North Carolina, South Carolina, Georgia, and Florida to the jurisdictional boundary at Key West?
- Develops management plans and recommends regulations to NOAA Fisheries Service for implementation

1.2 Who is Proposing the Actions?

The South Atlantic Fishery Management Council (South Atlantic Council) is proposing the actions. The South Atlantic Council develops the regulations and submits them to the National Marine Fisheries Service (NOAA Fisheries Service) who ultimately approves, disapproves, or partially approves the actions in the amendment on behalf of the Secretary of Commerce. NOAA Fisheries Service is an agency in the National Oceanic and Atmospheric Administration.

1.3 Where would the proposed actions be effective?

Management of the Federal shrimp fishery located off the South Atlantic in the 3-200 nautical mile (nm) U.S. Exclusive Economic Zone (EEZ) is conducted under the FMP for the Shrimp Fishery of the South Atlantic Region (1993) (**Figure 1-1**).

1.4 Why is the Council Considering Action?

Currently, the process to request a concurrent closure of the EEZ due to cold weather requires a state to provide data to demonstrate an 80% decrease in abundance of overwintering white shrimp to a review panel, and the panel's recommendations are reviewed at the next South Atlantic Council meeting (usually in March). After approval by the South Atlantic Council, a letter is drafted to the NOAA Fisheries Regional Administrator requesting that the EEZ for the state be closed to penaeid shrimp harvest. The Regional Administrator then publishes an official notice of closure. Although the process takes only a week or so to implement the closure after the South Atlantic Council approves the state's request, it is likely that the severe weather event has occurred weeks or even months earlier. The South Atlantic Council is concerned that the process may not be as helpful in protecting the overwintering stock affected by cold weather and wanted to consider modifications to improve the timeliness and effectiveness of the concurrent closures.

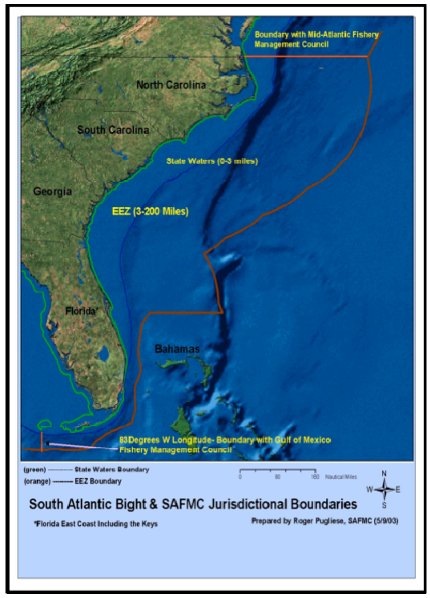

Figure 1-1. Jurisdictional boundaries of the South Atlantic Council

For the action to revise the overfished (B_{MSY}) proxy for pink shrimp, the South Atlantic Council discussed that the biological parameters used in pink shrimp management can be improved through different surveys and MSST proxy. Currently, data from the Southeast Area Monitoring and Assessment Program (SEAMAP) survey is used to determine the proxy for pink shrimp. According to SEAMAP sampling data, the stock of South Atlantic pink shrimp has been below the B_{MSY} proxy (0.461 shrimp/hectare) in recent years, which translates into an overfished status for pink shrimp. However, the Shrimp Review Panel (a group made up of scientists from North Carolina Department of Natural Resources, South Carolina Department of Natural Resources, Georgia Department of Natural Resources, Florida Fish and Wildlife Conservation Commission, and NOAA Fisheries Service) reviewed information about pink shrimp and felt that other factors likely affect the pink shrimp stock other than fishing mortality. Further, the SEAMAP survey does not have adequate data south of Cape Canaveral and north of Cape Hatteras. The Shrimp Review Panel has recommended other surveys to be considered in monitoring the pink shrimp population status in addition to or in replacement of SEAMAP.

Purpose for Action

The ***purpose*** of Amendment 9 is to modify the criteria for South Atlantic states requesting a concurrent closure to protect overwintering white shrimp, streamline the process by which a state can request a concurrent closure, and revise the methodology for monitoring and establishing an overfished (B_{MSY}) proxy for pink shrimp.

Need for Action

The ***need*** for action in Amendment 9 is to allow for a more efficient process to facilitate timely concurrent closure requests to maximize protection of overwintering white shrimp during cold weather events, and to improve the accuracy of the biological parameters for pink shrimp management.

Chapter 2. Proposed Actions

> **Proposed Actions in Amendment 9**
>
> 1. Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp fishery in the adjacent EEZ during severe winter weather
>
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>
> 3. Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

This section contains the proposed actions being considered to meet the purpose and need. Each action contains a range of alternatives, including the no action (the current regulations). Alternatives the South Atlantic Fishery Management Council (South Atlantic Council) considered but eliminated from detailed study during the development of this amendment are described in **Appendix A**.

2.1 Action 1. Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

Alternative 1. No Action. Currently, as defined under the FMP for the South Atlantic shrimp fishery, states may request a concurrent closure of the EEZ adjacent to their closed state waters following severe winter weather upon providing information that demonstrates an 80 % or greater reduction in the population of overwintering white shrimp.

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Comparison of Alternatives

Biological: The lower the temperature threshold is set, the more difficult it would be to meet the temperature criteria for requesting a concurrent closure, and therefore, the option with the lowest temperature threshold would result in the least biological benefit. Based on this assumption, **Alternative 2** would be the least biologically beneficial since it would require the lowest temperature of all those considered to trigger a request for a concurrent closure. Alternately, **Alternative 4** would be most biologically beneficial because it is the highest temperature option under consideration, and the concurrent closure criteria would more easily be met. **Preferred Alternative 3** represents a mid-point between **Alternatives 2** and **4**, and would likely result in biological benefits greater than **Alternative 2**, but less than **Alternative 4**.

Economic: Alternatives 2 – 4 provide a standardized method using a temperature threshold for determining when a state can ask for a concurrent closure affecting all penaeid species. Presumably, the higher the temperature for the closure, the sooner fishing pressure on the stock will end. While this might have short-term negative economic consequences for fishermen, preserving the remaining biomass for the next fishing season would have greater, positive economic impact the following season.

Social: The social effects from **Alternative 1 (No Action)** would depend upon whether shrimp stocks were significantly affected by the present closure system, which may not be as timely as that outlined in other alternatives. **Alternative 2** uses a water temperature threshold that would make the determination easier and more timely and may reduce the risk of negative social effects by protecting the shrimp stock. **Preferred Alternative 3** and **Alternative 4** each use a one-degree increase in temperature threshold respectively and the social effects would be the same as those described above, being determined by the ability of the alternative to provide sufficient protection to the stock. Overall, if the preferred alternative provides increased protection for the shrimp stock there should be positive social effects in the long-term that should outweigh any short-term negative impacts.

Table 2-1. Summary of effects under Action 1.

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (No Action)		
Alternative 2		
Preferred Alternative 3		
Alternative 4		

2.2 Action 2. Modify the process for a state to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

Alternative 1. No Action. Currently, the process requires any state requesting a concurrent closure to provide data to demonstrate an 80% decrease in abundance of overwintering white shrimp to a review panel, and the panel's recommendations are reviewed at the next Council meeting. After approval by the Council, a letter is sent to the NOAA Fisheries Regional Administrator requesting that the EEZ adjacent to the state be closed to penaeid shrimp harvest. The Regional Administrator then publishes an official notice of closure in the *Federal Register*.

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Comparison of Alternatives

Biological: Preferred Alternative 2 represents the most streamlined process by which South Atlantic states may request concurrent closures of federal waters to protect overwintering shrimp stocks. **Preferred Alternative 2** would, theoretically also require the least amount of time to actually implement the concurrent closure and is thus considered the most biologically beneficial alternative under this action.

Economic: Action 2 is an administrative action and any alternative chosen will not have positive or negative economic effects on the fishery.

Social: Under **Alternative 1** (**No Action**) the current process may not provide sufficient protection and therefore could have negative social effects. Under **Alternative 3**, review by the Shrimp Review Panel could delay the action more than **Preferred Alternative 2** that would be a more direct and timely approach. Again, the social effects would depend upon the effect of any delay on a closure and its impact upon the stock. It is assumed that a more timely closure will have beneficial effects upon the stock which should have positive long-term social effects.

Table 2-2. Summary of effects under Action 2.

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (No Action)		
Preferred Alternative 2		
Alternative 3		

2.3 Action 3. Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

Alternative 1. No Action. A proxy for B_{MSY} (0.461 individuals per hectare) has been established for pink shrimp 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. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from SEAMAP-SA data during the 2007-2011 time period (.273 individuals per hectare).

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Alternative 5. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from Pamlico Sound Survey data during the 2007-2011 time period (5.143 individuals per hectare).

Alternative 6. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from Pamlico Sound Survey data during the 2009-2011 time period (1.526 individuals per hectare).

Comparison of Alternatives

Biological: None of the alternatives under consideration address the issue of survey data not capturing the entire geographical range of pink shrimp abundance; however, **Alternatives 2**, **3**, **5** and **6** do use the most recent data available, which is a more accurate representation of current stock conditions relative to how the fishery is prosecuted now between Cape Hatteras and Cape Canaveral. The higher the B_{MSY} proxy is, the greater the chance that CPUE would fall below B_{MSY} in any given year and require administrative action to limit harvest. Therefore, if the B_{MSY} proxy is set too high, the probability of implementing corrective action when it may not be biologically necessary is higher relative other alternatives with low B_{MSY} values. Conversely, if the B_{MSY} proxy is set very low, the risk that CPUE would fall below B_{MSY} and corrective action may not be triggered when it is actually needed would be greater. The most accurate representation of biomass is likely to fall somewhere in between the lowest and the highest B_{MSY} proxy alternatives (**Alternatives 4** and **5**, respectively), and a B_{MSY} proxy that is closer to a mid-point between the highest and lowest CPUE averages is less likely to trigger corrective action when it would not be needed, or fail to trigger corrective action when it is needed.

Economic: Action 3 is a biological action that has indeterminate economic effects. Presumably, any alternative that would set an overfished level for pink shrimp that would lead to subsequent measures that might close the fishery early could have a negative economic effect. The lower the overfished threshold is set, the greater the probability the fishery could close early. However, such negative economic effects theoretically would only be short lived. Setting a lower overfished threshold could have positive economic effects for future fishing seasons.

Social: The ensuing regulatory actions because of overfished designation could trigger a number of negative social effects with a wide range of impacts that are not possible to determine at this time, although they could be similar to those mentioned in **Action 1**. Utilizing SEAMAP-SA data (**Alternatives 2-4**) could add additional confidence regarding the proxy B_{MSY} for pink shrimp. While primarily a biological decision, it could improve the overall assessment and be beneficial to the overall process that could result in positive social effects by ensuring the most accurate information to base management decisions. **Alternative 5** would provide an alternative perspective and offers a higher threshold than **Alternative 6**. Whichever alternative chosen as preferred, as long as it reflects the best estimate of stock status, it should have beneficial social effects in the long-term as mentioned in previous alternatives.

Table 2-3. Summary of effects under Action 3.

Alternatives	Biological Effects	Socioeconomic/Administrative Effects
Alternative 1 (No Action)		
Alternative 2		
Alternative 3		
Alternative 4		
Alternative 5		
Alternative 6		

Chapter 3. Affected Environment

This section describes the affected environment in the proposed project area. The affected environment is divided into four major components:

- **Habitat** (Section 3.1)

  Examples include coral reefs and sea grass beds

- **Biological environment** (Section 3.2)

  Examples include populations of shrimp, corals, turtles

- **Human environment** (Sections 3.3 & 3.4)

  Examples include fishing communities and economic descriptions of the fisheries

- **Administrative environment** (Section 3.5)

  Examples include the fishery management process and enforcement activities

3.1 Habitat Environment

3.1.1 Essential Fish Habitat

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 sub-tidal 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. Juvenile brown and white shrimp require enstuarine environments for development, while adults live and spawn offshore in areas with abundant marine plants and muddy substrates (McMillen-Jackcon 2003).

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).

Estuarine tidal creeks and salt marshes that serve as nursery grounds are perhaps the most important habitats occupied by penaeid shrimp. In a study conducted by Florido and Sanchez (2010), density of sea grasses and complexity of habitat play key roles in pink shrimp predation by crab species such as blue crab. 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.

3.1.2 Habitat Areas of Particular Concern

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.

3.2 Biological and Ecological Environment

3.2.1 Protected Species

There are 40 species protected by federal law that may occur in the EEZ of the South Atlantic Region that are under the purview of NMFS. Thirty-one of these species are marine mammals protected under the Marine Mammal Protection Act (MMPA) and six are also listed as endangered under the ESA (i.e., sperm, sei, fin, blue, humpback, and North Atlantic right whales). In addition to those six marine mammals, five species of sea turtles (green, hawksbill, Kemp's ridley, leatherback, and loggerhead); the smalltooth sawfish; the Atlantic sturgeon; and two Acropora coral species (elkhorn [*Acropora palmata*] and staghorn [*A. cervicornis*]) are also protected under the ESA. Portions of designated critical habitat for North Atlantic right whales and *Acropora* corals also occur within the South Atlantic Council's jurisdiction. Section 3.5 in the Comprehensive ACL Amendment (under review), describes the life history characteristics of these ESA-listed species, with the exception of Atlantic sturgeon, and discusses the features essential for conservation found in each critical habitat area. Subsequent to the completion of Section 3.5 in the Comprehensive ACL Amendment (under review), five distinct population segments (DPSs) of Atlantic sturgeon were listed under the ESA. The Carolina and South Atlantic DPSs of the Atlantic sturgeon occur in the South Atlantic region. The following sections briefly describe the general life history characteristics of animals from these DPSs. Because Atlantic sturgeon spawn in freshwater rivers, federal fisheries of the South Atlantic generally do not interact with spawning sturgeon. However, the populations of Atlantic sturgeon in spawning rivers and threats to animals occurring in those rivers is of significant importance to the species overall survival and recover. Additional information on specific river systems where Atlantic sturgeon spawn, and the threats to animals in those systems, can be found in ASSRT (2007).

Atlantic sturgeon are long lived (approximately 60 years), late maturing, relatively large, anadromous fish (Bigelow and Schroeder 1953, Vladykov and Greeley 1963, Mangin 1964, Pikitch et al. 2005, Dadswell 2006, ASSRT 2007). Atlantic sturgeon may reach lengths up to 14 feet and weigh over 800 pounds. They have armor-like plates and a long protruding snout that is ventrally located. Atlantic sturgeons are bottom feeders that use four barbells in front of the mouth to assist in locating prey (Bigelow and 1953). Adults and sub-adults eat mollusks, gastropods, amphipods, annelids, decapods, isopods, and fish such as sand lance (Bigelow and Schroeder 1953, ASSRT 2007, Guilbard et al. 2007, Savoy 2007), while juveniles feed on aquatic insects, insect larvae, and other invertebrates (Bigelow and Schroeder 1953, ASSRT 2007, Guilbard et al. 2007). Sturgeon are commonly found in less than 200 feet of water, but have been captured in water as deep as 3,000 feet (Stein et al. 2004, ASMFC 2007) and 40 miles offshore (D. Fox, DSU, pers. comm.).

Atlantic sturgeon mature between the ages of 5 and 19 years in South Carolina (Smith et al 1982). The age of maturity is unknown for animals originating in Florida, Georgia, and North Carolina rivers. In general, male Atlantic sturgeons grow faster than females and attain larger sizes (Smith et al. 1982, Smith et al. 1984, Smith 1985, Scott and Scott 1988, Young et al. 1998, Collins et al. 2000, Caron et al. 2002, Dadswell 2006, ASSRT 2007, Kahnle et al. 2007, DFO 2011). Females can produce between 400,000 to 4 million eggs per spawning year, but only spawn every 2-5 years; males spawn every 1-5 years (Vladykov and Greeley 1963, Smith et al.1982, Smith 1985, Van Eenennaam et al. 1996, Van Eenennaam and Doroshov 1998, Stevenson and Secor 1999, Collins et al. 2000, Caron et al. 2002, Dadswell 2006). In the South Atlantic region, spawning occurs in specific, freshwater rivers in North Carolina, South Carolina, and Georgia. Water temperature appears to trigger spawning migrations (ASMFC 2009), which generally occur during February-March in the South Atlantic region (Murawski and Pacheco 1977, Smith 1985, Bain 1997, Smith and Clugston 1997, Caron et al. 2002).

The Carolina DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) from Albemarle Sound, North Carolina south to Charleston Harbor, South Carolina. The marine range of Atlantic sturgeon from the Carolina DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the Carolina DPS and the adjacent portion of the marine range are shown in **Figure 3-1**. Rivers known to have current spawning populations within the range of the Carolina DPS include the Roanoke, Tar-Pamlico, Cape Fear, Waccamaw, and Pee Dee Rivers. There may also be spawning populations in the Neuse, Santee and Cooper Rivers, though it is uncertain. Both rivers may be used as nursery habitat by young Atlantic sturgeon originating from other spawning populations.

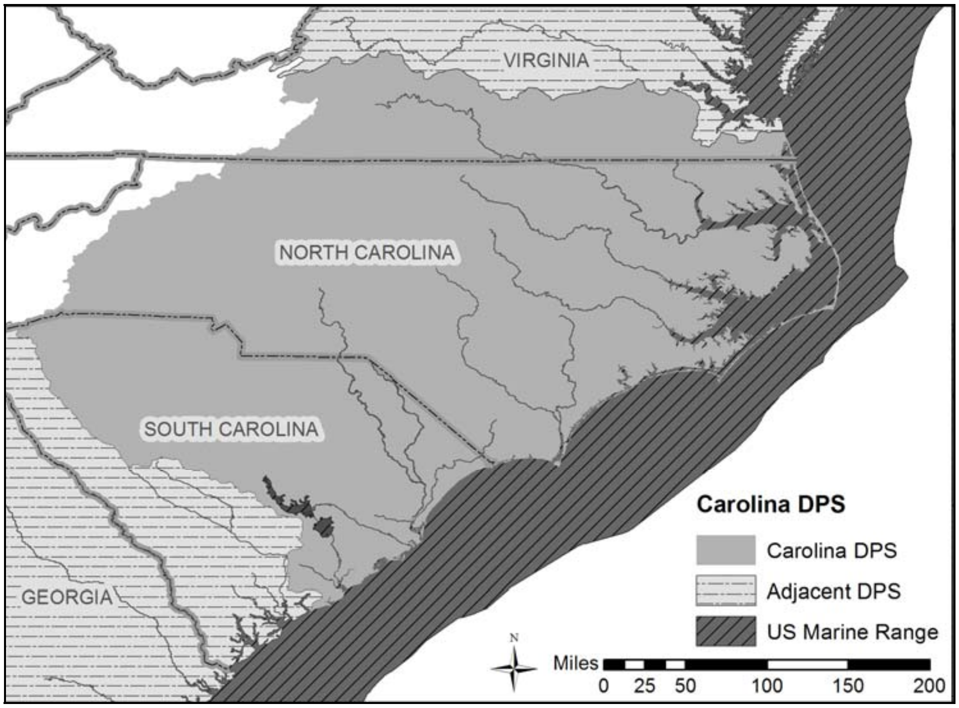


Figure 3-1. The Carolina DPS, Including the Marine Portion of the Range.

The South Atlantic DPS includes all Atlantic sturgeon that spawn or are spawned in the watersheds (including all rivers and tributaries) of the Ashepoo, Combahee, and Edisto Rivers southward along the South Carolina, Georgia, and Florida coastal areas to the St. Johns River, Florida. The marine range of Atlantic sturgeon from the South Atlantic DPS extends from the Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida. The riverine range of the South Atlantic DPS and the adjacent portion of the marine range are shown in **Figure 3-2**. Rivers known to have current spawning populations within the range of the South Atlantic DPS include the Combahee, Edisto, Savannah, Ogeechee, Altamaha, and Satilla Rivers.

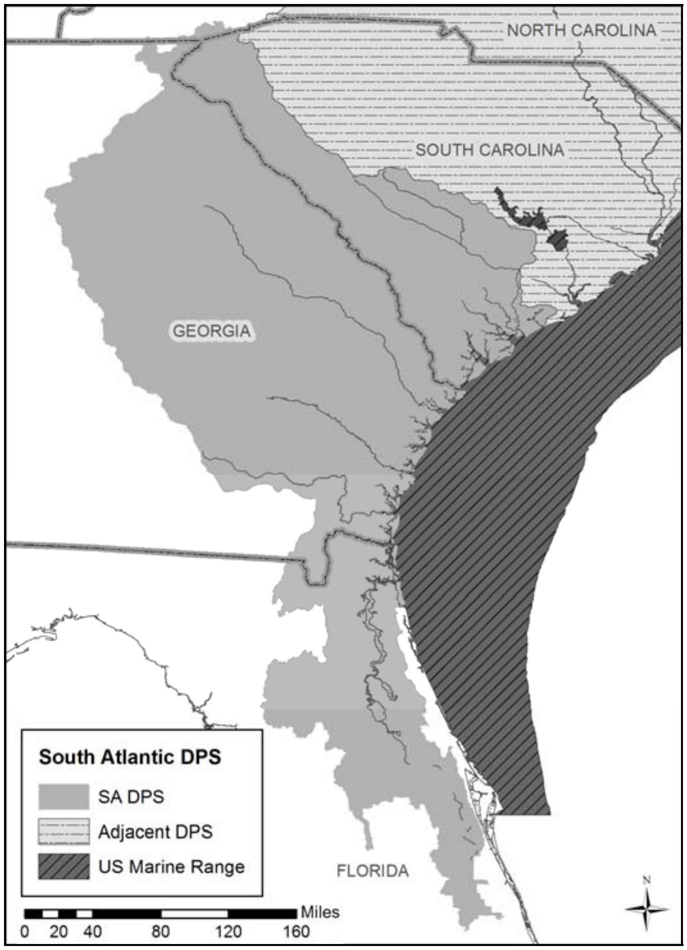


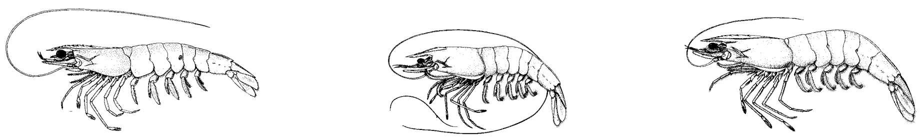
Figure 3-2. The South Atlantic DPS, Including the Marine Portion of the Range

Currently, only 16 U.S. rivers are known to support spawning based on available evidence (ASSRT 2007). The number of rivers supporting spawning of Atlantic sturgeon are approximately half of what they were historically. Between 7,000 and 10,500 adult female Atlantic sturgeon may have been present in North Carolina prior to 1890 (Armstrong and Hightower 2002, Secor 2002). Secor (2002) estimates that 8,000 adult females were present in South Carolina during that same time. However, past threats from commercial fishing and ongoing threats have drastically reduced the numbers of Atlantic sturgeon within the Carolina and South Atlantic DPSs. The abundances of the remaining river populations within these DPSs, each estimated to have fewer than 300 spawning adults, is estimated to range from less than 6 to less than 1 percent of what they were historically (ASSRT 2007).

3.2.2 Biological Description of Affected Shrimp Species

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*.

Common names for *Litopenaeus setiferus* (**Figure 3-3**) 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 3-3**) 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 3-3**) 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 3-3. Illustrations of white, brown and pink 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). 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. Brown shrimp 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). Brown shrimp are less tolerant of low salinities and high temperatures when compared to white shrimp, and brown shrimp rely more heavily on infauna for food (McMillen-Jackson 2003).

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).

Reproduction and Development

All three species of penaeid 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). 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 at greater depths than white shrimp, and their postlarvae recruit to estuaries earlier in the spring with shorter seasonal migrations (McMillen-Jackson 2003). 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).

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).

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). When compared with brown shrimp, white shrimp recruit to estuaries with warmer water temperatures and are more abundant than brown shrimp in estuaries in the winter because they are less cold tolerant and more susceptible to cold-weather related mortality (McMillen-Jackson 2003). 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).

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. During years of low densities, the average size of white shrimp is generally larger.

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).

Population Dynamics

Population size of brown, pink, and white 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.

Although shrimp trawling certainly reduces population size over the course of a season, the impact of fishing on subsequent year-class strength is unknown. Spawning stock size is associated with the survival of recruits of the same year (Ymin 2000); however, a study conducted by Yimin (2000) indicates that fishing effort plays a more significant role in controlling spawning stock size than recruitment. 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).

Targets and Thresholds for Penaeid Shrimp

A complete discussion of targets and thresholds for brown and white shrimp is contained in Shrimp Amendment 6 (SAFMC 2004), which is hereby incorporated by reference. Because Amendment 6 specifically modifies the overfished criteria for pink shrimp a detailed discussion of population benchmark and harvest parameters for pink shrimp is included below.

<u>Maximum Sustainable Yield</u>
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).

<u>Optimum Yield</u>
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).

<u>Overfished/Overfishing Definition</u>

Amendment 6 to the FMP (SAFMC 2004) established overfished and overfishing criteria for pink shrimp. 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. A proxy for B_{MSY} (0.461 individuals per hectare) has been established for pink shrimp 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.

3.2.2.1 Current Data Sources Used to Monitor and Assess Penaeid Shrimp Populations

For the South Atlantic shrimp fishery, only historical catch records and limited effort information is available. 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.

SEAMAP South Atlantic Survey

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). A complete discussion of the SEAMAP-SA Shallow Water Trawl Survey is included in Section 3.1.6 of Amendment 6 to the FMP (SAFMC 2004) and is hereby incorporated by reference. In summary, the SEAMAP-SA survey is funded by NOAA Fisheries and conducted by the South Carolina Department of Natural Resources - Marine Resources Division. 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. 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).

Current (1990-2011) SEAMAP data indicate that the average escapement results in annual abundance estimates ranging from 21.613 to 1.975 shrimp per hectare for brown shrimp, 1.725 to .089 shrimp per hectare for pink shrimp and 37.331 to 5.665 shrimp per hectare for white shrimp (**Table 3-1**).

Table 3-1. Annual CPUE (nos/ha) estimates derived from the SEAMAP Shallow water Trawl Survey.

Year	Brown Shrimp	Pink Shrimp	White Shrimp
1990	4.022	0.566	9.028
1991	2.469	0.872	12.880
1992	2.000	0.511	5.868
1993	5.899	0.671	5.665
1994	5.568	0.594	10.606
1995	3.104	1.725	17.535
1996	10.277	0.461	12.913
1997	2.275	0.949	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	0.908	9.186
2003	9.640	0.418	7.372
2004	8.788	0.383	26.492
2005	17.118	0.103	31.036
2006	10.934	0.218	22.385
2007	7.852	0.149	21.044
2008	6.275	0.340	37.331
2009	9.587	0.296	32.330
2010	8.145	0.089	23.302
2011	21.613	0.490	30.022

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**).

3.2.2.2 Pamlico Sound Survey as potential data source for development of status determination criteria for pink shrimp stocks

In Shrimp Amendment 9, the Pamlico Sound Survey data is being considered for use in developing status determination criteria for pink shrimp stocks (see **Table 3-2**). (Pamlico Sound Survey methodology and background information in section 3.2.3.2 provided via pers. communication, Jason Rock, Marine Biologist, NC Division of Marine Fisheries.)

The original Pamlico Sound Survey began in March 1987 and has received funding from the North Carolina Division of Marine Fisheries with additional federal funds provided by the SEAMAP program. Beginning in July 2011, the survey is funded through the federal Sport Fish Restoration grant. The primary objective of the Pamlico Sound Survey is to survey population parameters of marine recreational fish stocks in North Carolina. Data collected from the survey have provided juvenile abundance indices and long-term population parameters for interstate and statewide stock assessments of recreationally and commercially important fish stocks.

The survey was initially designed to provide a long-term fishery-independent database for the waters of Pamlico Sound, eastern Albemarle Sound, the lower Neuse, and Pamlico rivers. However, in 1990 all Albemarle Sound sampling was eliminated and the Pungo River was added. Sampling now occurs only in Pamlico Sound and associated rivers and bays in June and September (**Figure 3-4**).

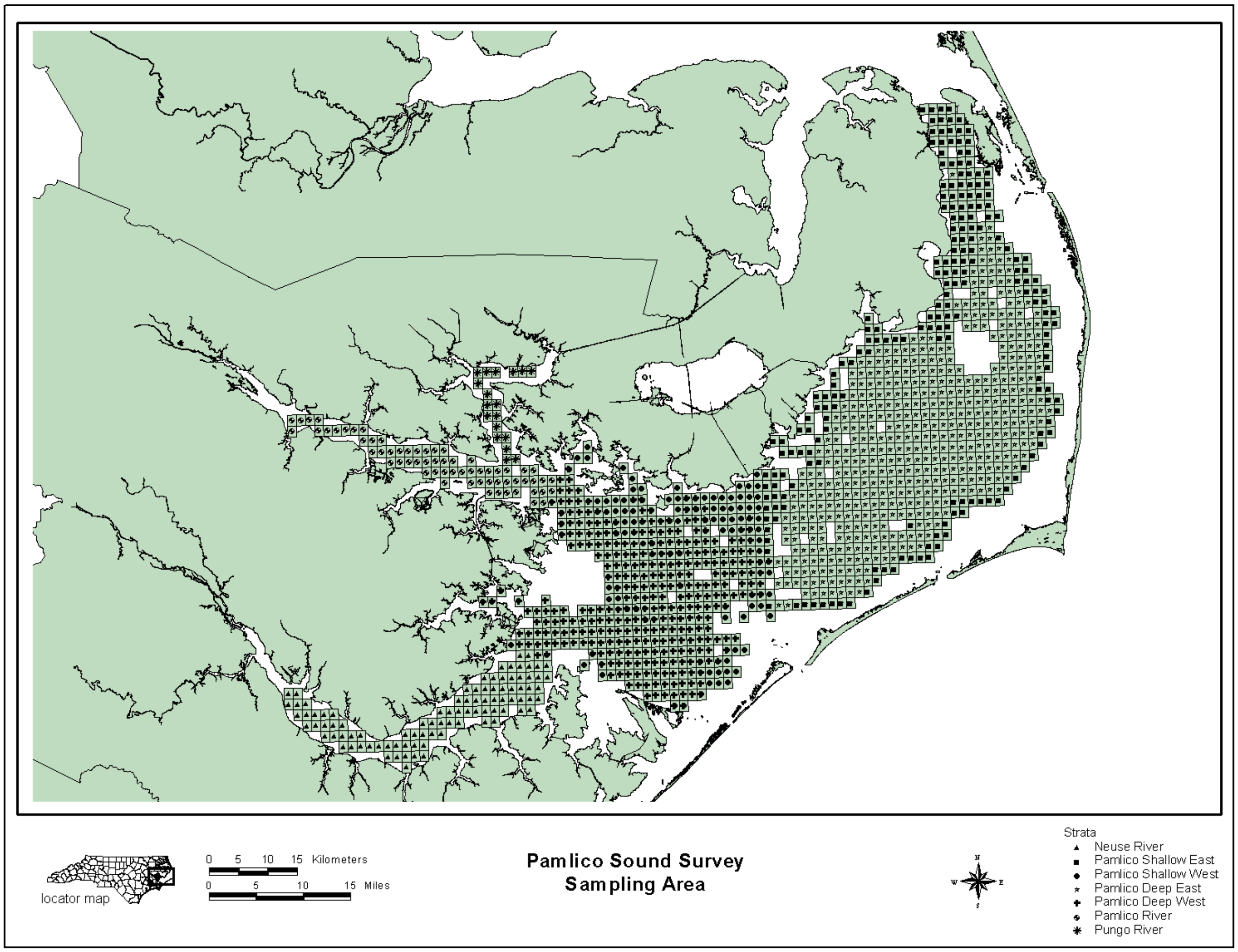


Figure 3-4. Current location and grids of the Pamlico Sound Survey area of eastern North Carolina. Each grid represents a potential sampling station.

From 1991 to the present, the Pamlico Sound Survey has been conducted over two weeks in June and September. As a result of scheduling conflicts or adverse weather conditions, there have been four years in which the survey did not occur over the same time series: 1988, 1999, 2003, and 2009.

Pamlico Sound Survey Study Area

From 1987-1989, the survey's sample area covered Pamlico Sound and its bays, Croatan Sound, Roanoke Sound, Albemarle Sound east of a line from the mouth of Alligator River to the mouth of North River, the Pamlico River up to Bath Creek, and the Neuse River up to Minnesott Beach. From 1990-present, the sample area covers inshore waters of the Pamlico Sound and its bays, the Pamlico River up to Blounts Bay, the Pungo River up to Smith Creek, and the Neuse River up to Upper Broad Creek.

Pamlico Sound Survey Site Selection

Initially survey site stations were allocated in proportion to the size of the strata. Each station is a unique one-minute by one-minute grid (approximately one square nautical mile). One sample is taken per station/grid. The number of stations per strata was determined by the following formula:

$N_S = N_T*(F_S / F_T)$ (Cornus, 1984)

Where N_S = number of samples per stratum
N_T = total number of samples
F_S = area of stratums
F_T = total survey area

Beginning in March 1989, the randomly drawn stations were optimally allocated among the strata based upon all the previous sampling in order to provide the most accurate abundance estimates (PSE <20) for selected species (see Analysis for SAS program). A minimum of three stations (replicates) are maintained in each strata, and 5 stations each are set for Neuse and Pamlico rivers and 3 stations for the Pungo River (added in 1990).

From 1990 to 2007, 52-54 randomly selected stations were sampled over a two week period, usually the second and third week of the month in both June and September. The stations sampled are randomly selected from strata based upon depth and geographic location. The seven designated strata are: Neuse River (NR), Pamlico River (PR), Pungo River (PUR), Pamlico Sound east of Bluff Shoal, shallow (PSE) and deep (PDE); and Pamlico Sound west of Bluff Shoal, shallow (PSW) and deep (PDW). Shallow water is considered water depth between 6-12 feet and deep water is considered water greater than 12 feet depth. A minimum of 104 stations were trawled per year. This was done each year so that maximum coverage of area was achieved.

Currently, 108 stations are sampled each year (54 per cruise).

Summary of Data Collected

Environmental and Habitat Data

Physical and environmental conditions such as temperature (^{o}C), salinity (ppt), dissolved oxygen (mg/L), bottom composition, a qualitative assessment of sediment size, and water clarity (began 2008) are recorded at the end of each tow.

Catch Data

The lead biologist inspects the catch to identify modal size categories for species present in high numbers (e.g. greater than 50 individuals of a species). The modal size categories are determined by eye on a tow-to- tow basis rather than a set range of lengths. This procedure is used in lieu of pre-set size ranges to ensure all size classes of a species are adequately sampled at each tow. Biologists sort all of the catch to species (spot, blue crab, Atlantic croaker etc.) and size class (if applicable) with each species/size in its own fish basket. Once the catch is sorted, all baskets are organized so those of the same species/size class are together and combined when possible.

For finfish, each species is enumerated and a total weight is taken for each species/size class. Individuals of each target species are measured. If present in large numbers, a sub-sample of 30-60 individuals of each target species/size class is measured and a total weight is taken of the measured individuals for each species/size class. If not on the target species list, the species is enumerated and a total weight taken.

For invertebrates, the total weight of all penaeid shrimp and blue crabs is taken for each species. Penaeid shrimp are assessed in the same manner as target finfish species. Other invertebrates will have a total weight for each species group taken and are enumerated. A separate sub-sampling protocol was started in September 2002 (modified 2005) for blue crabs.

Table 3-2. Annual CPUE estimates (#/ha) for pink shrimp derived from the Pamlico Sound Survey. The annual Pamlico Sound Survey CPUE is the arithmetic weighted mean of the number per tow, a tow equates to 1.951 hectares (NC Division of Marine Fisheries, 2012).

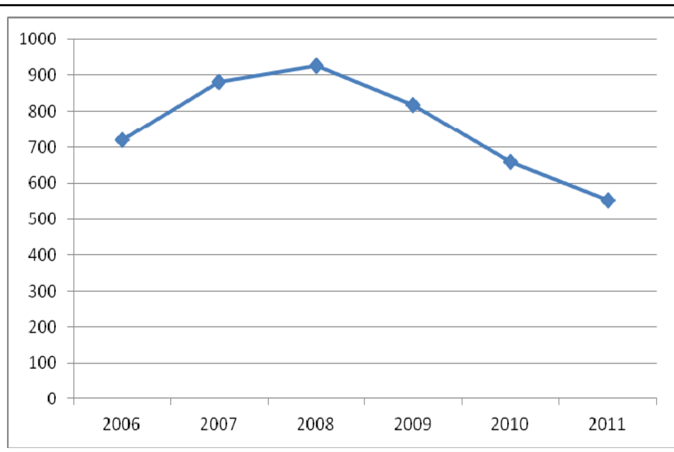
Year	Pink Shrimp
1990	1.030
1991	3.624
1992	9.810
1993	4.695
1994	9.231
1995	18.309
1996	9.462
1997	0.964
1998	13.060
1999	15.141
2000	4.367
2001	1.902
2002	11.266

2003	1.133
2004	2.225
2005	0.492
2006	6.986
2007	3.352
2008	17.786
2009	3.465
2010	0.584
2011	0.528

3.3 Human Environment

3.3.1 Social and Cultural Environment

Because recent South Atlantic shrimp amendments do not address penaeid shrimp, contemporary descriptions of the social environment of this particular fishery are lacking. Blount (2007) documents changes in the Georgia shrimp fishery highlighting the effects of an increasing global market for shrimp and the stresses placed upon fishermen and their communities. Whether all South Atlantic penaeid shrimp fishermen are experiencing the same types of stress is unknown. Yet, because they are exposed to the same market pressures, it is likely that those same factors are having similar impacts on South Atlantic shrimpers from other states. In fact, Griffith (2011) describes South Carolina shrimp fishermen as experiencing comparable effects from increasing imports and utilizing similar marketing strategies as those used by Georgia shrimp fishermen to combat lower prices and increase sales. These same issues were reflected in recent surveys conducted among North Carolina fishermen who cited rising fuel costs and low prices for seafood as their primary challenges (Crosson 2007a, 2007b).



Total South Atlantic Shrimp Permits 2006-2011 (SERO 2011)

Figure 3-5. Total number of South Atlantic Shrimp Permits 2006-2011 (SERO 2011).

While it is difficult to ascertain the current condition of the South Atlantic shrimp fishery from secondary data, over the past few years there has been a decline in the number of permits (**Figure 3-5**). Whether this is due to current market forces or the more general economic downturn that has affected the economy overall is unknown, however, the industry is likely facing difficult times as the economy recovers at a slow pace and it still faces high fuel prices and continuing competition from imports for market share. Until a more thorough study of the status of the fishery can be completed, a descriptive portrait using secondary data will have to suffice.

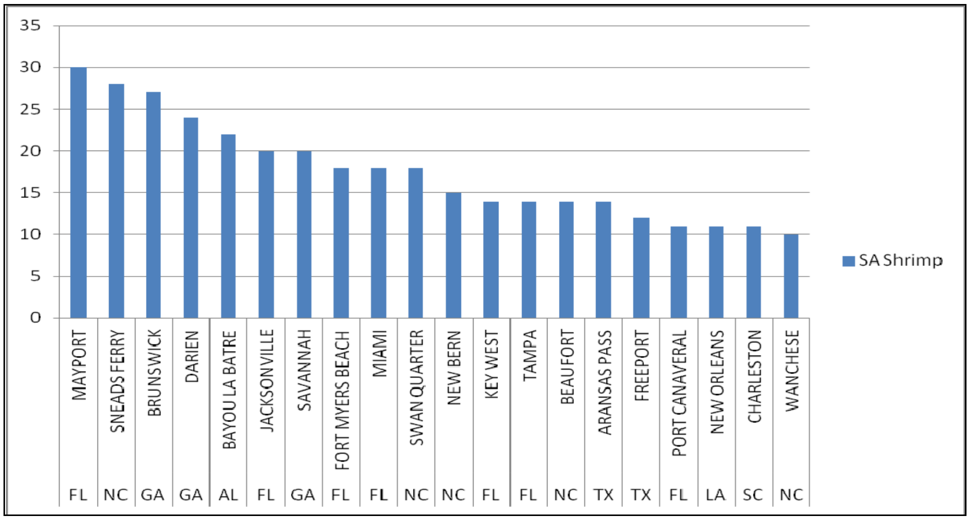


Figure 3-6. The top twenty fishing communities with South Atlantic shrimp permits in 2010 (SERO 2010).

As seen in **Figure 3-6**, fishing communities with the majority of South Atlantic shrimp permits are not confined to this region. Several communities located in the Gulf region are among the top twenty communities with South Atlantic shrimp permits. These Gulf vessels are likely participants in the rock shrimp fishery who seasonally migrate to South Atlantic waters and have so since the mid-1990s and are limited participants in the South Atlantic penaeid shrimp fishery. For South Atlantic states, the majority of permits are in located in Florida, North Carolina and Georgia.

Table 3-3. South Atlantic shrimp permits for top ten communities by South Atlantic state (SERO 2010)

South Carolina	Sum	North Carolina	Sum	Georgia	Sum	Florida	Sum
Charleston	11	Sneads Ferry	28	Brunswick	27	Jacksonville	20
McClellanville	9	Swan Quarter	18	Darien	24	Fort Myers Beach	18
Frogmore	4	New Bern	15	Savannah	20	Miami	18
Georgetown	4	Beaufort	14	Townsend	7	Key West	14
Mount Pleasant	4	Wanchese	10	Valona	4	Tampa	14
Bluffton	3	Belhaven	8	Sunbury	3	Port Canaveral	11
Hilton Head	3	Lowland	8	Lyons	2	Fernandina Beach	9
Edisto Beach	2	Supply	7	Meridian	2	Fort Myers	7

Murrells Inlet	2	Engelhard	5	Saint Marys	2	Hickory Island	5
Port Royal	2	Southport	5	Saint Simons Isl	2	Tarpon Springs	5

The top communities within each state for South Atlantic shrimp permits are listed in **Table 3-3**, although these are not necessarily vessels who actively land shrimp. In fact, it is only when landings by species are reported that those communities most actively involved become apparent.

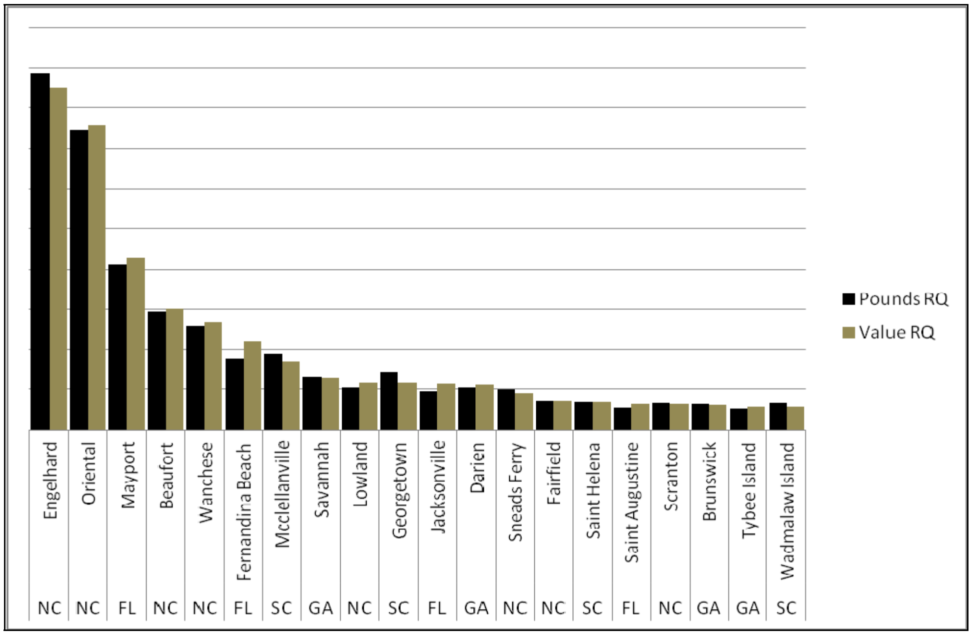


Figure 3-7. Top twenty fishing communities in the South Atlantic by regional quotient (RQ) of brown shrimp landings and value in 2010 (ALS 2011).

Most brown shrimp in the South Atlantic are landed in North Carolina with four communities having the highest regional quotients[1] (**Figure 3-7**). Engelhard and Oriental have the highest RQs for pounds and value respectively. Mayport, FL is next while both Beaufort, NC and Wanchese, NC complete the top five. The rest of the communities have less than 5% of the regional quotient of landings and value for brown shrimp.

For white shrimp, the communities with the highest regional quotient tend to be further south in Florida and Georgia as shown in **Figure 3-8**. Mayport, FL has the highest RQ of pounds and value of white shrimp landed for the region. The next closest communities are Savannah, GA and Darien, GA. McClellanville, SC is fourth with Fernandina Beach, FL and Jacksonville, FL even with regard to value of landed pounds but Jacksonville has a higher pounds RQ than Fernandina.

[1] Regional quotient is the share of pounds and value landed for a particular species within a community in relation to all landings and value in the region.

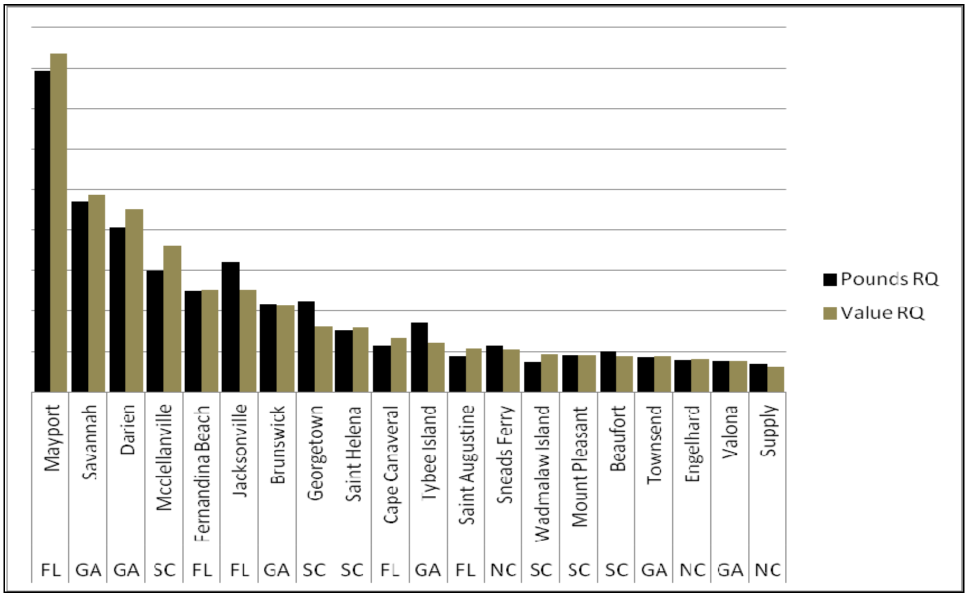


Figure 3-8. Top twenty fishing communities in the South Atlantic by Regional Quotient of white shrimp landings and value (ALS 2011).

For pink shrimp, it is not possible to separate Gulf landings from South Atlantic landings at the community level; therefore, **Figure 3-9** shows Key West as leading all communities in pounds landed and value for regional quotient of pink shrimp. Opa-Locka, FL, near north Miami, is a distant second.

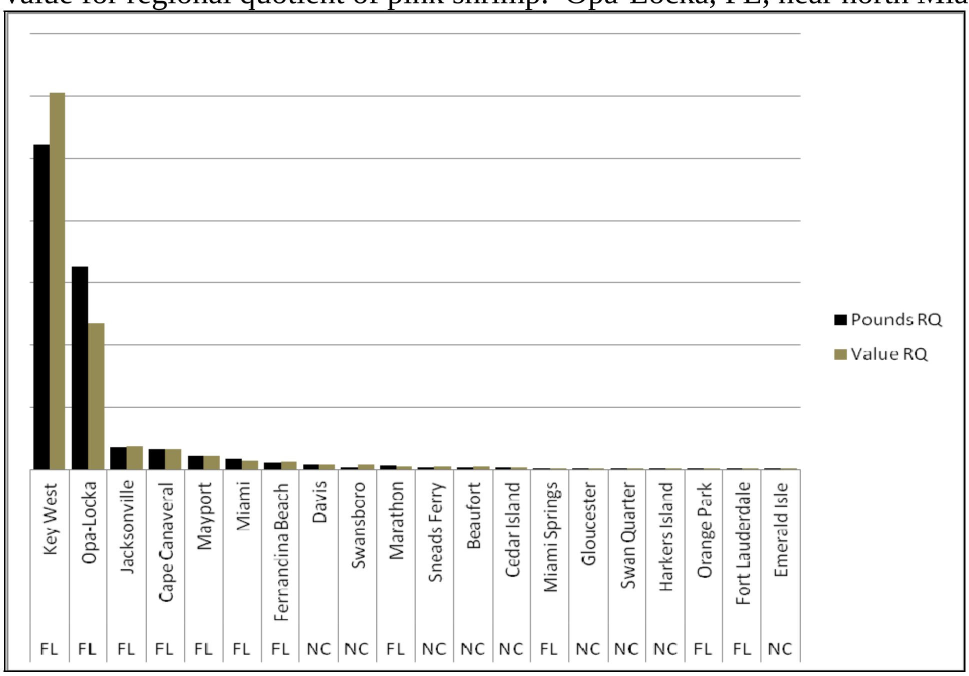


Figure 3-9. Top twenty fishing communities in the South Atlantic by Regional Quotient of pink shrimp landings and value (ALS 2011).

To examine South Atlantic shrimp fishing communities in terms of their fishing engagement and reliance, an index was created for both categories of fishing activity (Colburn and Jepson, 2012; Jacob et al., 2012). Using a principal component, single solution factor analysis on the variables numbers of commercial permits, value and pounds of landings, two indices were created for each community, which can be ranked on factor scores for each index. Fishing reliance has many of the same variables as engagement but population divides each variable. Each community's factor score is located on the axis radiating out from the center of the graph to its name. Factor scores are connected by colored lines and are standardized, therefore the mean is zero. A threshold of one standard deviation above the mean was chosen. Although most communities are near the threshold in **Figure 3-10**, several communities have factor scores on both indices that exceed 1 standard deviation above the mean. The communities of Key West, FL; Marathon, FL; Darien, GA; Beaufort, NC; Wanchese, NC; and McClellan, SC all exceed the threshold of 1 standard deviation above the mean for both commercial fishing engagement and reliance. These communities can be considered dependent upon commercial fishing and therefore more reactive to changes in fishing regulations

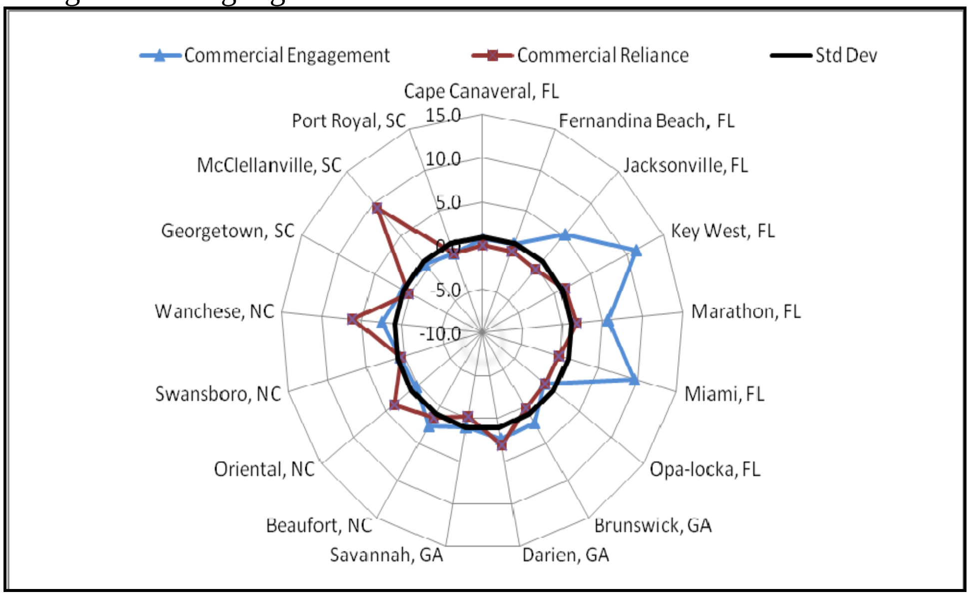


Figure. 3-10. Commercial engagement and reliance for the top South Atlantic shrimp communities (SERO 2012).

Another suite of indices were created to examine the social vulnerability/resilience of coastal communities and is depicted in **Figure 3-11**. The three indices are poverty, population composition and personal disruptions. The variables included in each of these indices have been identified through the literature as being important components that contribute to a community's vulnerability. Again, for those communities that exceed the threshold it would be expected that they would exhibit vulnerabilities to sudden changes or social disruption that might accrue from regulatory change.

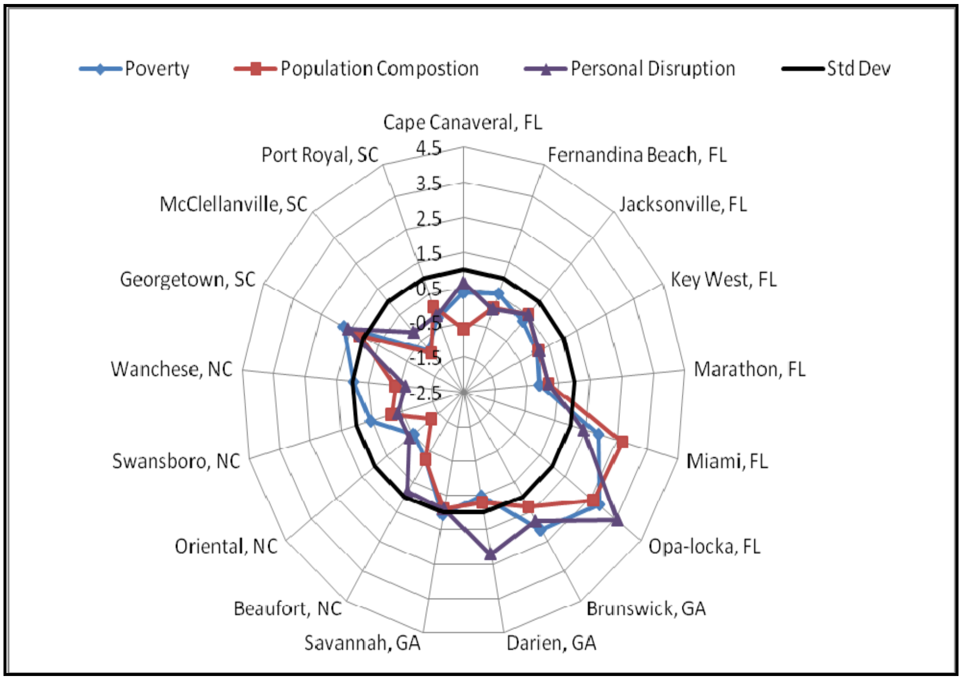


Figure 3-11. Social vulnerability and resilience for the top South Atlantic shrimp communities (SERO 2012).

As shown in **Figure 3-11** the communities of Miami, FL, Opa-Locka, FL, Brunswick, GA, Darien, GA, Savannah, GA and Georgetown, SC all exceed the threshold for social vulnerability of one standard deviation above the mean. It would be expected that these communities would be especially vulnerable to any social or economic disruption as a result of regulatory change.

Environmental Justice

Executive Order 12898 requires federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. This executive order is generally referred to as environmental justice (EJ).

Information on the communities discussed above was examined to identify the potential for EJ concern. Specifically, the rates of minority populations and the percentage of the population below the poverty line were examined. The threshold for comparison used was 1.2 times the state average such that, if the value for the community was greater than or equal to 1.2 times the state average, then the community was considered an area of potential EJ concern. Census data for the year 2010 was used for this analysis.

Based on the demographic information for each community, the communities of Opa-Locka, FL, Brunswick, GA, Savannah, GA and Georgtown, SC all exceed the threshold for minority populations. The communities of Miami, FL, Opa-Locka, FL, Brunswick, GA, Darien, GA, Savannah, GA and Georgetown, SC all exceed the threshold for poverty. These thresholds are highly correlated with the social vulnerability indices discussed above. These communities are considered vulnerable if regulatory action were to cause some type of social disruption.

3.3.2 Economic Environment

Permit Totals and Average Vessel Revenue

A description of the economics of the 2009 federal South Atlantic shrimp fishery is contained in NMFS (2011a) and is incorporated herein by reference. A report on the 2010 fishery is not currently available. Information on South Atlantic shrimp landings through 2010, ex-vessel values, and shrimp imports are available at http://www.st.nmfs.noaa.gov/st1/index.html. The following provides a brief summary of select information from NMFS (2011a) and estimates of business activity (economic impacts) associated with shrimp revenues in 2009. Both penaeid and rock shrimp are harvested in the South Atlantic shrimp fishery. However, because the focus of this proposed amendment is on penaeid shrimp, the following information primarily relates to activity associated with penaeid harvest.

A federal permit is required to commercially harvest shrimp in federal South Atlantic waters. Three South Atlantic federal shrimp permits exist: an open access penaeid shrimp permit, an open access rock shrimp permit (allows the harvest of rock shrimp in federal waters north of the South Carolina-Georgia border), and a limited access rock shrimp permit (allows the harvest of rock shrimp in federal waters south of the South Carolina-Georgia border). In 2009, an estimated 733 vessels held one or more South Atlantic shrimp permits, of which 692 held a permit for penaeid shrimp. However, only 324 of these vessels landed South Atlantic penaeid shrimp (penaeid shrimp harvested in South Atlantic waters) in 2009. Although information on more recent harvest activity is not available, on April 13, 2012, there were 546 valid (non-expired or renewable) South Atlantic federal penaeid shrimp permits (NMFS, Southeast Regional Office).

Vessels with South Atlantic federal penaeid shrimp permits often harvest both shrimp and non-shrimp marine species, and fish in both Gulf of Mexico and South Atlantic waters. In 2009, among the 692 vessels with a federal penaeid shrimp permit, the average vessel (total revenues averaged across all 692 vessels) received approximately $35,100 from penaeid shrimp harvested in the South Atlantic, $85,100 from penaeid shrimp harvested in the Gulf of Mexico, $4,500 from rock shrimp harvested in the South Atlantic, and $73,400 from non-shrimp species harvested in either the South Atlantic or Gulf of Mexico, or a total of approximately $198,100 (2009 dollars).

For the 324 vessels with South Atlantic penaeid shrimp harvests, the average vessel received approximately $75,900 from penaeid shrimp harvested in the South Atlantic, $3,200 from penaeid shrimp harvested in the Gulf of Mexico, $9,700 from rock shrimp harvested in the South Atlantic, and $68,100 from non-shrimp species harvested in either the South Atlantic or Gulf of Mexico, or a total of approximately $156,800 (2009 dollars).

A comparison of the results of the two groups of vessels suggests that vessels that actually harvested South Atlantic penaeid shrimp were more dependent on revenue from these species (approximately 48 percent of total average annual revenue) than all permit holders (approximately 18 of total average annual revenue) and more dependent on non-shrimp revenue (approximately 43 percent of total average annual revenue) than all permit holders (approximately 37 percent of total average annual revenue).

Business Activity

Estimates of the business activity (economic impacts) in the U.S. associated with shrimp harvests by vessels landing South Atlantic penaeid shrimp were derived using the model developed for and applied in NMFS (2011b). Business activity for the commercial sector is characterized in the form of full-time equivalent (FTE) jobs, income impacts (wages, salaries, and self-employed income), and output (sales) impacts (gross business sales). Income impacts should not be added to output (sales) impacts because this would result in double counting. The estimates of economic activity include the direct effects (effects in the sector where an expenditure is actually made), indirect effects (effects in sectors providing goods and services to directly affected sectors), and induced effects (effects induced by the personal consumption expenditures of employees in the direct and indirectly affected sectors).

The estimates of business activity were based on revenue from all shrimp landings, regardless of species (penaeid or rock shrimp) or area fished (South Atlantic or Gulf of Mexico). Total revenue in 2009 for all shrimp harvested by vessels with a South Atlantic shrimp permit was approximately $28.75 million (2009 dollars). The business activity associated with this revenue is estimated to be 7,021 FTE jobs (661 harvester jobs), approximately $208.75 million in income impacts, and approximately $495.06 million in output (sales) impacts. Comparable estimates for the business activity associated with revenue from non-shrimp species harvested in 2009 by these vessels (approximately $22.06 million, 2009 dollars) are not available because the species harvested were not identified in the summary report (NMFS 2011a).

3.4 Administrative Environment

3.4.1 The Fishery Management Process and Applicable Laws

3.4.1.1 Federal Fishery Management

Federal fishery management is conducted under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.), originally enacted in 1976 as the Fishery Conservation and Management Act. The Magnuson-Stevens Act claims sovereign rights and exclusive fishery management authority over most fishery resources within the U.S. Exclusive Economic Zone (EEZ), an area extending 200 nautical miles from the seaward boundary of each of the coastal states, and authority over U.S. anadromous species and continental shelf resources that occur beyond the U.S. EEZ.

Responsibility for Federal fishery management decision-making is divided between the U.S. Secretary of Commerce and eight regional fishery management councils that represent the expertise and interests of constituent states. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary of Commerce (Secretary) is responsible for collecting and providing the data necessary for the councils to prepare fishery management plans and for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the Magnuson-Stevens Act and with other applicable laws. In most cases, the Secretary has delegated this authority to NOAA Fisheries Service.

The South Atlantic Council is responsible for conservation and management of fishery resources in Federal waters of the U.S. South Atlantic. These waters extend from 3 to 200 miles offshore from the seaward boundary of the States of North Carolina, South Carolina, Georgia, and east Florida to Key West. The South Atlantic Council has thirteen voting members: one from NOAA Fisheries Service; one each from the state fishery agencies of North Carolina, South Carolina, Georgia, and Florida; and eight public members appointed by the Secretary. On the South Atlantic Council, there are two public members from each of the four South Atlantic States. Non-voting members include representatives of the U.S. Fish and Wildlife Service, U.S. Coast Guard, State Department, and Atlantic States Marine Fisheries Commission (ASMFC). The South Atlantic Council has adopted procedures whereby the non-voting members serving on the Council Committees have full voting rights at the Committee level but not at the full Council level. South Atlantic Council members serve three-year terms and are recommended by State Governors and appointed by the Secretary of Commerce from lists of nominees submitted by State governors. Appointed members may serve a maximum of three consecutive terms.

Public interests also are involved in the fishery management process through participation on Advisory Panels and through council meetings, which, with few exceptions for discussing personnel matters, are open to the public. The South Atlantic Council uses a Scientific and Statistical Committee to review the data and science being used in assessments and fishery management plans/amendments. In addition, the regulatory process is in accordance with the Administrative Procedures Act, in the form of “notice and comment” rulemaking.

3.4.1.2 State Fishery Management

The state governments of North Carolina, South Carolina, Georgia, and Florida have the authority to manage fisheries that occur in waters extending three nautical miles from their respective shorelines. North Carolina’s marine fisheries are managed by the Marine Fisheries Division of the North Carolina Department of Environment and Natural Resources. The Marine Resources Division of the South Carolina Department of Natural Resources regulates South Carolina’s marine fisheries. Georgia’s marine fisheries are managed by the Coastal Resources Division of the Department of Natural Resources. The Marine Fisheries Division of the Florida Fish and Wildlife Conservation Commission is responsible for managing Florida’s marine fisheries. Each state fishery management agency has a designated seat on the South Atlantic Council. The purpose of state representation at the Council level is to ensure state participation in Federal fishery management decision-making and to promote the development of compatible regulations in state and Federal waters.

The South Atlantic States are also involved through the Atlantic States Marine Fisheries Commission (ASMFC) in management of marine fisheries. This commission was created to coordinate state regulations and develop management plans for interstate fisheries. It has significant authority, through the Atlantic Striped Bass Conservation Act and the Atlantic Coastal Fisheries Cooperative Management Act, to compel adoption of consistent state regulations to conserve coastal species. The ASFMC is also represented at the Council level, but does not have voting authority at the Council level.

NOAA Fisheries Service’ State-Federal Fisheries Division is responsible for building cooperative partnerships to strengthen marine fisheries management and conservation at the state, inter-regional, and national levels. This division implements and oversees the distribution of grants for two national (Inter-jurisdictional Fisheries Act and Anadromous Fish Conservation Act) and two regional (Atlantic Coastal Fisheries Cooperative Management Act and Atlantic Striped Bass Conservation Act) programs. Additionally, it works with the ASMFC to develop and implement cooperative State-Federal fisheries regulations.

3.4.1.3 Enforcement

Both the National Oceanic and Atmospheric Administration (NOAA) Fisheries Office for Law Enforcement (NOAA/OLE) and the United States Coast Guard (USCG) have the authority and the responsibility to enforce South Atlantic Council regulations. NOAA/OLE agents, who specialize in living marine resource violations, provide fisheries expertise and investigative support for the overall fisheries mission. The USCG is a multi-mission agency, which provides at sea patrol services for the fisheries mission.

Neither NOAA/OLE nor the USCG can provide a continuous law enforcement presence in all areas due to the limited resources of NOAA/OLE and the priority tasking of the USCG. To supplement at sea and dockside inspections of fishing vessels, NOAA entered into Cooperative Enforcement Agreements with all but one of the States in the Southeast Region (North Carolina), which granted authority to State officers to enforce the laws for which NOAA/OLE has jurisdiction. In recent years, the level of involvement by the States has increased through Joint Enforcement Agreements, whereby States conduct patrols that focus on Federal priorities and, in some circumstances, prosecute resultant violators through the State when a state violation has occurred.

NOAA General Counsel issued a revised Southeast Region Magnuson-Stevens Act Penalty Schedule in June 2003, which addresses all Magnuson-Stevens Act violations in the Southeast Region. In general, this Penalty Schedule increases the amount of civil administrative penalties that a violator may be subject to up to the current statutory maximum of $120,000 per violation. NOAA General Counsel requested public comment through December 20 2010, on a new draft policy.

Chapter 4. Environmental Consequences

4.1 Action 1. Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

Alternative 1. No Action. Currently, as defined under the FMP for the South Atlantic shrimp fishery, states may request a concurrent closure of the EEZ adjacent to their closed state waters following severe winter weather upon providing information that demonstrates an 80 % or greater reduction in the population of overwintering white shrimp.

Alternative 2. A state may request a concurrent closure upon providing information that demonstrates an exceeded threshold for water temperature. Water temperature must be 7°C (45°F) or below for at least one week.

Preferred Alternative 3. A state may request a concurrent closure upon providing information that demonstrates an exceeded threshold for water temperature. Water temperature must be 8°C (46°F) or below for at least one week.

Alternative 4. A state may request a concurrent closure upon providing information that demonstrates an exceeded threshold for water temperature. Water temperature must be 9°C (48°F) or below for at least one week.

4.1.1 Biological Effects

White shrimp are especially prone to negative impacts of severe cold weather events due to their life cycle, and the majority of white shrimp are caught in state waters (SAFMC 1993). 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. 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).

The rationale for allowing states to request concurrent closures of federal waters for overwintering shrimp according to the Shrimp FMP (SAFMC 1993) was to protect the small portion of overwintering shrimp that survive by moving offshore and south during a cold weather event. In the spring, some remaining adult white shrimp are thought to move north to spawn, providing some postlarval recruitment for northern Georgia, South Carolina, and lower North Carolina. If federal waters were not closed to harvest of penaeid shrimp, vessels could continue to fish on the roe shrimp, legally in federal water and illegally in state waters, causing enforcement difficulties. At the time the FMP was developed, available data suggested that in freeze years continued fishing on the row shrimp could significantly reduce the capacity of the fall white shrimp crop to rebound. Furthermore, revenue generated by the increased abundance of white shrimp in the fall is greater than that which is generated by the smaller spring harvest of roe shrimp in the absence of a concurrent closure.

Under **Alternative 1 (No Action)**, white shrimp relative abundance following a winter cold kill is compared with the historical long-term mean CPUE for that month, or the average CPUE in samples taken prior to the onset of the cold weather are compared to CPUE in samples taken immediately after and within two weeks of the winter kill to determine if the overwintering population has decreased by 80% or more. If this criterion is met, then the affected state could request concurrent closure of the penaeid shrimp fishery in federal waters adjacent to their state waters.

[Insert other state data collection information here]

The state of South Carolina currently collects water temperature information. The South Carolina Department of Natural Resources (SC DNR) uses the U.S. Geological Service (USGS) data found at (http://waterdata.usgs.gov/sc/nwis/uv?021720710). USGS takes readings every 15 minutes, and SC DNR calculates a daily average for the temperatures (Personal communication Larry DeLancy 2012).

As stated in Section 3.2 of this document, penaeid shrimp, especially white shrimp, are highly vulnerable to fluctuations in water temperature. 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).

Because temperature is such an important factor in protecting and assessing white shrimp populations throughout the year, the Council determined it would be appropriate to include a temperature parameter in addition to the abundance reduction criteria for states requesting concurrent closures of federal waters for overwintering shrimp. The range of temperature alternatives represents input from the Shrimp Advisory Panel as well as the Shrimp Review Panel. The lower the temperature threshold is set, the more difficult it would be to meet the temperature criteria for requesting a concurrent closure, and therefore, would result in the least biological benefit. Based on this assumption, **Alternative 2** would be the least biologically beneficial since it would require the lowest temperature of all those considered to trigger a request for a concurrent closure. Alternately, **Alternative 4** would be most biologically beneficial because it is the highest temperature option under consideration, and the concurrent closure criteria would more easily be met. **Preferred Alternative 3** represents a mid-point between **Alternatives 2** and **4**, and would likely result in biological benefits greater than **Alternative 2**, but less than **Alternative 4**.

It is important to note that this action would not modify the criteria under which a closure is lifted and areas are reopened to penaeid shrimp fishing.

Alternative 1 is likely to perpetuate the existing level of risk for interactions between the South Atlantic shrimp fishery and ESA-listed species. The remaining alternatives, including **Preferred Alternative 3**, are likely to have greater biological benefits than **Alternative 1** for ESA-listed species. Closure of federal waters is likely to reduce the risk of interactions between the fishery and ESA-listed species, particularly sea turtles, during the closure period. **Alternative 4** is likely to have the greatest biological benefit because that threshold is more likely to be met than the other alternatives. Though both **Preferred Alternative 3** and **Alternative 2** are also likely to provide greater biological benefits than **Alternative 1**, **Preferred Alternative 3** is likely to have slightly greater biological benefits than **Alternative 2** because the threshold of the former is likely to be met more often than the later.

4.1.2 Economic Effects

Alternative 1 (No Action) allows states to request a closure in the EEZ off their state presuming the state has already closed state waters and can provide evidence demonstrating a reduction of at least 80% in the population of overwintering white shrimp. The evidence provided is up to the state and could vary across states. **Alternatives 2 – 4** provide a standardized method using a temperature threshold for determining when a state can ask for a concurrent closure affecting all penaeid species. Presumably, the higher the temperature for the closure, the sooner fishing pressure on the stock will end. While this might have short term negative economic consequences for fishermen, preserving the remaining biomass for the next fishing season would have greater, positive economic impact the following season.

4.1.3 Social Effects

The social effects from **Alternative 1 (No Action)** would depend upon whether shrimp stocks were significantly affected by the present closure system, which may not be as timely as that outlined in other alternatives. If the cold weather event has had a significant detrimental effect on the stock, then there could be negative social effects from **No Action**. The likely negative effects would depend upon the severity of impacts upon the stock and could range from a slight decrease in income that may have little effect or a larger decrease that may require more important changes to the fishing patterns or household labor structure/pattern for fishing families involved. Any substantial negative social effect could have compounding effects for the community. If there are substantial impacts some effort should be made to ascertain whether they are concentrated in those communities that show social vulnerabilities and a dependence upon that particular shrimp fishery as documented in Section 3.3.1. Rather than continue to risk such depletions, **Alternative 2** uses a water temperature threshold that would make the determination easier and more timely and may reduce the risk of negative social effects by protecting the shrimp stock. **Preferred Alternative 3** and **Alternative 4** each use a one-degree increase in temperature threshold respectively and the social effects would be the same as those described above, being determined by the ability of the alternative to provide sufficient protection to the stock. Overall, if the preferred alternative provides increased protection for the shrimp stock there should be positive social effects in the long-term that should outweigh any short-term negative impacts.

4.1.4 Administrative Effects

The FMP for the Shrimp Fishery of the South Atlantic Region (SAFMC 1993) provided states with the ability to request a concurrent closure of the EEZ adjacent to their closed state waters following severe winter cold weather in an effort to eliminate fishing mortality on over-wintering white shrimp following severe winter cold kills. The Shrimp FMP also 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."

The specification of criteria as identified through **Alternatives 2-4** would not result in increased administrative impacts on the agency from the status quo (**Alternative 1 No Action**). Primarily, a state would bear any administrative burden associated with this measure. Under **Alternatives 2-4**, states would be required to demonstrate that data (from a state-level monitoring program) indicate an exceeded threshold in water temperatures. With a change in the required criteria that a state would demonstrate in order to request a concurrent closure (**Alternatives 2-4**), modifications may occur at the state-level in how such a request is administered.

4.2 Action 2. Modify the process for a state to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

Alternative 1. No Action. Currently, the process requires any state requesting a concurrent closure to provide data to demonstrate an 80% decrease in abundance of overwintering white shrimp to a review panel, and the panel's recommendations are reviewed at the next Council meeting. After approval by the Council, a letter is sent to the NOAA Fisheries Regional Administrator requesting that the EEZ adjacent to the state be closed to penaeid shrimp harvest. The Regional Administrator then publishes an official notice of closure in the *Federal Register*.

Preferred Alternative 2. A state requesting a concurrent closure would send a letter directly to NOAA Fisheries Service with the request and necessary data to demonstrate that criterion has been met.

Alternative 3. A state requesting a concurrent closure would send a letter directly to NOAA Fisheries Service with the request and necessary data to demonstrate that criterion has been met. The requesting state would also submit data to the Shrimp Review Panel, who would review data and make a recommendation to NOAA Fisheries Service. This option would require a notice to be published in the *Federal Register* at least 23 days prior to the convening of the Shrimp Review Panel.

4.2.1 Biological Effects

The Shrimp FMP (SAFMC 1993) established the procedure by which states may request concurrent closure of federal waters to protect overwintering white shrimp, including formation of a Shrimp Review Panel. The Shrimp Review Panel is comprised of one Council staff, one Southeast Fisheries Science Center scientist, one member of the Council's Scientific and Statistical Committee, and one state shrimp biologist from each of the states in the Council's area of jurisdiction (SAFMC 1993). The procedure outlined in the original Shrimp FMP constitutes **Alternative 1 (No Action)**, which is considered the least biologically beneficial because it requires the most amount of time to implement a concurrent closure compared to all other alternatives. Under **Alternative 1 (No Action)**, not only is the Shrimp Review Panel required to convene to examine the data supporting the concurrent closure request, but the Council must also review the subject data. Because the Council only meets four times per year, in December, March, June, and September; the requirement that the Council also review the state's data often means the state may be forced to wait several months before the Council convenes a formal Council meeting to consider the state's information.

Preferred Alternative 2 represents the most streamlined process by which South Atlantic states may request concurrent closures of federal waters to protect overwintering shrimp stocks. **Preferred Alternative 2** would, theoretically also require the least amount of time to actually implement the concurrent closure and is thus considered the most biologically beneficial alternative under this action. Because the states would still be required to provide information demonstrating the concurrent closure criteria have been met, and NOAA Fisheries Service would examine that information before making a final determination to implement a closure, there is a low probability that a closure would unnecessarily be implemented based on inaccurate information provided by the states.

The level of biological benefit of **Alternative 3** is likely to fall between that of **Alternative 1 (No Action)** and **Preferred Alternative 2** given the theoretical length of time it would be expected to take to implement a concurrent closure. Based on the assumption that the sooner a concurrent closure could be implemented the longer overwintering penaeid shrimp would be protected from fishing in federal waters, the option that would require the least amount of time to implement would be considered the most biologically advantageous. **Preferred Alternative 2** would eliminate the need for states to wait until the next Council meeting to implement a closure, but there would still be a one month wait period in order to accommodate the *Federal Register* notice period required prior to the convening of the Shrimp Review Panel.

Alternative 1 is likely to perpetuate the existing level of risk for interactions between the South Atlantic shrimp fishery and ESA-listed species, particularly sea turtles. It is unclear what effect the remaining alternatives will have on the likelihood of interactions between the fishery and ESA-listed species. If they ultimately result in more timely closures, which lead to longer closures, the likelihood of interactions between the fishery and ESA-listed species decreases. The decreased likelihood of interaction equates to a greater biological benefit to ESA-listed species. The extent of those benefits is currently unknown.

4.2.2 Economic Effects

Action 2 is an administrative action and any alternative chosen will not have positive or negative economic effects on the fishery.

4.2.3 Social Effects

Modifying the process of requesting a concurrent closure may have positive social effects similar to those described in Action 1 as there may be increased protection for shrimp stocks provided through more timely action. Under **Alternative 1** (**No Action**) the current process may not provide sufficient protection and therefore could have negative social effects. Under **Alternative 3**, review by the Shrimp Review Panel could delay the action more than **Preferred Alternative 2** that would be a more direct and timely approach. Again, the social effects would depend upon the effect of any delay on a closure and its impact upon the stock. It is assumed that a more timely closure will have beneficial effects upon the stock which should have positive long-term social effects.

4.2.4 Administrative Effects

Pursuant to the Shrimp FMP (SAFMC 2003), when adjacent EEZ closures are requested by a state due to cold weather events, the Council evaluates the request prior to a closure based on the specific criteria as identified under Action 1, Alternative 1. Upon receiving a concurrent closure request from one or more states (typically in January or February), the Council convenes the Shrimp Review Panel to evaluate data supporting the request to determine compliance with the criteria. After receiving the report of the Shrimp Review Panel, the Shrimp Committee reviews (typically at the March Council meeting) the state's request and makes recommendations to the Council. The Council then determines if a request is warranted, and if so, recommends that the Regional Administrator proceed with an EEZ closure by Notice Action. Requests for an EEZ closure are on a state-by-state basis and efforts are made to coordinate requests among states.

Action 2 is primarily an administrative action, and the alternatives correlate to an accelerated timeframe for the agency in implementing a concurrent closure. **Preferred Alternative 2** and **Alternative 3** identify two different processes for implementation of a concurrent closure, with a different timeframe stipulated under each scenario.

Under **Preferred Alternative 2**, convening the Shrimp Review Panel following a state's concurrent closure request would no longer be required. Convening the Shrimp Review Panel requires noticing in the *Federal Register*, with 23 days, at minimum, a pre-requisite for holding a meeting. From an administrative perspective for the agency, this often lengthy and multi-step process would be streamlined under **Preferred Alternative 2**, eliminating several steps in the current process. **Preferred Alternative 2** would also eliminate the need for discussion and review of this issue during the Shrimp Committee at a Council meeting. As noted above, due to the limitations of a quarterly Council meeting schedule, **Alternative 1 (No Action)** often results in a significant lapse in time between a state's request for a concurrent closure of the adjacent EEZ during severe winter weather and the pending implementation of a closure by the Regional Administrator. **Preferred Alternative 2** would expedite the process currently in place.

Administrative impacts associated with **Alternative 3** would be greater than those under **Preferred Alternative 2**, however they would be less than those currently in place with the status quo (**No Action**). Under **Alternative 3**, the agency would still be required to develop and publish a notice in the *Federal Register* to convene a meeting of the Shrimp Review Panel in order for a state's data to be reviewed, but the need to wait for review and discussion during a Council meeting would be eliminated. The intent of Action 2, to expedite the current process, would likely still be achieved under **Alternative 3**, but the process would require additional administrative steps than those identified in **Preferred Alternative 2**. Unlike **Alternative 1** (**No Action**), **Alternative 3** eliminates the requirement for review and discussion of this issue at a Council meeting, but still requires input from the Shrimp Review Panel before a final determination is made at the agency level.

4.3 Action 3. Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

Alternative 1. No Action. A proxy for B_{MSY} (0.461 individuals per hectare) has been established for pink shrimp 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. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from SEAMAP-SA data during the 2007-2011 time period (.273 individuals per hectare).

Alternative 3. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from SEAMAP-SA during the 2009-2011 time period (.292 individuals per hectare).

Alternative 4. Establish a proxy for B_{MSY} for pink shrimp using the lowest CPUE value from SEAMAP-SA during the 1990-2011 time period (.089 individuals per hectare).

Alternative 5. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from Pamlico Sound Survey data during the 2007-2011 time period (5.143 individuals per hectare).

Alternative 6. Establish a proxy for B_{MSY} for pink shrimp using average CPUE values from Pamlico Sound Survey data during the 2009-2011 time period (1.526 individuals per hectare).

4.3.1 Biological Effects

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.

Under **Alternative 1 (No Action)** CPUE data from the SEAMAP survey between 1990 and 2003 (**Table 4-1**) was used to determine a proxy for B_{MSY} (0.461).

Table 4-1. (Alternative 1 (No Action)) Annual CPUE (nos/ha) estimates derived from the SEAMAP Shallow water Trawl Survey.

Year	Pink Shrimp
1990	0.566
1991	0.872
1992	0.511
1993	0.671
1994	0.594
1995	1.725

1996	0.461
1997	0.949
1998	0.853
1999	0.450
2000	0.211
2001	0.502
2002	0.908
2003	0.418

The SEAMAP 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. 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). 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. 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).

The SEAMAMP sampling area extends between Cape Hatteras, North Carolina and Cape Canaveral, Florida. However, pink shrimp are found well beyond these northern and southern sampling area boundaries of the SEAMAP survey, and therefore, this survey are not sampling in areas where some of the highest concentrations of pink shrimp are found. To address this issue the Council determined it is appropriate to explore alternative means of calculating a proxy for B_{MSY} for pink shrimp. If **Alternative 1 (No Action)** were chosen as a preferred alternative, the overfished criteria would not be modified at this time. The Council could choose to defer establishment of a new B_{MSY} proxy until a stock assessment is completed, or until some supplemental information becomes available upon which a new B_{MSY} proxy could be based.

Alternative 2 would establish a new B_{MSY} proxy for pink shrimp using the average CPUE from the SEAMAP survey results for the years of 2007-2011 (**Table 4-2**).

Table 4-2. (Alternative 2) Annual CPUE (nos/ha) estimates and average CPUE derived from the SEAMAP Shallow water Trawl Survey for the years of 2007-2011.

Year	Pink Shrimp

2007	0.149
2008	0.340
2009	0.296
2010	0.089
2011	0.490
Ave.	**0.273**

Alternative 3 would establish a new BMSY proxy for pink shrimp using the average CPUE from the SEAMAP survey results from the years of 2009-2011 (**Table 4-3**).

Table 4-3. (**Alternative 3**) Annual CPUE (nos/ha) estimates and average CPUE derived from the SEAMAP Shallow water Trawl Survey for the years of 2009-2011.

Year	Pink Shrimp
2009	0.296
2010	0.089
2011	0.490
Ave.	**0.292**

Alternatives 2 and **3** do not address the issue of the SEAMAP survey not covering the entire geographical range of pink shrimp abundance; however, they do use the most recent SEAMAP data available, which is a more accurate representation of current stock conditions relative to how the fishery is prosecuted today between Cape Hatteras and Cape Canaveral. The average CPUE under **Alternative 2** is roughly half of the B_{MSY} proxy under the no action alternative. The average CPUE for **Alternative 3** would be 0.292 individuals per hectare. **Alternative 4** also uses the average CPUE values from SEAMAP data, but using the entire sampling time frame of the survey, which began in 1990. Using SEAMAP CPUE data from 1990 through 2011 (**Table 4-4**), results in a B_{MSY} proxy of 0.089 individuals per hectare, the lowest biomass that can support harvest of MSY of all the alternatives being considered.

B_{MSY} is a measure of the biomass of a species that can support harvest of the MSY over time while maintaining the stock's productive capacity. The higher the B_{MSY} proxy is more likely CPUE would fall below that level in any given year and trigger administrative action to limit harvest. Therefore, if the B_{MSY} proxy is set too high, the more likely corrective action would be triggered when it may not be biologically necessary. Conversely, if the B_{MSY} proxy is set very low it would be unlikely the CPUE would fall below the B_{MSY} level and corrective action may not be triggered when it is actually needed.

Table 4-4. (Alternative 4) Annual CPUE (nos/ha) estimates and the average CPUE for 1990-2011 derived from the SEAMAP Shallow water Trawl Survey.

Year	Pink Shrimp
1990	0.566
1991	0.872
1992	0.511
1993	0.671
1994	0.594
1995	1.725

1996	0.461
1997	0.949
1998	0.853
1999	0.450
2000	0.211
2001	0.502
2002	0.908
2003	0.418
2004	0.383
2005	0.103
2006	0.218
2007	0.149
2008	0.340
2009	0.296
2010	0.089
2011	0.490
Ave.	**0.089**

Alternative 4 would use the most comprehensive set of data available from SEAMAP for pink shrimp and would account for all peaks and troughs in CPUE data across all years since the SEAMAP survey began. However, this alternative would also result in the lowest B_{MSY} proxy relative to the other alternatives considered, which could lead to corrective action not being taken when it may actually be needed. Furthermore, this time series of data may not represent the most appropriate characterization of the current conditions of the fishery or the stock as it currently exists. Since 1990, the fishery has been greatly reduced; therefore, using a more recent time series as are included in **Alternatives 2** and **3**, would represent a more accurate B_{MSY} proxy for pink shrimp considering how the fishery is prosecuted today.

Alternatives 5 and **6** would use data from the Pamlico Sound Survey to establish a new B_{MSY} proxy for pink shrimp. **Section 3.2.3.2** of this document describes the Pamlico South Survey in detail. In summary, the Pamlico Sound Survey has been conducted since 1987 to the present over two weeks in June and September. As a result of scheduling conflicts or adverse weather conditions, there have been four years in which the survey did not occur over the same time series: 1988, 1999, 2003, and 2009. From 1990 to 2007, 52-54 randomly selected stations were sampled over a two week period, usually the second and third week of the month in both June and September. The stations sampled are randomly selected from strata based upon depth and geographic location. The seven designated strata are: Neuse River (NR), Pamlico River (PR), Pungo River (PUR), Pamlico Sound east of Bluff Shoal, shallow (PSE) and deep (PDE); and Pamlico Sound west of Bluff Shoal, shallow (PSW) and deep (PDW). Shallow water is considered water depth between 6-12 feet and deep water is considered water greater than 12 feet depth. A minimum of 104 stations were trawled per year. This was done each year so that maximum coverage of area was achieved. Currently, 108 stations are sampled each year (54 per cruise). Physical and environmental conditions such as temperature (^{o}C), salinity (ppt), dissolved oxygen (mg/L), bottom composition, a qualitative assessment of sediment size, and water clarity (began 2008) are recorded at the end of each tow.

For invertebrates, the total weight of all penaeid shrimp is taken for each species. Penaeid shrimp are assessed by sorting all of the catch to species with each species/size in its own fish basket. Once the catch is sorted, all baskets are organized so those of the same species/size class are together and combined when possible. Each species is enumerated and a total weight is taken for each species/size class. Individuals of each species are measured. If present in large numbers, a sub-sample of 30-60 individuals of each target species/size class is measured and a total weight is taken of the measured individuals for each species/size class.

Alternative 5 would use an average of the CPUE values from the Pamlico Sound Survey for the years of 2007-2011, which would result in a B_{MSY} proxy of 5.143 individuals per hectare (**Table 4-5**).

Table 4-5. (Alternative 5) Annual CPUE estimates and average CPUE (#/ha) for pink shrimp derived from the Pamlico Sound Survey from 2007-2011. The annual Pamlico Sound Survey CPUE is the arithmetic weighted mean of the number per tow, a tow equates to 1.951 hectares (NC Division of Marine Fisheries, 2012).

Year	Pink Shrimp
2007	3.352
2008	17.786
2009	3.465
2010	0.584
2011	0.528
Ave.	**5.143**

Alternative 6 would use an average of the CPUE values from the Pamlico Sound survey for the years of 2009-2011, which would result in a B_{MSY} proxy of 1.526 individuals per hectare (**Table 4-6**).

Table 4-6. (Alternative 6) Annual CPUE estimates and average CPUE (#/ha) for pink shrimp derived from the Pamlico Sound Survey from 2009-2011. The annual Pamlico Sound Survey CPUE is the arithmetic weighted mean of the number per tow, a tow equates to 1.951 hectares (NC Division of Marine Fisheries, 2012).

Year	Pink Shrimp
2009	3.465
2010	0.584
2011	0.528
Ave.	**1.526**

Alternative 5 would result in the largest B_{MSY} proxy for pink shrimp at 5.143 individuals per hectare and **Alternative 6** would result in the second largest B_{MSY} proxy at 1.526 individual per hectare. Under both **Alternatives 5** and **Alternative 6**, similar geographical challenges are presented as those related to the alternatives that would SEAMAP survey data. The Pamlico Sound Survey captures shrimp abundance information for inshore areas within the Pamlico Sound areas; however, the Pamlico Sound Survey does not sample areas north of Cape Hatteras, nor does it address the issue of a lack of survey data south of Cape Canaveral FL, where pink shrimp abundance is thought to be high. Additionally, the data gathered

by the Pamlico Sound Survey is somewhat different from that produced by the SEAMAP survey because it only sample inshore waters where shrimp abundance and size may vary greatly when compared to the depths surveyed through SEAMAP (15-30 feet). Furthermore, the larger the B_{MSY} proxy is, the more likely yearly CPUE estimates would fall below that level and trigger some corrective action to limit harvest. The higher the B_{MSY} proxy is the more likely corrective action would be triggered when it is not biologically necessary.

The lowest B_{MSY} proxy (**Alternative 4**) and the highest B_{MSY} proxy (**Alternative 5**) represent the lowest and the highest B_{MSY} proxy alternatives under consideration. The most accurate representation of biomass is most likely somewhere in between these two alternatives, and a B_{MSY} proxy that is closer to a mid-point between the highest and lowest CPUE average values is less likely to trigger corrective action when it would not be needed, or fail to trigger corrective action when it is needed.

4.3.2 Economic Effects

Action 3 is a biological action that has indeterminate economic effects. Presumably, any alternative that would set an overfished level for pink shrimp that would lead to subsequent measures that might close the fishery early could have a negative economic effect. The lower the overfished threshold is set, the greater the probability the fishery could close early. However, such negative economic effects theoretically would only be short lived. Setting a lower overfished threshold could have positive economic effects for future fishing seasons.

4.3.3 Social Effects

Establishing the best proxy of overfished status for pink shrimp should have beneficial social effects, as it would provide the best protection for the stock without imposing unnecessary regulatory burdens on fishermen, their families and communities. Currently, under **Alternative 1**, the no action alternative, negative social effects could occur if the fishery is declared overfished when the current proxy may not be an accurate portrayal of stock status. The ensuing regulatory actions because of overfished designation could trigger a number of negative social effects with a wide range of impacts that are not possible to determine at this time, although they could be similar to those mentioned in **Action 1**. **Alternative 2** through **Alternative 4** offer a B_{MSY} proxy utilizing SEAMAP-SA data with differing time frames. Each time frame equates to a different measure of individual shrimp per hectare with the smallest threshold of .089 in **Alternative 4** and the highest threshold being .292 under **Alternative 3**. In any case, utilizing SEAMAP-SA data could add additional confidence regarding the proxy B_{MSY} for pink shrimp. While primarily a biological decision, it could improve the overall assessment and be beneficial to the overall process that could result in positive social effects by ensuring the most accurate information to base management decisions. Management decisions that ultimately harm stock status could have numerous negative social effects similar to those discussed in **Alternative 1**. With **Alternative 5**, a proxy for B_{MSY} is determined from the Pamlico Sound Survey data. Primarily an inshore sample, it would provide an alternative perspective and offers a higher threshold (5.143 individuals per hectare) than **Alternative 6**. Whichever alternative chosen as preferred, as long as it reflects the best estimate of stock status, it should have beneficial social effects in the long-term as mentioned in previous alternatives. However, it is not clear whether an offshore or inshore proxy would be better. If both together are thought to present the best overall picture of stock status, then some provision for review and determination of an overall proxy would be needed. Whatever the case, the communities in Figure 3.9 are those that could be affected more than others as they have the most pink shrimp landings. The communities of Miami and Opa-Locka, FL both may be exhibiting social vulnerabilities as they exceed thresholds on both the social vulnerability indices and EJ measures. Because these actions are primarily biological and should have positive social effects, neither community should experience any negative social impacts as a result.

4.3.4 Administrative Effects

Currently, the agency analyzes the trend of the SEAMAP-SA program's fishery-independent CPUE data to gain insight into the South Atlantic pink shrimp population size. Through Shrimp Amendment 6 (SAFMC 2003) a proxy for B_{MSY} has been established for pink shrimp 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 (.461 individuals per hectare). The geographical sampling limitations of the SEAMAP program (limited data north or Cape Hatteras, and south of Cape Canaveral) warrant the need for a better estimate of population size.

Alternatives 2-4 establish a new proxy for B_{MSY} based on more recent time series data from the SEAMAP program. **Alternatives 5 and 6** establish a new proxy for B_{MSY} based on more recent time series data from the the Pamlico Sound Survey data. The Council has the option to add the Pamlico Sound Survey data into consideration of the overfished status of pink shrimp, or reference this data in replacement of the SEAMAP program data. For the agency, administrative impacts associated with **Alternatives 2-4** would not differ from the status quo (**Alternative 1 No Action**). **Alternatives 5 and 6** would require agency review of the Pamlico Sound Survey data potentially in addition to the SEAMAP data on an annual cycle.

If CPUE values for pink shrimp continue to fall below the B_{MSY} proxy (from SEAMAP and/or Pamlico Sound Survey data), the Council shall convene the Shrimp Advisory Panel, and Shrimp Committee to review the causes of such declines and recommend any appropriate Council action to address the problem (Shrimp FMP, SAFMC 1993).

Chapter 5. Council's Choice for the Preferred Alternative

5.1 Specify criteria that triggers states' ability to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

5.2 Modify the process for a state to request a concurrent closure of the overwintering white shrimp stock in the adjacent EEZ during severe winter weather

5.3 Revise the overfished status determination criteria (B_{MSY} proxy) for the pink shrimp stock

Chapter 6. Cumulative Effects

6.1 Biological

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.

Penaeid shrimp occur throughout the South Atlantic and Gulf of Mexico regions. However, the Council's area of jurisdiction is limited to federal waters of the South Atlantic between the North Carolina Virginia border and the Gulf of Mexico Fishery Management Council's area of jurisdiction in the Florida Keys. Therefore, Amendment 9 immediately affects penaeid shrimp species in the South Atlantic region. However, any positive or negative biological impacts of this amendment on penaeid shrimp species may be carried over into the Gulf of Mexico Region and north of North Carolina as shrimp in those areas may move in and out the Council area of jurisdiction.

3. Establish the timeframe for the analysis.

The shrimp fishery in the South Atlantic has been under federal management since 1993 when the original FMP was developed. However, CPUE data from the SEAMAP Survey, which is used to monitor penaeid shrimp stocks, is currently available from 1990 through 2011. Therefore this is the time series of data that is generally used in the impacts analysis for the amendment.

4. Identify the other actions affecting the resources, ecosystems, and human communities of concern (the cumulative effects to the human communities are discussed in Section 4).

Listed are other past, present, and reasonably foreseeable actions occurring in the South Atlantic region. These actions, when added to the proposed management measures, may result in cumulative effects on the biophysical environment.

I. Fishery-related actions affecting penaeid shrimp species:

A. Past

The reader is referred to **Appendix H. History of Management of the Penaeid Shrimp Fishery** for past regulatory activity for the fish species being impacted by this amendment.

B. Present

Currently there is an action under development to require all skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) to use turtle excluder devices in their nets. The purpose of the proposed rule is to aid in the protection and recovery of listed sea turtle populations by reducing incidental bycatch and mortality of sea turtles in the southeastern U.S. shrimp fisheries.

C. Reasonably Foreseeable Future

No new shrimp-related amendments or other regulatory actions are currently under development for future implementation.

II. Non-Council and other non-fishery related actions, including natural events affecting penaeid shrimp species.

Several factors impact penaeid shrimp species in the South Atlantic. Some of these issues include weather events such as hurricanes, economic events such as the economic downturn of 2008, and environmental changes including pollution and climate change. Annual variability in natural conditions such as water temperature, currents, food availability, predator abundance, etc. can affect the abundance of penaeid shrimp. Furthermore, natural factors such as storms, red tide, cold water upwelling, etc. can affect the survival of shrimp roe and adult shrimp; however, it is very difficult to quantify the magnitude of mortality these factors may have on a stock. Alteration of preferred habitats for snapper grouper species could affect survival of fish at any stage in their life cycles.

Ocean acidification reduces the pH of seawater, which changes carbonate chemistry by reducing the amount of carbonate ion in the water negatively impacts invertebrates that use calcium carbonate to form shells (Bechmann et al. 2011). Bechmann et al. (2011) indicated that shrimp grown out in low pH (7.6) environments experience delayed development; however, overall survival of shrimp larvae in low pH (7.6) seawater was not affected. Juvenile shrimp reared in low pH seawater are significantly smaller that those reared in more neutral pH environments (Bechmann et al. 2011). Reduced development time for shrimp larvae may increase their risk of mortality from predation (Bechmann 2011), and slower growing shrimp could negatively impact segments of the shrimp industry that rely on the harvest of large shrimp during certain times of the year.

Changes to predator-prey relationships caused by management measures affecting shrimp prey species may impact penaeid shrimp stock sizes. According to Ehrhardt, Legault, and Restrepo (2001), several commercially important fish species prey on migrating pink shrimp. If those species experience a suggen surge in population size and subsequently increase predation on pink shrimp, the pink shrimp population would be impacts by that shift in the predator prey relationship (Ehrhardt, Legault, and Restrepo 2001). Additionally, degradation of juvenile shrimp habitat via weather events and point and non-point source pollution could also affect juvenile shrimp density recruitment relationship (Ehrhardt, Legault, and Restrepo 2001).

Global climate changes could have significant effects on Atlantic fisheries. However, the extent of these effects is not known at this time, specifically for the Atlantic. Possible impacts include temperature changes in coastal and marine ecosystems that can influence organism metabolism and alter ecological processes such as productivity and species interactions; changes in precipitation patterns and a rise in sea level which could change the water balance of coastal ecosystems; altering patterns of wind and water circulation in the ocean environment; and influencing the productivity of critical coastal ecosystems such as wetlands, estuaries, and coral reefs (IPCC 2007; Kennedy et al. 2002).

5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress.

A characterization of the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress is included in Section 3 of this document.

6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.

Stresses affecting the shrimp fishery and the communities, which depend on the shrimp fishery, are discussed under Number 4 and Section II of this Cumulative Impacts Analysis. Additionally, a description of the fishery and penaeid stock status relative to current regulatory thresholds is contained in Section 3 of this document.

7. Define a baseline condition for the resources, ecosystems, and human communities.

Pink Shrimp

<u>Maximum Sustainable Yield</u>

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).

<u>Optimum Yield</u>

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).

<u>Overfished/Overfishing Definition</u>

Amendment 6 to the FMP (SAFMC 2004) established overfished and overfishing criteria for pink shrimp. 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. A proxy for B_{MSY} (0.461 individuals per hectare) has been established for pink shrimp 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.

White Shrimp

<u>Maximum Sustainable Yield</u>

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
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. 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 = 5.868 individuals per hectare.

Overfishing Definition
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.

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
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. 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.

Overfishing Definition
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.

Shrimp are annual crops that fluctuate considerably from year to year depending primarily on environmental factors. Population size is regulated by environmental condition, 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 reset every year. The current baseline conditions of the affected ecosystem and surrounding communities is discussed in Section 3 of this document.

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.

The relationship between human activities and biophysical ecosystems within the context of this CEA is solely related to extractive activities and the installment of regulations as outlined in **Table 6-1**.

Table 6-1. Installment of regulations pertaining to South Atlantic shrimp fisheries.

Time period/dates	Cause	Observed and/or Expected Effects
1991	SAFMC allowed concurrent closure of EEZ adjacent to closed state waters after cold winter kills. Restricted trawling areas and mesh size, and defined MSY, and OY for white shrimp, and established overfishing criterion for white shrimp. (South Atlantic Shrimp FMP)	Reduced fishing effort during times of lower stock abundance. Reduced bycatch of unmarketable fish.
1996	Require federal rock shrimp permit, trawling area limited. (SAFMC 1996)	Enhanced existing federal regulations for coral and snapper grouper by protecting EFH, coral, and the Oculina Bank HAPC from trawl related damage.
1996	Required use of BRDs in all penaeid shrimp trawls in the South Atlantic EEZ. (SAFMC 1996b)	BRDs reduced bycatch, and standardized BRD certification criteria and testing protocol.
1998	Defined EFH and EFH-HAPCs for South Atlantic shrimp resource. (SAFMC 1998a)	Created protections for South Atlantic shrimp EFH.
1998	Expanded the Oculina HAPC to include the area closed to rock shrimp harvest. (SAFMC 1998c)	No person may use bottom longline, bottom trawl, dredge, pot or trap, anchors and chains, or grapples and chains. No one may fish for rock shrimp or possess rock shrimp in or from the area on board a fishing vessel, or possess *Oculina* coral.
1999	Established a reporting requirement and designated biological reference points. (SAFMC 1999)	Enhanced and supplemented existing data for the shrimp fishery, and helped to inform future management actions.
2002/2003	Established rock shrimp limited access program,	Reduced number of latent permits in the rock shrimp fishery, and helped rock

Time period/dates	Cause	Observed and/or Expected Effects
	required vessel operators permit, established minimum mesh size for tail bag, required use of VMS in rock shrimp limited access fishery. (SAFMC 2002)	shrimpers avoid catching small unmarketable shrimp. Use of VMS enhanced enforcement of the limited access rock shrimp fishery.
2004	Specified reduction in total weight of finfish of at least 30% for new BRDs to be certified; adopted the ACCSP release, discard and protected species module; and required BRDs on all rock shrimp trips in the South Atlantic. (SAFMC 2004)	Reduced the level of catch allowed for a BRD to be certified, thereby reducing bycatch overall; will be able to more accurately assess bycatch mortality; and reduce bycatch in the rock shrimp fishery.
2008	Eliminate rock shrimp landing requirement for limited access endorsement; reinstate endorsement lost due to not meeting the rock shrimp landing requirement, reinstate endorsements lost due to failure to renew, change endorsement and permit names; require proof of VMS for endorsement renewal or transfer; and require the collection of economic data.	Helped maintain the rock shrimp fishery at a sustainable level, while still preventing overexploitation of the fishery. Clarified any confusion about the endorsement vs. permit names and application process, improved enforcement of closed areas, and ensured the collection of economic data to fill large economic data gaps for the rock shrimp fishery.

9. Determine the magnitude and significance of cumulative effects.

Past, present and reasonably foreseeable future actions probably have not and would not have a significant, adverse effect on the shrimp resource. As stated throughout this 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 three years in duration).

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.

Management actions in Shrimp Amendment 9 would be expected to yield minimal cumulative effects on the biological environment. Those impacts could take the form of a more appropriate overfished threshold for pink shrimp, improved accuracy of monitoring pink shrimp using additional sources of data, and expedited implementation of protective concurrent closures of federal waters for overwintering shrimp.

10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.

The cumulative effects on the biophysical environment are expected to be negligible. Therefore, avoidance, minimization, and mitigation are not necessary.

11. Monitor the cumulative effects of the selected alternative and adopt management.

The effects of the proposed action are, and will continue to be, monitored through collection of data by NOAA Fisheries Service, the Pamlico Sound Trawl Survey, the SEAMAP Trawl Survey, as well as state landings information, and other scientific observations.

6.2 Socioeconomic

Chapter 7. Research Needs

Chapter 8. List of Preparers

Table 8-1. List of Amendment 9 preparers.

Name	Agency/Division	Area of Amendment Responsibility
Kate Michie	NMFS/SF	IPT Lead/Fishery Biologist
Anna Martin	SAFMC	IPT Lead/Fishery Biologist
Jack McGovern	NMFS/SF	Fishery Scientist
David Dale	NMFS/HC	EFH Specialist
Andy Herndon	NMFS/PR	Biologist
Stephen Holiman	NMFS/SF	Economist
Mike Jepson	NMFS/SF	Social Scientist
Mike Travis	NMFS/SF	Economist
Otha Easley	NMFS/LE	Supervisory Criminal Investigator
Scott Sandorf	NMFS/SF	Regulations Writer
Monica Smit-Brunello	NOAA/GC	Attorney Advisor
David Keys	NMFS/SF	NEPA Coordinator
Brian Cheuvront	SAFMC	Economist
Scott Crosson	SEFSC	Economist
Rick Hart	SEFSC	Biologist

NMFS = National Marine Fisheries Service, SAFMC = South Atlantic Fishery Management Council, SF = Sustainable Fisheries Division, PR = Protected Resources Division, SERO = Southeast Regional Office, HC = Habitat Conservation Division, GC = General Counsel, Eco=Economics

Chapter 9. List of Agencies, Organizations, and Persons To Whom Copies of the Statement are Sent

<u>Responsible Agency</u>

Amendment 9:
South Atlantic Fishery Management Council
4055 Faber Place Drive, Suite 201
Charleston, South Carolina 29405
(843) 571-4366 (TEL)
Toll Free: 866-SAFMC-10
(843) 769-4520 (FAX)
safmc@safmc.net

Environmental Assessment:
NMFS, Southeast Region
263 13th Avenue South
St. Petersburg, Florida 33701
(727) 824-5301 (TEL)
(727) 824-5320 (FAX)

<u>List of Agencies, Organizations, and Persons Consulted</u>

SAFMC Law Enforcement Advisory Panel
SAFMC Scientific and Statistical Committee
SAFMC Shrimp Advisory Panel
SAFMC Deepwater Shrimp Advisory Panel
North Carolina Coastal Zone Management Program
South Carolina Coastal Zone Management Program
Georgia Coastal Zone Management Program
Florida Coastal Zone Management Program
Florida Fish and Wildlife Conservation Commission
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
North Carolina Division of Marine Fisheries
North Carolina Sea Grant
South Carolina Sea Grant
Georgia Sea Grant
Florida Sea Grant
Atlantic States Marine Fisheries Commission
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

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Appendix A. Considered But Eliminated Alternatives

This section describes actions and alternatives that the South Atlantic Council considered in developing this document, but decided not to pursue. The description of each alternative is followed by a summary statement of why it was eliminated from more detailed summary in the document.

Note: The Alternatives removed from consideration below are associated with Action 3. (Action 3. Revise the overfished status determination criteria (BMSY proxy) for the pink shrimp stock.)

Alternative 2. Pink shrimp are overfished when the annual landings fall below two standard deviations below mean landings 1957-1993 for three consecutive years [286,293 pounds heads-on]. It is assumed that overfishing is occurring when the overfished threshold specified is met. (Reference to Shrimp Amendment 6, Action 6, Alternative 2)

Alternative 3. Revise or establish consistent overfishing and overfished definitions for penaeid shrimp (specifically, pink shrimp) based on the established MSY and OY catch values. Overfishing (MFMT) for 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 pink shrimp would be defined as annual landings smaller than two standard deviations below MSY for two consecutive years.
Pink shrimp: MSST = 0.3 MP MSY = 1.8 MP MFMT = 3.3 MP.
(Reference to Shrimp Amendment 6, Action 6, Alternative 3)

Alternative 4. A BMSY proxy for pink shrimp would be calculated using the best scientific information available as determined by the Shrimp Review Panel, which would meet on an annual basis to review the BMSY proxy and stock status.

Alternative 5. Two proxies for BMSY for pink shrimp has been established using CPUE information from SEAMAP and the Pamlico Sound Trawl Survey as the lowest values in the [insert time range] that produced catches meeting MSY the following year.

Discussion

During the June 2012 Council meeting, these alternatives were removed from further consideration. The Council discussed that Alternatives 2 and 3 carry over from Shrimp Amendment 6 (Action 6, Alternatives 2 and 3)(SAFMC 2003) and are based on landings data. The alternatives would not address the issue currently faced with triggering the BMSY proxy for pink shrimp in the South Atlantic. The Council removed Alternative 4 from consideration because it does not specify which data sources would be used in determining the BMSY proxy for pink shrimp, and allows considerable deference to the Shrimp Review Panel for making the determination. Alternative 5 was removed from consideration as a result of the Council's interest in a more specific suite of alternatives that identify a fishery independent sampling program and a time range to base CPUE values in developing a BMSY proxy.